UNITED STATES OF AMERICA

DEPARTMENT OF ENERGY

OFFICE OF FOSSIL ENERGY

SABINE PASS LIQUEFACTION, LLC	)	FE DOCKET NO. 13-30-LNG
	)	FE DOCKET NO. 13-42-LNG
	)	FE DOCKET NO. 13-121-LNG
	)	(Consolidated)

FINAL OPINION AND ORDER GRANTING LONG-TERM, MULTI-CONTRACT AUTHORIZATION TO EXPORT LIQUEFIED NATURAL GAS BY VESSEL FROM THE SABINE PASS LNG TERMINAL LOCATED IN CAMERON PARISH, LOUISIANA, TO NON-FREE TRADE AGREEMENT NATIONS

DOE/FE ORDER NO. 3669

JUNE 26, 2015

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FREQUENTLY USED ACRONYMS

AEA	America's Energy Advantage, Inc.
AEO	Annual Energy Outlook
APGA	American Public Gas Association
API	American Petroleum Institute
Bcf/d	Billion Cubic Feet per Day
Bcf/yr	Billion Cubic Feet per Year
CEQ	The Council on Environmental Quality
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalents
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EUR	Estimated Ultimate Recovery
FE	Office of Fossil Energy, U.S. Department of Energy
FERC	Federal Energy Regulatory Commission
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWP	Global Warming Potential
HAP	Hazardous Air Pollutant
IECA	Industrial Energy Consumers of America
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-Hour
LCA	Life Cycle Analysis
LNG	Liquefied Natural Gas
Mcf	Thousand Cubic Feet
MMBtu	Million British Thermal Units
mtpa	Million Metric Tons per Annum
MWh	Megawatt-Hour
NEPA	National Environmental Policy Act
NERA	NERA Economic Consulting
NETL	National Energy Technology Laboratory
NGA	Natural Gas Act
NGL	Natural Gas Liquid
NOx	Nitrogen Oxides
PM	Particulate Matter
SPA	Sale and Purchase Agreement
SPL	Sabine Pass Liquefaction, LLC
Tcf/yr	Trillion Cubic Feet per Year

TGPNA	Total Gas & Power North America, Inc.
tpy	Tons per Year
VOC	Volatile Organic Compound

I. INTRODUCTION

Between February and September 2013, Sabine Pass Liquefaction, LLC (SPL or Sabine Pass)[1] filed three export applications (collectively, Applications) with the Office of Fossil Energy of the Department of Energy (DOE/FE) in FE Docket Nos. 13-30-LNG, 13-42-LNG, and 13-121-LNG, respectively. These three Applications and their respective dockets have been consolidated for purposes of this Order. Each of the three Applications requests long-term authorization under section 3 of the Natural Gas Act (NGA)[2] to export domestically produced liquefied natural gas (LNG) by vessel to both: (i) nations with which the United States has entered into a free trade agreement (FTA) providing for national treatment for trade in natural gas, and with which trade is not prohibited by U.S. law or policy (FTA countries); and (ii) any other country with which trade is not prohibited by U.S. law or policy (non-FTA countries). As discussed below, DOE/FE already has issued three separate export authorizations granting the portion of the Applications requesting authority to export LNG to FTA countries, pursuant to NGA section 3(c), 15 U.S.C. § 717b(c). This Final Opinion and Order reviews and grants SPL's remaining request in the Applications for authority to export LNG to non-FTA countries, pursuant to NGA section 3(a), 15 U.S.C. § 717b(a).

The proposed exports in each of the Applications would originate from the existing Sabine Pass LNG import, storage, and vaporization terminal located in Cameron Parish, Louisiana (Sabine Pass LNG Terminal). The first four LNG liquefaction trains at the Terminal

[1] SPL is an indirect subsidiary of Cheniere Energy Partners, L.P., a limited partnership majority owned by Cheniere Energy, Inc., a developer of LNG terminals and natural gas pipelines on the Gulf Coast of the United States. *See infra* § IV.A.

[2] The authority to regulate the imports and exports of natural gas, including liquefied natural gas, under section 3 of the NGA (15 U.S.C. § 717b) has been delegated to the Assistant Secretary for FE in Redelegation Order No. 00-006.02F issued on November 17, 2014.

(Trains 1, 2, 3, and 4) are currently under construction, and are subject to three other LNG export authorizations issued by DOE/FE, as discussed below. In the Applications subject to this proceeding, SPL's proposed exports would originate from two additional liquefaction trains to be constructed at the Terminal—Trains 5 and 6—and which constitute SPL's "Liquefaction Expansion Project." As described below, the Federal Energy Regulatory Commission (FERC) has issued an order authorizing SPL and two other entities, Sabine Pass LNG, L.P., and Sabine Pass Liquefaction Expansion, LLC (collectively, Sabine Pass), to construct Trains 5 and 6. With the issuance of this Order, SPL now holds a total of seven LNG export authorizations (both FTA and non-FTA) for the Sabine Pass LNG Terminal. Each authorization is described below and identified in Tables 1 and 2 (*see infra* § IV.B).

SPL's Applications in this proceeding are comprised of the following, which collectively request authority to export LNG in a total volume equivalent to **503.3 billion cubic feet per year (Bcf/yr) of natural gas**:

- **First Application, FE Docket No. 13-30-LNG:** Filed on February 27, 2013, the First Application requests authorization to export domestically produced LNG in a volume equivalent to approximately **101 Bcf/yr of natural gas**, pursuant to the LNG Sale and Purchase Agreement (SPA) between SPL as seller and Total Gas & Power North America, Inc. (TGPNA or TOTAL) as buyer, dated December 14, 2012 (TGPNA SPA).[3] SPL states that, under the TPGNA SPA, SPL will deliver LNG to TGPNA for a primary term of 20 years, to commence on the date of first commercial delivery from Train 5 of the Terminal.[4]

[3] Sabine Pass Liquefaction, LLC, Application for Long-Term Authorization To Export Liquefied Natural Gas, FE Docket No. 13-30-LNG (Feb. 27, 2013) [hereinafter SPL App. 1]. The TPGNA SPA is appended to SPL App. 1 as Appendix A.
[4] SPL App. 1 at 2-3.

- **Second Application, FE Docket No. 13-42-LNG:** Filed on April 2, 2013, the Second Application requests authorization to export domestically produced LNG in a volume equivalent to approximately **88.3 Bcf/yr of natural gas**, pursuant to the terms of the LNG SPA between SPL as seller and Centrica plc (Centrica) as buyer, dated March 22, 2013 (Centrica SPA).[5] SPL states that, under the Centrica SPA, SPL will deliver LNG to Centrica for a primary term of 20 years, to commence on the date of first commercial delivery from Train 5 of the Terminal.[6]

- **Third Application, FE Docket No. 13-121-LNG:** Filed on September 10, 2013, the Third Application requests authorization to export domestically produced LNG in a volume equivalent to approximately **314 Bcf/yr of natural gas**, which SPL states represents the volume of LNG that can be produced from Trains 5 and 6 that is not already committed for export under the TGPNA and Centrica SPAs.[7] In this Application alone, SPL requests authorization to export the LNG on its own behalf and as agent for other entities that hold title to the LNG, after registering each such entity with DOE/FE.

In sum, SPL's three Applications together request a LNG export authorization of 503.3 Bcf/yr of natural gas to be allocated as follows:

(i) Up to 101 Bcf/yr under the TGPNA SPA;

(ii) Up to 88.3 Bcf/yr under the Centrica SPA; and

(iii) Up to 314 Bcf/yr from Trains 5-6.

[5] Sabine Pass Liquefaction, LLC, Application for Long-Term Authorization To Export Liquefied Natural Gas, FE Docket No. 13-42-LNG (April 2, 2013) [hereinafter SPL App. 2]. The Centrica SPA is appended to SPL App. 2 as Appendix A.
[6] SPL App. 2 at 2-3.
[7] Sabine Pass Liquefaction, LLC, Application of Sabine Pass Liquefaction, LLC for Long-Term Authorization To Export Liquefied Natural Gas, FE Docket No. 13-121-LNG (Sept. 10, 2013) [hereinafter SPL App. 3].

For each of the three Applications, SPL seeks authorization to export the LNG for a 20-year term commencing on the earlier of the date of first export or eight years from the date this authorization is issued. For the reasons discussed herein, this Final Opinion and Order authorizes SPL to export LNG, pursuant to the TGPNA and Centrica SPAs and/or on its own behalf and as agent for other entities, from Trains 5 and 6 of the Sabine Pass LNG Terminal to non-FTA countries in the requested volume—503.3 Bcf/yr of natural gas. This authorization is for a 20-year term commencing when SPL begins commercial export of domestically sourced LNG from Train 5 of the Sabine Pass LNG Terminal, consistent with the TGPNA and Centrica SPAs.

We note that SPL states in the Applications that "[its] delivery obligations under [both] SPAs are not tied to individual trains."[8] SPL further asserts that "[its] obligations to deliver LNG under its contracts becomes effective upon the date that specified trains become commercially operable," but that "it retains the flexibility to satisfy its delivery obligations [under the SPAs] with LNG from ***any train at its facility***."[9] Insofar as SPL is requesting authority through these statements to satisfy some or all of its delivery obligations under the two SPAs from Trains 1-4 of the Terminal (instead of from Trains 5-6), we find that it is reasonable to allow this operational flexibility, subject to any applicable DOE/FE export limitations in previously issued orders bearing on exports using Trains 1-4 (including *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961-A (*Sabine Pass*))[10] and the terms of those

[8] SPL App. 1 at 3 n.6; SPL App. 2 at 3 n.6; SPL App. 3 at 3 n.9.
[9] *Id*. (emphasis added).
[10] *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961, FE Docket No. 10-111-LNG, Opinion and Order Conditionally Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (May 20, 2011) (conditional order); *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961-A, FE Docket No. 10-111-LNG, Final Opinion and Order Granting Long-Term Authorization to

individual SPAs. Therefore, SPL may export the volume of LNG authorized for export by this Order from any of the Terminal's Trains 1-6, but may not utilize this authority to exceed the volume limits set forth in prior authorizations regarding Trains 1-4, including DOE/FE Order No. 2961-A (803 Bcf/yr of natural gas). Use of Trains 1-4 to meet SPL's contractual obligations to TGPNA or Centrica consequently will reduce the volumes of LNG that may be exported using Trains 1-4 for other customers under DOE/FE Order No. 2961-A. *See also infra* §§ XIII (Terms and Conditions, Para. H).

Moreover, the volumes of LNG authorized for export in SPL's three FTA orders for Trains 5-6 and this Order reflect the planned liquefaction capacity of those two liquefaction trains and are not additive to one another. By contrast, the volume of LNG authorized for export in this Order is distinct from, and therefore additive to, the volumes of LNG authorized for export in SPL's orders for Trains 1-4. *See infra* § XIII.I.

DOE/FE Proceedings. On July 25, 2013, DOE/FE published Notices of Application for both the First and Second Application in the Federal Register.[11] The Notices of Application called on interested persons to submit protests, motions to intervene, notices of intervention, and comments on both the First and Second Applications by September 23, 2013. In response to the Notice of First Application, DOE/FE received six motions to intervene from the following entities: TGPNA, America's Energy Advantage, Inc. (AEA), the American Petroleum Institute (API), Centrica, Industrial Energy Consumers of America (IECA), and Sierra Club. The motions

Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (Aug. 7, 2012) (final order).

[11] Sabine Pass Liquefaction, LLC, Application for Long-Term Authorization to Export Liquefied Natural Gas Produced from Domestic Natural Gas Resources to Non-Free Trade Agreement Countries for a 20-Year Period, 78 Fed. Reg. 44,937 (July 25, 2013) [hereinafter Notice of First App.]; Sabine Pass Liquefaction, LLC, Application for Long-Term Authorization to Export Liquefied Natural Gas Produced from Domestic Natural Gas Resources to Non-Free Trade Agreement Countries for a 20-Year Period, 78 Fed. Reg. 44, 934 (July 25, 2015) [hereinafter Notice of Second App.].

filed by AEA, IECA, and Sierra Club included comments on the First Application, and Sierra Club protested that Application. In response to the Notice of Second Application, DOE/FE received corresponding motions to intervene, comments, and a protest from the same six entities.

On February 13, 2014, DOE/FE published a Notice of SPL's Third Application in the Federal Register.[12] The Notice of Third Application called on interested persons to submit protests, motions to intervene, notices of intervention, and comments on the Third Application by April 14, 2014. In response to the Notice of Third Application, DOE/FE received three motions to intervene from the American Public Gas Association (APGA), Sierra Club, and API. The APGA and Sierra Club submissions included protests of the Third Application. Additional procedural history is set forth below. *See infra* §§ IV.C, VII.

Previously, on May 20, 2011, DOE/FE issued Order No. 2961 to SPL, which was DOE/FE's first order conditionally granting a long-term authorization to export LNG produced in the lower-48 states to non-FTA countries.[13] As noted above, in that order DOE/FE conditionally authorized SPL to export a volume of LNG equivalent to 803 Bcf/yr of natural gas (or 2.2 Bcf per day (Bcf/d)) from Trains 1-4 of the Sabine Pass LNG Terminal.

By August 2011, with several other non-FTA export applications then pending before it, DOE/FE determined that further study of the economic impacts of LNG exports was warranted to better inform its public interest review under section 3 of the NGA.[14] Accordingly, DOE/FE

[12] Sabine Pass Liquefaction, LLC, Application for Long-Term Authorization to Export Liquefied Natural Gas Produced from Domestic Natural Gas Resources to Non-Free Trade Agreement Countries for a 20-Year Period, 79 Fed. Reg. 8698 (Feb. 13, 2014) [hereinafter Notice of Third App.].
[13] *Sabine Pass*, DOE/FE Order No. 2961, *supra* at 4 n.10.
[14] DOE/FE stated in *Sabine Pass* that it "will evaluate the cumulative impact of the [Sabine Pass] authorization and any future authorizations for export authority when considering any subsequent application for such authority." DOE/FE Order No. 2961, at 33.

engaged the U.S. Energy Information Administration (EIA) and NERA Economic Consulting (NERA) to conduct a two-part study of the economic impacts of LNG exports.[15]

First, in August 2011, DOE/FE requested that EIA assess how prescribed levels of natural gas exports above baseline cases could affect domestic energy markets. Using its National Energy Modeling System (NEMS), EIA examined the impact of two DOE/FE-prescribed levels of assumed natural gas exports (at 6 Bcf/d and 12 Bcf/d) under numerous scenarios and cases based on projections from EIA's 2011 *Annual Energy Outlook* (AEO 2011), the most recent EIA projections available at the time.[16] The new scenarios and cases examined by EIA included a variety of supply, demand, and price outlooks. EIA published its study, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, in January 2012.[17] As discussed below, EIA generally found that LNG exports will lead to higher domestic natural gas prices, increased domestic natural gas production, reduced domestic natural gas consumption, and increased natural gas imports from Canada via pipeline.

Second, DOE contracted with NERA to assess the potential macroeconomic impact of LNG exports by incorporating EIA's then-forthcoming case study output from the NEMS model into NERA's general equilibrium model of the U.S. economy. NERA analyzed the potential macroeconomic impacts of LNG exports under a range of global natural gas supply and demand scenarios, including scenarios with unlimited LNG exports. DOE published the NERA Study, *Macroeconomic Impacts of LNG Exports from the United States*, in December 2012 (2012

[15] *See* 2012 LNG Export Study, 77 Fed. Reg. 73,627 (Dec. 11, 2012), *available at* http://energy.gov/sites/prod/files/2013/04/f0/fr_notice_two_part_study.pdf (Federal Register Notice of Availability of the LNG Export Study).
[16] The Annual Energy Outlook (AEO) presents long-term projections of energy supply, demand, and prices. It is based on results from EIA's NEMS model. *See infra* §§ IX.A, XII.B.4 (discussion of AEO projections).
[17] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/downloads/lng-export-study-related-documents (EIA Analysis (Study - Part 1)).

NERA Study).[18] Among its key findings, NERA projected that the United States would gain net economic benefits from allowing LNG exports. For every market scenario examined, net economic benefits increased as the level of LNG exports increased. *See infra* § VIII.B.

On December 11, 2012, DOE/FE published a Notice of Availability (NOA) of the EIA and NERA studies (collectively, the 2012 LNG Export Study or Study).[19] DOE/FE invited public comment on the Study, and stated that its disposition of the then-pending non-FTA LNG export applications would be informed by the Study and the comments received in response thereto.[20] The NOA required initial comments by January 24, 2013, and reply comments between January 25 and February 25, 2013.[21] DOE/FE received over 188,000 initial comments and over 2,700 reply comments, of which approximately 800 were unique.[22] The comments also included 11 economic studies prepared by commenters or organizations under contract to commenters.

The public comments represent a diverse range of interests and perspectives, including those of federal, state, and local political leaders; large public companies; public interest organizations; academia; industry associations; foreign interests; and thousands of U.S. citizens. While the majority of comments were short letters expressing support or opposition to the LNG Export Study or to LNG exports in general, others contained detailed statements of differing points of views. The comments were posted on the DOE/FE website and entered into the public

[18] *See id*. (NERA Economic Consulting Analysis (Study - Part 2)).
[19] 77 Fed. Reg. at 73,627.
[20] *Id*. at 73,628.
[21] *Id*. at 73,627. On January 28, 2013, DOE issued a Procedural Order accepting for filing any initial comments that had been received as of 11:59 p.m., Eastern time, on January 27, 2013.
[22] Because many comments were nearly identical form letters, DOE/FE organized the initial comments into 399 docket entries, and the reply comments into 375 entries. *See* http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_initial_comments.html (Initial Comments – LNG Export Study) & http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_reply_comments.html (Reply Comments – LNG Export Study).

records of the 15 LNG export proceedings identified in the NOA.[23] As discussed below, DOE/FE has carefully examined the comments and has considered them in its review of SPL's Applications.

Additionally, on June 4, 2014, DOE/FE issued two notices in the Federal Register proposing to evaluate different environmental aspects of the LNG production and export chain. First, DOE/FE announced that it had conducted a review of existing literature on potential environmental issues associated with unconventional gas production in the lower-48 states. The purpose of this review was to provide additional information to the public concerning the potential environmental impacts of unconventional natural gas exploration and production activities, including hydraulic fracturing. DOE/FE published its draft report for public review and comment, entitled *Draft Addendum to Environmental Review Documents Concerning Exports of Natural Gas from the United States* (Draft Addendum).[24] DOE/FE received comments on the Draft Addendum and, on August 15, 2014, issued the final Addendum (hereafter Addendum) with its response to the public comments contained in Appendix B.[25]

Second, DOE/FE commissioned the National Energy Technology Laboratory (NETL), a DOE applied research laboratory, to conduct an analysis calculating the life cycle greenhouse gas (GHG) emissions for LNG exported from the United States. *See infra* § XI.A. The purpose of this analysis was to determine: (i) how domestically-produced LNG exported from the United States compares with regional coal (or other LNG sources) for electric power generation in

[23] *See* 77 Fed. Reg. at 73,629 & n.4.
[24] Dep't of Energy, Draft Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States, 79 Fed. Reg. 32,258 (June 4, 2014). DOE/FE announced the availability of the Draft Addendum on its website on May 29, 2014.
[25] Dep't of Energy, Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States, 79 Fed. Reg. 48,132 (Aug. 15, 2014). *See infra* § X.

Europe and Asia from a life cycle GHG perspective, and (ii) how those results compare with natural gas sourced from Russia and delivered to the same markets via pipeline. DOE/FE published NETL's report entitled, *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (LCA GHG Report).[26] DOE/FE also received public comment on the LCA GHG Report, and provides its response to those comments in this Order. *See infra* § XI.B.

With respect to both the Addendum and the LCA GHG Report, DOE/FE has taken all public comments into consideration in this decision and has made those comments, as well as the underlying studies, part of the record in this proceeding.[27] As explained below, neither the Addendum nor the LCA GHG Report are required by the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, but DOE/FE believes that these documents will inform its review of the public interest under NGA section 3(a), and are responsive to concerns previously raised in this proceeding.

Parallel FERC Proceeding. Concurrently with its Applications to DOE/FE, SPL, together with Sabine Pass Liquefaction Expansion, LLC and Sabine Pass LNG, L.P. (collectively, Sabine Pass), were pursuing authorization from FERC to site, construct, and operate the Liquefaction Expansion Project under NGA section 3(a). In February 2013, Sabine Pass commenced FERC's mandatory pre-filing process under NEPA for the Liquefaction

[26] Dep't of Energy, Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas From the United States, 79 Fed. Reg. 32,260 (June 4, 2014) [hereinafter LCA GHG Report]. DOE/FE announced the availability of the LCA GHG Report on its website on May 29, 2014.

[27] By electronic mail, DOE/FE notified all parties to this proceeding of the issuance of both the draft Addendum and the LCA GHG Report, as well as the opportunity to submit comments on those documents.

Expansion Project in FERC Docket No. PF13-8-000.[28] In June 2013, FERC issued a Notice of Intent to Prepare an Environmental Assessment (NOI) for the proposed Liquefaction Expansion Project and the related Cheniere Creole Trail Pipeline Expansion Project.[29] The NOI stated that DOE/FE had agreed to participate as a cooperating agency in FERC's proceeding to satisfy its NEPA responsibilities.[30] In September 2013, Sabine Pass filed its application with FERC to site, construct, and operate the Liquefaction Expansion Project in FERC Docket No. CP13-552-000.[31] Likewise, in FERC Docket No. CP13-553-000, Cheniere Creole Trail Pipeline, L.P. (CCTPL) requested a certificate of public convenience and necessity to construct and operate the interstate natural gas pipeline, compression, and related facilities to deliver additional domestic natural gas to the Sabine Pass LNG Terminal (Cheniere Creole Trail Pipeline Expansion Project) under NGA section 7(c), 15 U.S.C. § 717f(c).[32]

On December 12, 2014, FERC issued the Environmental Assessment (EA) for the Sabine Pass Liquefaction Expansion Project and Cheniere Creole Trail Pipeline Expansion Project (collectively, Expansion Projects) and placed it into the public record.[33] The EA recommended

[28] Sabine Pass Liquefaction Expansion, LLC; Sabine Pass Liquefaction, LLC; Sabine Pass LNG, L.P; and Cheniere Creole Trail Pipeline, L.P.; Request to Initiate Pre-Filing Review Process for Liquefaction Expansion Project and Pipeline Extension and Expansion, FERC Docket No. PF13-8-000 (Feb. 27, 2013); *see also* SPL App. at 6 n.20 (stating that the pre-filing request also includes a request by an affiliated interstate pipeline company, Cheniere Creole Trail Pipeline, L.P. (CCTPL), to initiate the pre-filing review process for a proposed extension and expansion of the existing Cheniere Creole Trail Pipeline system in order to deliver feed-gas to the Liquefaction Expansion Project).

[29] Sabine Pass Liquefaction Expansion, LLC, *et al.*, Notice of Intent to Prepare an Environmental Assessment for the Proposed Sabine Pass Liquefaction Expansion Project and Cheniere Creole Trail Pipeline Expansion Project, 78 Fed. Reg. 35,625 (June 13, 2014) [hereinafter FERC NOI].

[30] *See id.*, 78 Fed. Reg. at 35,626.

[31] Sabine Pass Liquefaction Expansion, LLC, *et al.*, Application for Authorizations Under the Natural Gas Act, FERC Docket Nos. CP13-552-000 and CP13-553-000 (Sept. 30, 2013) [hereinafter Sabine Pass FERC App.]; *see* 78 Fed. Reg. 62,344 (Oct. 18, 2013)]Notice of Application].

[32] *See* 78 Fed. Reg. at 62,344.

[33] S*ee* 79 Fed. Reg. 76,997 (Dec. 23, 2014) [Notice of availability of EA].

that FERC subject any approval of the Expansion Projects to 64 environmental conditions.[34] FERC received comments on the EA from Sierra Club and the U.S. Environmental Protection Agency (EPA), as well as other interested federal agencies and individuals.

On April 6, 2015, FERC issued an Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificate (FERC Order), which authorized Sabine Pass to site, construct, and operate the proposed Liquefaction Expansion Project subject to 65 environmental conditions contained in the appendix of that Order (the 64 environmental conditions recommended in the EA, plus an additional environmental condition imposed by FERC).[35] The FERC Order also granted CCTPL authorization under section 7(c) of the NGA to construct and operate its proposed Cheniere Creole Trail Pipeline Expansion Project, subject to the same 65 environmental conditions. Details of the FERC Order are discussed below. *See infra* § VI.C.

Sierra Club intervened in Sabine Pass's proceeding before FERC, challenging the adequacy of the EA. In its Order, FERC addressed assertions by Sierra Club, among others, that the EA failed to consider the potential indirect environmental impacts of the Project—specifically, any indirect effects of additional shale gas production that would be induced by the demand for export volumes from Sabine Pass's customers.[36] FERC found that the potential environmental effects associated with shale gas development are not sufficiently causally related to the Liquefaction and Creole Trail Expansion Projects to warrant detailed analysis as indirect

[34] Federal Energy Regulatory Comm'n, Environmental Assessment for the Sabine Pass Liquefaction Expansion Project and Cheniere Creole Trail Pipeline Expansion Project, Docket Nos. CP13-552-000 and CP13-553-000, at 183 (Dec. 2014) [hereinafter EA].
[35] *Sabine Pass Liquefaction Expansion, LLC, et al.*, Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates, 151 FERC ¶ 61,012 (April 6, 2015) [hereinafter FERC Order].
[36] *See* FERC Order at P 88.

impacts. FERC stated that such production is not "reasonably foreseeable," as contemplated by the Council on Environmental Quality's (CEQ) NEPA regulations.[37]

Next, FERC rejected the argument that it was required to analyze direct, cumulative, and indirect impacts on climate change from GHG emissions. As to Sierra Club and EPA's suggestion for FERC to rely on the LCA GHG Report discussed herein, FERC stated that the Report "is too general to assist us in our consideration of the specific proposal before us."[38] FERC further observed that potential GHG emissions associated with the Liquefaction Expansion Project, as well as impacts on water and air resources were, in fact, addressed in the EA. FERC emphasized the EA's conclusion that the construction and operation of the Liquefaction Expansion Project will not significantly impact these resources.[39]

FERC also rejected claims that it should have used CEQ's recently-issued *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts* and the "social cost of carbon tool" in its analysis.[40] FERC noted that the revised guidance was not issued until after issuance of the EA, and found that the social cost of carbon tool is not appropriate for estimating a specific project's impact or informing analysis under NEPA. FERC likewise rejected assertions that an environmental impact statement (EIS) rather than an EA should have been prepared for the Project. On this record, FERC concluded that the Liquefaction and Pipeline Expansion Projects, if built and operated in compliance with the specified environmental

[37] *Id.* at 90.
[38] FERC Order at P 95.
[39] *See id.* at P 96.
[40] *See id.* at P 100 (citing Council on Envt'l Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts (Dec. 18, 2014), *available at*: http://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf).

conditions, "would not constitute a major federal action significantly affecting the quality of the human environment."[41]

Sierra Club filed a timely request for rehearing of the FERC Order. FERC granted rehearing for purposes of further consideration on June 3, 2015, and denied the request for rehearing on June 23, 2015.[42]

DOE/FE's Adoption of EA and Issuance of Finding of No Significant Impact (FONSI) Under NEPA, and NGA Section 3(a) Authorization. After an independent review, DOE/FE is concurrently adopting FERC's EA for the Liquefaction Expansion Project (DOE/EA-1983) and issuing a Finding of No Significant Impact (FONSI) for the proposed Expansion Project and other related facility modifications.[43] As discussed below, this Order grants SPL's three Applications and is conditioned on SPL's compliance with the 65 environmental conditions adopted in the FERC Order.

II. SUMMARY OF FINDINGS AND CONCLUSIONS

This Order presents DOE/FE's findings and conclusions on all issues associated with SPL's proposed exports under NGA section 3(a), including both environmental and non-environmental issues.[44] As the basis for this Order, DOE/FE has reviewed a substantial administrative record that includes (but is not limited to) the following: SPL's Applications and Supplements; the comments, motions, and protests submitted in response to the Applications; the

[41] FERC Order at P 122.
[42] *Sabine Pass Liquefaction Expansion, LLC, et al.*, Order Denying Reh'g, 151 FERC ¶ 61,253 (June 23, 2015) [hereinafter FERC Order Denying Reh'g].
[43] U.S. Dep't of Energy, Finding of No Significant Impact for Sabine Pass Liquefaction Expansion Project Regarding Sabine Pass Liquefaction, LLC Applications Seeking Department of Energy Authorization to Export Liquefied Natural Gas from Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations, DOE/EA-1983 (June 26, 2015) [hereinafter SPL FONSI].
[44] The non-environmental issues primarily include economic and international impacts associated with SPL's proposed exports, as well as security of the natural gas supply in the United States. *See infra* § III (public interest standard).

2012 LNG Export Study; FERC's EA on the proposed Liquefaction Expansion Project; the FERC Order granting authorization for Sabine Pass to site, construct, and operate the Liquefaction Expansion Project; the FERC Rehearing Order; the Addendum; the LCA GHG Report; and public comments received on DOE/FE's various analyses. Based on that record and for the reasons set forth below, DOE/FE has determined that the protestors have not demonstrated that the proposed exports will be inconsistent with the public interest, as would be required to deny SPL's Applications under NGA section 3(a).

On this basis, DOE/FE authorizes SPL's export of domestically produced LNG from Trains 5 and 6 of the Sabine Pass LNG Terminal to non-FTA countries in a total volume equivalent to 503.3 Bcf/yr of natural gas (including up to 101 Bcf/yr under the TGPNA SPA, up to 88.3 Bcf/yr under the Centrica SPA, and up to 314 Bcf/yr from Trains 5 and 6). In the Applications, SPL had asked DOE/FE to issue a conditional order authorizing the export of domestically produced LNG, followed by issuance of a final order immediately upon FERC's completion of its environmental review process. However, that issue is moot because we are granting a final authorization based on FERC's and DOE/FE's environmental review, as discussed below.[45] This authorization is subject to the Terms and Conditions and Ordering Paragraphs set forth herein, which incorporate by reference the 65 environmental conditions imposed by FERC. *See infra* §§ XIII-XV.

III. PUBLIC INTEREST STANDARD

Section 3(a) of the NGA sets forth the standard for review of SPL's 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

[45] *See* U.S. Dep't of Energy, Procedures for Liquefied Natural Gas Export Decisions, 79 Fed. Reg. 48,132 (Aug. 15, 2014).

> secured an order of the [Secretary of Energy[46]] 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.

15 U.S.C. § 717b(a). This provision creates a rebuttable presumption that a proposed export of natural gas is in the public interest. DOE/FE must grant such an application unless opponents of the application overcome that presumption by making an affirmative showing of inconsistency with the public interest.[47]

While section 3(a) establishes a broad public interest standard and a presumption favoring export authorizations, the statute does not define "public interest" or identify criteria that must be considered. In prior decisions, however, DOE/FE has identified a range of factors that it evaluates when reviewing an application for export authorization. These factors include economic impacts, international impacts, security of natural gas supply, and environmental impacts, among others. To conduct this review, DOE/FE looks to record evidence developed in the application proceeding.[48]

[46] The Secretary's authority was established by the Department of Energy Organization Act, 42 U.S.C. § 7172, which transferred jurisdiction over imports and export authorizations from the Federal Power Commission to the Secretary of Energy.

[47] *See, e.g.*, *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961, FE Docket No. 10-111-LNG, Opinion and Order Conditionally Granting Long-Term Authorization to Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations, at 28 (May 20, 2011) [hereinafter *Sabine Pass*]; *see also Phillips Alaska Natural Gas Corp. & Marathon Oil Co.*, DOE/FE Order No. 1473, FE Docket No. 96-99-LNG, Order Extending Authorization to Export Liquefied Natural Gas from Alaska, at 13 (April 2, 1999) [hereinafter *Phillips Alaska Natural Gas*], citing *Panhandle Producers & Royalty Owners Ass'n v. ERA*, 822 F.2d 1105, 1111 (D.C. Cir. 1987).

[48] *See, e.g.*, *Sabine Pass*, DOE/FE Order No. 2961, at 28-42 (reviewing record evidence in issuing conditional authorization).

DOE/FE's prior decisions have also looked to certain principles established in its 1984 Policy Guidelines.[49] The goals of the Policy Guidelines are to minimize federal control and involvement in energy markets and to promote a balanced and mixed energy resource system. The Guidelines provide that:

> The market, not government, should determine the price and other contract terms of imported [or exported] natural gas …. The federal government's primary responsibility in authorizing imports [or exports] will be to evaluate the need for the gas and whether the import [or export] arrangement will provide the gas on a competitively priced basis for the duration of the contract while minimizing regulatory impediments to a freely operating market.[50]

While nominally applicable to natural gas import cases, DOE/FE subsequently held in Order No. 1473 that the same policies should be applied to natural gas export applications.[51]

In Order No. 1473, DOE/FE stated that it was guided by DOE Delegation Order No. 0204-111. That delegation order, which authorized the Administrator of the Economic Regulatory Administration to exercise the agency's review authority under NGA section 3, directed the Administrator to regulate exports "based on a consideration of the domestic need for the gas to be exported and such other matters as the Administrator finds in the circumstances of a particular case to be appropriate."[52] In February 1989, the Assistant Secretary for Fossil Energy assumed the delegated responsibilities of the Administrator of ERA.[53]

Although DOE Delegation Order No. 0204-111 is no longer in effect, DOE/FE's review of export applications has continued to focus on: (i) the domestic need for the natural gas

[49] New Policy Guidelines and Delegations Order Relating to Regulation of Imported Natural Gas, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines].
[50] *Id*. at 6685.
[51] *Phillips Alaska Natural Gas*, DOE/FE Order No. 1473, at 14 (citing *Yukon Pacific Corp.*, DOE/FE Order No. 350, Order Granting Authorization to Export Liquefied Natural Gas from Alaska, 1 FE ¶ 70,259, at 71,128 (1989)).
[52] DOE Delegation Order No. 0204-111, at 1; *see also* 1984 Policy Guidelines, 49 Fed. Reg. at 6690.
[53] *See* Applications for Authorization to Construct, Operate, or Modify Facilities Used for the Export or Import of Natural Gas, 62 Fed. Reg. 30,435, 30,437 n.15 (June 4, 1997) (citing DOE Delegation Order No. 0204-127, 54 Fed. Reg. 11,436 (Mar. 20, 1989)).

proposed to be exported, (ii) whether the proposed exports pose a threat to the security of domestic natural gas supplies, (iii) whether the arrangement is consistent with DOE/FE's policy of promoting market competition, and (iv) any other factors bearing on the public interest described herein.

IV. DESCRIPTION OF REQUEST

A. Description of Applicant

SPL is a limited liability company with its principal place of business in Houston, Texas. As noted above, SPL is an indirect subsidiary of Cheniere Partners, a limited partnership majority owned by Cheniere Energy. Cheniere Partners is a Delaware limited partnership with its primary place of business in Houston, Texas. Cheniere Energy is a Delaware corporation with its primary place of business in Houston, Texas. SPL is authorized to do business in the States of Texas and Louisiana.

B. Procedural History

Pertinent aspects of SPL's procedural history with DOE/FE are summarized below.

As noted above, DOE/FE has granted the portion of each of the three Applications requesting authority to export LNG to FTA countries. The three FTA export authorizations related to the Liquefaction Expansion Project, Trains 5 and 6, are:

DOE/FE Order No. 3306: On July 11, 2013, in DOE/FE Order No. 3306, DOE/FE granted the request of SPL to export domestically produced LNG from the Liquefaction Expansion Project to FTA nations under the TGPNA SPA. Pursuant to that order, SPL is authorized to export LNG in a volume equivalent to 101 Bcf/yr of natural gas for a 20-year term

commencing on the earlier of the date of first export or eight years from the date that the authorization is issued (July 11, 2021).[54]

DOE/FE Order No. 3307. On July 12, 2013, in DOE/FE Order No. 3307, DOE/FE granted the request of SPL to export domestically produced LNG from the Liquefaction Expansion Project to FTA nations under the Centrica SPA. Pursuant to that order, SPL is authorized to export LNG in a volume equivalent to 88.3 Bcf/yr of natural gas for a 20-year term commencing on the earlier of the date of first export or eight years from the date that the authorization is issued (July 12, 2021).[55]

DOE/FE Order No. 3384. On January 22, 2014, in DOE/FE Order No. 3384, DOE/FE granted the request of SPL to export domestically produced LNG, on its own behalf and as agent for other entities, in a volume equivalent to 314 Bcf/yr of natural gas for a 20-year term commencing on the earlier of the date of first export or eight years from the date the authorization is issued (January 22, 2022).[56]

These orders, and the other two FTA orders issued for Trains 1-4, are depicted in Table 1 below:

Table 1: Orders Issued by DOE/FE to SPL for the Export of Domestic LNG from the Sabine Pass LNG Terminal to FTA Countries

Docket No.	Order No.	Date Issued	Trains	Volume (Bcf/yr)	Term/Type
10-85-LNG	2833	Sept. 7, 2010	1-4	803.0	30 years,[57] multi-contract

[54] *See* SPL FTA Order No. 3306 at 8.
[55] *See* SPL FTA Order No. 3307 at 8.
[56] *See* SPA FTA Order No. 3384 at 11.
[57] *See Sabine Pass Liquefaction, LLC*, Errata to DOE/FE Order Nos. 3595 & 3384, FE Docket Nos. 14-92-LNG & 13-121-LNG (Feb. 24, 2015).

13-30-LNG	3306	July 11, 2013	5-6	101.0	20 years, LNG Sale and Purchase Agreement with Total Gas & Power North America (TGPNA)
13-42-LNG	3307	July 12, 2013	5-6	88.3	20 years, LNG Sale and Purchase Agreement with Centrica plc
13-121-LNG	3384	Jan. 22, 2014	5-6	314.0	20 years, multi-contract
14-92-LNG	3595	Feb. 12, 2015	1-4	203.0	25 years, multi-contract
Total Volume				**1,509.3**	

Additionally, on August 7, 2012, in DOE/FE Order No. 2961-A, DOE/FE granted final authorization to SPL to export LNG from Trains 1-4 of the Sabine Pass LNG Terminal to non-FTA countries in a volume equivalent to approximately 803 Bcf/yr of natural gas (2.2 Bcf/d). The non-FTA export volume authorized in DOE/FE Order No. 2961-A is not additive to the FTA export volumes authorized in DOE/FE Order No. 2833 and 3595, which are also for Trains 1-4. SPL's two non-FTA export authorizations, including this Order, are depicted in Table 2 below:

Table 2: Orders Issued by DOE/FE to SPL for the Export of Domestic LNG from the Sabine Pass LNG Terminal to Non-FTA Countries

Docket No.	Order No.	Date Issued	Trains	Volume (Bcf/yr)	Term/Type
10-111-LNG	2961-A (Final Opinion and Order)	Aug. 7, 2012	1-4	803.0	20 years, multi-contract
13-30-LNG 13-42-LNG 13-121-LNG	3669 (Final	June 26, 2015	5-6	503.3	20 years, multi-contract

	Opinion and Order)				
Total Volume				**1,306.3**	

More recently, on April 20, 2015, we note that SPL filed an application in FE Docket No. 15-63-LNG requesting authority to export an additional incremental amount of LNG from Trains 1-4, equivalent to approximately 203 Bcf/yr of natural gas (0.56 Bcf/d), to non-FTA countries for a 20-year term commencing on the date of first commercial export from the Liquefaction Project. SPL states that the grant of this new application will align the volumes authorized for export to non-FTA countries with the liquefaction production capacity of the Terminal, as already approved by FERC (as well as with the total FTA export volumes authorized to date by DOE/FE). That application is currently pending before DOE/FE.

SPL supplemented the three Applications in this proceeding with the following two filings:

First Supplement to Applications. SPL filed a supplement to its Applications in each of the three dockets on November 7, 2013.[58] In this Supplement, SPL asserted its view that DOE/FE cannot delay the review of, nor impose a quota on, applications to export LNG to World Trade Organization countries without causing the United States to be in violation of Article XI:1 of the General Agreement on Tariffs and Trade of 1994 (GATT 1994).[59] None of the proposed intervenors opposed SPL's Supplement or otherwise responded to it.

[58] Sabine Pass Liquefaction, LLC, Supplement to Applications of Sabine Pass Liquefaction, LLC for Long-Term Authorization to Export Liquefied Natural Gas, FE Docket Nos. 13-30-LNG, 13-42-LNG, & 13-121-LNG (Nov. 7, 2013) [hereinafter First Supp.].
[59] General Agreement on Tariffs and Trade, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 [hereinafter GATT 1994].

Second Supplement to Applications. On February 28, 2014, SPL submitted a Second Supplement to the Applications in each of the three dockets.[60] SPL stated that the purpose of the Second Supplement was to augment the administrative record by submitting a new report to update the 2012 NERA Study conducted for DOE/FE as part of the 2012 LNG Export Study (discussed *infra* § 8).[61] SPL's parent company, Cheniere Energy, commissioned NERA to conduct this report, entitled *Updated Impacts of LNG Exports from the United States* (2014 NERA Study), which SPL submitted as Appendix A to the Second Supplement. SPL states that the 2014 NERA Study uses more recent EIA data and modeling assumptions than NERA originally used in the 2012 LNG Export Study—specifically, data from EIA's *Annual Energy Outlook 2013* (AEO 2013) and *International Energy Outlook 2013* studies.[62] SPL characterizes the key findings of its 2014 NERA Study as follows:

- "The 2014 NERA Study reinforces NERA's prior findings: LNG exports contribute net benefits to the U.S. economy; those benefits consistently increase as exports increase; and U.S. economic welfare is greatest under scenarios in which unconstrained exports occur."
- "Greater LNG exports and domestic demand can be supported in the U.S. natural gas market at lower prices compared to results presented in the 2012 NERA Study."
- "Greater economic benefits would result to the United States at a given level of LNG exports compared to the 2012 NERA Study results."

[60] Sabine Pass Liquefaction, LLC, Supplement to Applications of Sabine Pass Liquefaction, LLC for Long-Term Authorization to Export Liquefied Natural Gas, FE Docket Nos. 13-30-LNG, 13-42-LNG, & 13-121-LNG (Feb. 28, 2014) [hereinafter Second Supp.].
[61] Second Supp. at 1.
[62] Second Supp. at 3. During the time of DOE/FE's comment period on the LNG Export Study, the AEO 2013 Early Release was the most current AEO available. On May 2, 2013, shortly after the comment period closed, EIA issued its final AEO 2013 projections. *See* U.S. Energy Information Administration, *Annual Energy Outlook 2013 with Projections to 2040* (April 2013), *available at* http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf [hereinafter AEO 2013].

- "LNG exports would contribute job gains and reduce near-term unemployment in the U.S. economy."[63]

None of the proposed intervenors opposed SPL's Second Supplement or otherwise responded to it.

C. Liquefaction Expansion Project

SPL states that it filed the Applications in conjunction with the development of the Liquefaction Expansion Project at the Sabine Pass LNG Terminal. The existing Sabine Pass Liquefaction Project consists of four liquefaction trains (Trains 1-4) with a combined capacity of 20 mtpa of LNG, or 2.76 Bcf/d of natural gas, which FERC authorized in 2012. [64] SPL states that Trains 1 through 4 are currently under construction.[65]

SPL states that the Liquefaction Expansion Project will expand the capacity of the Liquefaction Project by constructing two additional liquefaction trains, Trains 5 and 6, with a liquefaction capacity of approximately 251.5 Bcf/yr of natural gas each. Therefore, the Expansion Project will add liquefaction capacity totaling approximately 503 Bcf/yr of natural gas (1.38 Bcf/d),[66] bringing the Liquefaction Project's total authorized production capacity from Trains 1-6 to approximately 29 mtpa of LNG, or 4.14 Bcf/d of natural gas.[67]

[63] Second Supp. at 2.
[64] FERC originally authorized the Liquefaction Project in 2012 for 16 mtpa of LNG, or 2.2 Bcf/d of natural gas, but authorized an increase to 20 mtpa, or 2.76 Bcf/d, in 2014. FERC Order at PP 4-5 (citing *Sabine Pass Liquefaction, LLC*, Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates, 139 FERC ¶ 61,039, *reh'g denied*, 140 FERC ¶ 61076 (2012) [hereinafter 2012 FERC Order]; *Sabine Pass Liquefaction, LLC*, Order Granting Authorization Under Section 3 of the Natural Gas Act and Issuing Certificates, 146 FERC ¶ 61,117, *reh'g denied*, 148 FERC ¶ 61,200 (2014)).
[65] *See* SPL App 3. at 3-4.
[66] SPL App. 1 at 6; SPL App. 3 at 3, n.5.
[67] FERC Order at P 3.

With this Order, the total capacity authorized for export by DOE/FE will match the peak proposed production capacity of the Liquefaction Project—1509.3 Bcf/yr of natural gas, or 4.14 Bcf/d.

D. Business Model

In connection with the first two Applications, SPL has entered into SPAs with TGPNA and Centrica to export LNG from the Liquefaction Project as follows:

1. TGPNA SPA (Dec.14, 2012) for approximately 101 Bcf/yr of natural gas (comprised of an annual tranche of 91,250,000 MMBtu and a seasonal tranche of 13,000,000 MMBtu per year) for a 20-year term;[68] and

2. Centrica SPA (March 22, 2013) for approximately 88.3 Bcf/yr of LNG for a 20-year term.[69]

As noted above, SPL states that its delivery obligations under these SPAs are not tied to individual trains. Although SPL's obligation to deliver LNG under the contracts becomes effective upon the date that Train 5 becomes commercially operable, SPL seeks authority to diversity its deliveries among any of the Trains 1-6 available at the Terminal. Additionally, SPL states that the SPAs call for title of the LNG to transfer from SPL to TGPNA and Centrica at the "flange coupling of the LNG intake manifold of the relevant LNG tanker."[70] DOE/FE has previously stated that the flange of the LNG vessel is the point of export.[71] As such, SPL states that it will be the exporter of the LNG under these agreements.[72]

In connection with the Third Application, SPL requests long-term, multi-contract authorization to export the allocation of LNG (314 Bcf/yr) on its own behalf and as agent for

[68] SPL App. 1 at 3.
[69] SPL App. 2 at 3.
[70] *See* TGPNA SPA at 31 (Appendix to SPL App. 1); Centrica SPA at 29-30 (Appendix to SPL App. 2).
[71] *See Dow Chem. Co.*, DOE/FE Order No. 2859, FE Docket No. 10-57-LNG, Order Granting Blanket Authorization to Export Liquefied Natural Gas (Oct. 5, 2010).
[72] *See also* FTA Order No. 3306; FTA Order No. 3307.

other entities, after registering each such entity with DOE/FE. SPL states that it will comply with all DOE/FE requirements for exporters and agents, including the registration requirements set forth in recent DOE/FE orders.[73]

Finally, SPL states that it will bear the responsibility for sourcing supplies of natural gas for delivery to the Sabine Pass LNG Terminal, and that it will file any long-term gas supply or long-term contracts with DOE/FE pursuant to DOE/FE's regulations and precedent.

E. Source of Natural Gas

SPL states that it will purchase natural gas to be used as fuel and feedstock for LNG production from the interstate and intrastate grid at points of interconnection with other pipelines and points of liquidity both upstream and downstream of the CCTPL system and other systems that interconnect with the Liquefaction Project.[74] SPL states that through these pipelines' interconnections with other interstate and intrastate pipeline systems, the Liquefaction Expansion Project will have access to virtually any point on the U.S. interstate pipeline system through direct delivery or by displacement. Further, SPL notes that the proximity of the Liquefaction Expansion Project to multiple interstate and intrastate pipelines will enable SPL to purchase natural gas from multiple conventional and unconventional basins located across the region, state, and nation. As of the date of each Application, SPL states that it has not entered into any natural gas purchase agreements for the purpose of supplying natural gas feedstock for the proposed exports.[75]

V. 2012 LNG EXPORT STUDY

As noted above, in August 2011, with several non-FTA applications pending before it,

[73] SPL App. 3 at 4.
[74] SPL App. 1 at 7.
[75] *See id.*; SPL App. 2 at 7; SPL App. 3 at 8.

DOE/FE determined that study of the cumulative economic impact of LNG exports was warranted to better inform its public interest review under section 3 of the NGA. To address this issue, DOE/FE undertook a two-part study of the cumulative economic impact of LNG exports. The first part of the study was conducted by EIA and looked at the potential impact of additional natural gas exports on domestic energy consumption, production, and prices under several export scenarios prescribed by DOE/FE. The EIA Study did not evaluate macroeconomic impacts of LNG exports on the U.S. economy. The second part of the study, performed by NERA Economic Consulting, assessed the potential macroeconomic impact of LNG exports using its energy-economy model (the "NewERA" model). NERA built on the EIA Study requested by DOE/FE by calibrating the NERA U.S. natural gas supply model to the results of the study by EIA. The EIA Study was limited to the relationship between export levels and domestic prices without considering whether those quantities of exports could be sold at high enough world prices to support the calculated domestic prices. NERA used its Global Natural Gas Model (GNGM) to estimate expected levels of U.S. LNG exports under several scenarios for global natural gas supply and demand. A more detailed discussion of each study follows.

A. EIA Study, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*

1. Methodology

DOE/FE asked EIA to assess how four scenarios of increased natural gas exports could affect domestic energy markets, particularly consumption, production, and prices. The four scenarios assumed LNG exports of:

- 6 Bcf/d, phased in at a rate of 1 Bcf/d per year (low/slow scenario);
- 6 Bcf/d phased in at a rate of 3 Bcf/d per year (low/rapid scenario);
- 12 Bcf/d phased in at a rate of 1 Bcf/d per year (high/slow scenario); and

- 12 Bcf/d phased in at a rate of 3 Bcf/d per year (high/rapid scenario).

According to EIA, total marketed natural gas production in 2011 was approximately 66 Bcf/d. Thus, exports of 6 Bcf/d and 12 Bcf/d represent roughly 9 and 18 percent of natural gas production in 2011, respectively.

DOE/FE also requested that EIA consider the above four scenarios of increased natural gas exports in the context of four cases from EIA's AEO 2011. These four cases are:

- The AEO 2011 Reference Case;
- The High Shale Estimated Ultimate Recovery (EUR) case (reflecting optimistic assumptions about domestic natural gas supply, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent higher than in the Reference Case);
- The Low Shale EUR case (reflecting pessimistic assumptions about domestic natural gas supply, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent lower than in the Reference Case); and
- The High Economic Growth case (assuming the U.S. gross domestic product will grow at an average annual rate of 3.2 percent from 2009 to 2035, compared to 2.7 percent in the Reference Case, which increases domestic energy demand).

Taken together, the four scenarios with different additional export levels imposed from the indicated baseline case (no additional exports) presented 16 case scenarios:

Table 3: Case Scenarios Considered By EIA in Analyzing Impacts of LNG Exports

	AEO 2011 Cases	**Export Scenarios**
1	AEO 2011 Reference	Low/Slow
2	AEO 2011 Reference	Low/Rapid
3	AEO 2011 Reference	High/Slow
4	AEO 2011 Reference	High/Rapid
5	High EUR	Low/Slow
6	High EUR	Low/Rapid
7	High EUR	High/Slow
8	High EUR	High/Rapid
9	Low EUR	Low/Slow

10	Low EUR	Low/Rapid
11	Low EUR	High/Slow
12	Low EUR	High/Rapid
13	High Economic Growth	Low/Slow
14	High Economic Growth	Low/Rapid
15	High Economic Growth	High/Slow
16	High Economic Growth	High/Rapid

EIA used the final AEO 2011 projections issued in April 2011 as the starting point for its analysis and applied the NEMS model. Because NEMS did not generate a projection of LNG export demand, EIA specified additional natural gas demand levels as a proxy for projected export levels consistent with the scenarios prescribed by DOE/FE.

EIA assigned these additional exports to the West South Central Census Division. This meant that EIA effectively assumed that the incremental LNG exports would be shipped out of the Gulf Coast states or Texas.

EIA also counted any additional natural gas consumed during the liquefaction process within the total additional export volumes specified in the DOE/FE scenarios. Therefore the net volumes of LNG produced for export were roughly 10 percent below the gross volumes considered in each export scenario. By way of illustration, the cases where cumulative export volumes are 6 Bcf/d, liquefaction would consume 0.6 Bcf/d and net exports of 5.4 Bcf/d.

EIA made other changes in modeled flows of gas into and out of the lower-48 United States where necessary to analyze the increased export scenarios.[76] Additionally, EIA assumed

[76] U.S. natural gas exports to Canada and U.S. natural gas imports from Mexico are exogenously specified in all the AEO 2011 cases. U.S. imports of natural gas from Canada are endogenously set in the model and continue to be so for this study. However, U.S. natural gas exports to Mexico and U.S. LNG imports that are normally determined endogenously within the model were set to the levels projected in the associated AEO 2011 cases for this study. EIA Study at 2-3.

that a pipeline transporting Alaskan natural gas into the lower-48 states would not be built during the forecast period, thereby isolating the lower-48 states' supply response.

2. Scope of EIA Study

In the Preface to its Study, EIA identifies several limiting factors governing use of the Study results:

> The projections in this report are not statements of what *will* happen but of what *might* happen, given the assumptions and methodologies used. The Reference case in this report is a business-as-usual trend estimate, reflecting known technology and technological and demographic trends, and current laws and regulations. Thus, it provides a policy-neutral starting point that can be used to analyze policy initiatives. EIA does not propose, advocate, or speculate on future legislative and regulatory changes.[77]

Additionally, the EIA Study recognizes that projections of energy markets over a 25-year period are highly uncertain, and that many events—such as supply disruptions, policy changes, and technological breakthroughs—cannot be foreseen. Other acknowledged limitations on the scope of the EIA Study include:

- The NEMS model is not a world energy model, and therefore does not address the interaction between the potential for additional U.S. natural gas exports and developments in world natural gas markets;

- Global natural gas markets are not integrated, and their nature could change substantially in response to significant changes in natural gas trading patterns;

- Macroeconomic results were not included in the analysis because energy exports are not explicitly represented in the NEMS macroeconomic module; and

The domestic focus of the NEMS model makes it unable to account for all interactions between energy prices and supply/demand in energy-intensive industries that are globally competitive.

[77] EIA Study at ii (emphasis in original).

3. Natural Gas Markets

The EIA Study recognized that natural gas markets are not integrated globally and natural gas prices span a wide range. EIA stated that the current large disparity in natural gas prices across major world regions is likely to narrow as markets become more globally integrated. However, key questions remain as to how quickly and to what extent convergence might occur.

U.S. market conditions are also variable, according to EIA, and lower or higher U.S. natural gas prices would tend to make additional exports more or less likely. EIA pointed out that prospects for LNG exports depend greatly on the cost-competitiveness of liquefaction projects in the United States relative to those at other locations.

EIA observed that relatively high shipping costs from the United States may add a cost disadvantage compared to exporting countries closer to key markets, such as in Asia. EIA notes that LNG projects in the United States would frequently compete not just against other LNG projects, but also against pipeline projects from traditional natural gas sources or projects to develop shale gas in Asia or Europe.

4. Results of EIA Study

EIA generally found that LNG exports will lead to higher domestic natural gas prices, increased domestic natural gas production, reduced domestic natural gas consumption, and increased natural gas imports from Canada via pipeline. The impacts of exports, according to EIA, included:

Increased natural gas prices at the wellhead. EIA stated that larger export levels would lead to larger domestic price increases; rapid increases in export levels would lead to large initial price increases that moderate somewhat in a few years; and slower increases in export

levels would lead to more gradual price increases but eventually would produce higher average prices during the decade between 2025 and 2035.

Increased natural gas production and supply. Increased exports would result in a supply response, *i.e.*, increased natural gas production that would satisfy about 60 to 70 percent of the increase in natural gas exports, with a minor additional contribution from increased imports from Canada. Across most cases, EIA stated that about three-quarters of this increased production would come from shale sources.

Decreased natural gas consumption. Due to higher prices, EIA projects a decrease in the volume of gas consumed domestically. EIA states that the electric power sector, by switching to coal and renewable fuels, would account for the majority of this decrease but indicates that there also would be a small reduction in natural gas use in all sectors from efficiency improvements and conservation.

Increased end-user natural gas and electricity delivered prices. EIA states that even while consuming less, on average, consumers will see an increase in their natural gas and electricity expenditures.

Additional details regarding these conclusions are discussed in the following sections.

5. Wellhead Price Increases

EIA projects that natural gas prices will increase in the Reference Cases even absent expansion of natural gas exports. This baseline increase in natural gas prices bears an inverse relationship to projected increases in the volumes of natural gas produced from shale resources. Thus, in the high shale EUR Reference Case, the long-term natural gas price is lower than it is in the low shale EUR case.

While EIA projected a rising baseline price of gas without exports, EIA also found that the price of gas will increase over the rising baseline when exports occur. Exports are projected to impact natural gas prices in two ways. First, the export scenarios that contained rapid growth in exports experienced large initial price increases that moderated in the long run, while cases projecting a slow growth in exports experienced more gradual price increases. Second, cases with larger cumulative exports resulted in higher prices in the long-term relative to those cases with lower overall export levels. The largest price increase over the baseline exists in the Low Shale EUR case. The High Shale EUR case yields the smallest price response.

6. Increased Natural Gas Production and Supply

EIA projected that most of the additional natural gas needed for export would be provided by increased domestic production with a minor contribution from increased pipeline imports from Canada. The remaining portion of the increased export volumes would be offset by decreases in consumption resulting from the higher prices associated with the increased exports.

7. Decreased Natural Gas Consumption

EIA projected that greater export levels would lead to decreases in natural gas consumption. Most of this projected decrease would occur in the electric power sector. Increased coal-fired generation accounts for about 65 percent of the projected decrease in natural gas-fired generation. However, EIA also noted that the degree to which coal might be used in lieu of natural gas depends on what regulations are in place. As noted above, EIA's projections reflected the laws and regulations in place at the time AEO 2011 was produced.

EIA further projected that small increases in renewable generation would contribute to reduced natural gas-fired generation. Relatively speaking, the role of renewables would be greater in a higher-gas-price environment (*i.e.*, the Low Shale EUR case) when renewables can

more successfully compete with coal, and also in a higher-generation environment (*i.e.*, the High Economic Growth case), particularly in the later years.

EIA projected that increased natural gas exports would result in reductions in industrial natural gas consumption. However, the NEMS model does not capture the link between energy prices and the supply/demand of industrial commodities in global industries. To the extent that the location of production is sensitive to changes in natural gas prices, EIA acknowledged that industrial natural gas demand would be more responsive than shown in its analysis.

8. Increased End-User Natural Gas and Electricity Delivered Prices

EIA projected that, with increased natural gas exports, consumers would consume less and pay more on both their natural gas and electricity bills, and generally pay a little less for liquid fuels.

EIA projected that the degree of change to total natural gas bills with added exports varies significantly among economic sectors. This is because the natural gas commodity charge represents significantly different portions of each natural gas consuming sector's bill. However, EIA projected that natural gas expenditures would increase at the highest percentages in the industrial sector, where low transmission and distribution charges constitute a relatively small part of the delivered natural gas price.

EIA projected that average electricity prices would increase between 0.14 and 0.29 cents per kilowatt-hour (kWh) (between 2 and 3 percent) when gas exports are added. The greatest projected increase in electricity prices occurs in 2019 under the Low Shale EUR case for the high export/rapid growth export scenario, with an increase of 0.85 cents per kWh (9 percent).

EIA projected that, on average between 2015 and 2035, total U.S. end-use electricity expenditures as a result of added exports would increase between $5 billion to $10 billion

(between 1 to 3 percent), depending on the export scenario. The High Macroeconomic Growth case shows the greatest average annual increase in natural gas expenditures over the same time period, with increases over the baseline (no additional exports) scenario ranging from $6 billion to $12 billion.

9. Impact on Natural Gas Producer Revenues

As part of its analysis, EIA considered the impact of natural gas exports on natural gas producer revenues. According to EIA, total additional natural gas revenues to producers from exports would increase from 2015 to 2035 between $14 billion and $32 billion over the AEO 2011 Reference Case, depending on the export scenario. These revenues reflect dollars spent to purchase and move the natural gas to the export facility, but do not include any revenues associated with the liquefaction and shipping process.

EIA cautioned that these projected increases in natural gas producer revenues do not represent profits and a large portion of the additional revenues would be expended to cover the costs associated with increased production, such as for equipment (*e.g.*, drilling rigs) and labor. In contrast, the additional revenues resulting from the higher price of natural gas that would have been produced and sold to largely domestic customers even in the absence of the additional exports posited in the analysis would preponderantly reflect increased profits for producers and resource owners.

10. Impacts Beyond the Natural Gas Industry

EIA stated that, other than impacts on their energy expenditures, impacts on non-energy sectors were generally beyond the scope of its study. However, EIA did project impacts on total energy use and energy-related CO_2 emissions. EIA projected that annual primary energy consumption in the AEO 2011 Reference Case will average 108 quadrillion Btu between 2015

and 2035, with a growth rate of 0.6 percent. Also, cumulative CO_2 emissions are projected to total 125,000 million metric tons for that 20-year period.

According to EIA, the changes in overall energy consumption would largely reflect changes in the electric power sector. While additional exports would result in decreased natural gas consumption, changes in overall energy consumption would be relatively minor as much of the decrease in natural gas consumption would be replaced with increased coal consumption.

While lower domestic natural gas deliveries resulting from added exports are projected to reduce natural gas related CO_2 emissions, EIA projected that the increased use of coal in the electric sector would generally result in a net increase in domestic CO_2 emissions. Exceptions occur in scenarios where renewables are better able to compete against natural gas and coal. However, when also accounting for emissions related to natural gas used in the liquefaction process, EIA projected that additional exports would increase domestic CO_2 levels under all cases and scenarios, particularly in the earlier years of the projection period. EIA did not evaluate the effect of U.S. LNG exports on global CO_2 emissions.

B. NERA Study, *Macroeconomic Impacts of LNG Exports from the United States*

Because the NEMS model used by EIA did not account for the impact of energy price changes on global energy utilization patterns and did not include a full macroeconomic model, DOE/FE commissioned NERA to provide such an analysis. NERA developed a two-step approach. First, it modeled energy markets by drawing on several of the scenarios that EIA had developed and adding global market scenarios developed through its GNGM model. Second, using its "N_{ew}ERA" energy-economy model, NERA drew conclusions regarding the domestic macroeconomic impacts of LNG exports. The impacts measured using the N_{ew}ERA

macroeconomic model included price, welfare,[78] gross domestic product (GDP), aggregate consumption, aggregate investment, natural gas export revenues, sectoral output,[79] and wages and other household incomes. In addition, NERA identified impacts that would affect certain energy intensive, trade exposed (EITE) industries, as discussed below.

1. Overview of NERA's Findings

NERA's key findings include the following:

Net economic benefits across all scenarios. Across all the scenarios studied, NERA projected that the United States would gain net economic benefits from allowing LNG exports. For every market scenario examined, net economic benefits increased as the level of LNG exports increased. Scenarios with unlimited exports had higher net economic benefits than corresponding cases with limited exports. In all cases, the benefits that come from export expansion outweigh the losses from reduced capital and wage income to U.S. consumers, and hence LNG exports have net economic benefits in spite of higher domestic natural gas prices.

Net benefits to the United States would be highest if the United States is able to produce large quantities of gas from shale at low cost, if world demand for natural gas increases rapidly, and if LNG supplies from other regions are limited. If the promise of shale gas is not fulfilled and costs of producing gas in the United States rise substantially, or if there are ample supplies of LNG from other regions to satisfy world demand, the United States would not export LNG. Under these conditions, allowing exports of LNG would cause no change in natural gas prices

[78] According to NERA, the measure of welfare used in its study is known as the "equivalent variation" and is the amount of income a household would be willing to give up in the case without LNG exports to achieve the benefits of LNG exports. NERA states that it measured welfare in present value terms, and therefore captures in a single number benefits and costs that might vary year by year over the period. NERA Study at 6, n.5 & 55.

[79] NERA evaluated seven key sectors of the U.S. economy: agriculture, energy intensive sector, electricity, natural gas, motor vehicle, manufacturing, refined petroleum products, and services. *Id*. at 9.

and do no harm to the overall economy.

Natural gas price increases. U.S. natural gas prices would increase if the United States exports LNG. However, the global market limits how high U.S. natural gas prices can rise under pressure of LNG exports because importers will not purchase U.S. exports if U.S. wellhead price rises above the cost of competing supplies.

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

Socio-economic impacts. How increased LNG exports will affect different socioeconomic groups will depend on their income sources. Like other trade measures, LNG exports will cause shifts in industrial output and employment and in sources of income. Overall, both total labor compensation and income from investment are projected to decline, and income to owners of natural gas resources will increase. Different socioeconomic groups depend on different sources of income; workers with retirement savings that include shares of natural resource companies will benefit from higher incomes to those companies. Nevertheless, impacts will not be positive for all groups in the economy. Households with income solely from wages or government transfers, in particular, might not participate in these benefits.

Competitive impacts and impact on employment. Serious competitive impacts are likely to be confined to narrow segments of industry. About 10 percent of U.S. manufacturing,

measured by value of shipments, has both energy expenditures greater than 5 percent of the value of its output and serious exposure to foreign competition. Employment in these energy-intensive industries is about one-half of one percent of total U.S. employment.

LNG exports are unlikely to affect the overall level of employment in the United States. There will be some shifts in the number of workers across industries, with those industries associated with natural gas production and exports attracting workers away from other industries. In no scenario is the shift in employment out of any industry projected to be larger than normal rates of turnover of employees in those industries.

Additional discussion of the above key findings is offered below and in the NERA Study itself.

2. Overview of NERA's Methodology

NERA states that it attempted to answer two principal questions:

- At what price can various quantities of LNG exports be sold?
- What are the economic impacts on the United States of LNG exports?

To answer these questions, NERA used the GNGM model to estimate expected levels of U.S. LNG exports under several scenarios for global natural gas supply and demand. NERA also relied on the EIA Study to characterize how U.S. natural gas supply, demand, and prices would respond if the specified level of LNG exports were achieved. Further, NERA examined the same 16 scenarios for LNG exports analyzed by EIA but added additional scenarios to reflect global supply and demand. These additional scenarios were constructed on the basis of NERA's analytical model of global natural gas markets, as described below.

The resulting scenarios ranged from Reference Case conditions to stress cases with high costs of producing natural gas in the United States and exceptionally large demand for U.S.

LNG exports in world markets. The three scenarios chosen for the U.S. resource outlook were the EIA Reference Case, based on AEO 2011, and two cases assuming different levels of EUR from new gas shale development. Outcomes of the EIA high demand case fell between the High and Low EUR cases and, therefore, would not have changed the range of results. The three different international outlooks were: (1) a Reference Case, based on EIA's International Energy Outlook 2011; (2) a Demand Shock case with increased worldwide natural gas demand caused by shutdowns of some nuclear capacity; and (3) a Supply/Demand Shock case that added to the Demand Shock a supply shock that assumed key LNG exporting regions did not increase their exports above current levels.

When the global and U.S. scenarios were combined with seven scenarios specifying limits on exports and export growth, NERA's analysis covered 63 possible scenarios. From these 63 scenarios, 21 scenarios resulted in some level of LNG export from the United States. Of these 21 scenarios, the GNGM model identified 13 "NewERA scenarios" that spanned the range of economic impacts from all of the scenarios and eliminated scenarios with essentially identical outcomes. The 13 scenarios included:

Table 4: N_{ew}ERA Scenarios Analyzed by NERA

	U.S. Scenarios	International Demand and Supply Scenarios	Export Scenarios
1	Reference	Supply and Demand Shock	Low/Rapid
2	Reference	Supply and Demand Shock	Low/Slow
3	Reference	Supply and Demand Shock	High/Rapid
4	Reference	Supply and Demand Shock	High/Slow
5	Reference	Demand Shock	Low/Rapid
6	Reference	Demand Shock	Low/Slow
7	Reference	Demand Shock	Low/Slowest
8	High EUR	Supply and Demand Shock	High/Rapid
9	High EUR	Supply and Demand Shock	High/Slow
10	High EUR	Supply and Demand Shock	Low/Rapid
11	High EUR	Supply and Demand Shock	Low/Slow
12	High EUR	Supply and Demand Shock	Low/Slowest
13	Low EUR	Supply and Demand Shock	Low/Slowest

To project the macroeconomic impacts of the above scenarios, NERA used its N_{ew}ERA model to compare the impacts of each of the 13 export scenarios to baselines with no LNG exports. NERA thus derived a range of projected impacts on the U.S. economy, including impacts on welfare, aggregate consumption, disposable income, GDP, and loss of wage income.

3. Scope of the NERA Study

NERA started its analysis with the domestic economic AEO 2011 cases and the export scenarios present in the EIA Study.[80] In addition to the export scenarios used by EIA, NERA added two export cases, including the "low/slowest case" and a "no restraints" case in which no regulatory restraints on exports existed. The low/slowest case assumed exports of 6 Bcf/d, with a growth rate of 0.5 Bcf/d per year, which is half the growth rate in the slow scenarios used by EIA.

[80] For a full discussion of the scope, see pages 3-15 of the NERA Study, http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf.

Because NERA, unlike EIA, modeled the international gas market, NERA also created three international gas market scenarios not contained in the EIA Study. The first was a business as usual Reference Case. The second assumed an international demand shock with increased worldwide natural gas demand caused by shutdowns of some nuclear capacity. Finally, NERA created an international scenario that added to the demand shock a supply shock that assumed key LNG exporting regions did not increase their exports above current levels.

While these additional aspects of the analysis expanded the scope of the NERA Study relative to the study conducted by EIA, significant elements of the dynamics of the global natural gas trade and its domestic economic implications were outside the scope of the NERA Study or beyond the reach of the modeling tools used.[81] NERA expressly excluded the following factors from its analysis:

- The extent to which an overbuilding of liquefaction capacity could affect the ability to finance the projects and profitably export natural gas;
- The extent to which engineering or infrastructure limitations would impact the rate at which liquefaction capacity would come online, potentially impacting the cost of that capacity;
- The locations of the liquefaction facilities, or alternatives;
- The impacts of the liquefaction and exportation of natural gas on various regions within the United States;
- The extent to which the impacts of LNG export vary among different socio-economic groups; and
- The extent to which macroeconomic impacts to the United States would vary if the liquefaction projects were funded through foreign direct investment.

[81] For a full discussion of the unexplored factors, see Appendix E of the NERA Study, http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf.

4. NERA's Global Natural Gas Model

The GNGM model is designed to estimate natural gas production, consumption, and trade in the major gas producing or consuming regions.[82] The model attempts to maximize the difference between surplus and cost, constrained by various factors including liquefaction capacity and pipeline constraints. The model divides the world into 12 regions and specifies supply and demand curves for each region. The regions are: Africa, Canada, China/India, Central and South America, Europe, Former Soviet Union, Korea/Japan, Middle East, Oceania, Sakhalin, Southeast Asia, and the United States. The GNGM model's production and consumption assumptions for these regions are based on projections contained in the Reference Cases of EIA's AEO 2011 and International Energy Outlook 2011. NERA ran the GNGM model in five-year increments between 2015 and 2035.

According to NERA, the characteristics of a regional market will affect LNG trading patterns and the pricing of natural gas within the region. With respect to trading patterns, NERA observed that a significant portion of LNG, such as LNG moving to Europe, is traded on a long-term basis using dedicated supplies and dedicated vessels moving to identified markets. On the other hand, NERA stated that some LNG markets, particularly those in Asia, operate on the basis of open market competitive bids in which LNG is delivered to those who value it the most. NERA also found that Southeast Asian and Australian suppliers most often market LNG to Asian markets; African suppliers deliver LNG most often to Europe; and Middle Eastern suppliers deliver LNG both to Europe and Asia.

With respect to the pricing of LNG in global markets, NERA states that the price

[82] For a full discussion of GNGM, see page 20 of the NERA Study, http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf.

differential, or "basis," between two regions reflects the difference in the pricing mechanism for each regional market. If pricing for two market hubs were set by the same mechanism and there were no constraints in the transportation system, the basis would simply be the cost of transportation between the two market hubs. NERA asserts, however, that different pricing mechanisms set the price in each regional market, so the basis is often not set by transportation differences alone.

NERA offers the following example: Japan depends on LNG as its source for natural gas and indexes LNG prices to crude oil prices. For Europe, on the other hand, NERA states that LNG is only one of three potential sources of supply for natural gas. The others are interregional pipelines and indigenous production. According to NERA, the competition for market share between these alternative sources of supply will establish the basis for LNG prices in Europe. NERA further states that within North America, pricing at Henry Hub has been for the most part set by competition between different North American supply sources and has been independent of pricing in Japan and Europe.

5. The N_{ew}ERA Macroeconomic Model

NERA developed the N_{ew}ERA model to forecast how, under a range of domestic and international supply and demand conditions, U.S. LNG exports could affect the U.S. economy.[83] Like other general equilibrium models, N_{ew}ERA is designed to analyze long-term economic trends. NERA explained that, in any given year, actual prices, employment, or economic activity may differ from the projected levels.

The version of N_{ew}ERA used in NERA's analysis considered all sectors of the U.S.

[83] For a full discussion of the N_{ew}ERA macroeconomic model, see pages 20 to 22 of the NERA Study, http://fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf

economy. In short, the model:

- Contains supply curves for domestic natural gas,
- Accounts for imports of Canadian pipeline gas and other foreign imports,
- Recognizes the potential for increases to U.S. liquefaction capacity, and
- Recognizes changes in international demand for domestically produced natural gas.

As discussed below, the results of the N_{ew}ERA model address changes in demand and supply of all goods and services, prices of all commodities, and impacts from LNG exports to U.S. trade, including changes in imports and exports. As with the GNGM model, NERA ran the N_{ew}ERA model in five-year increments for 2015 through 2035.

6. Relationship to the EIA Study

As explained above, EIA's study focused on potential impacts of natural gas exports to domestic energy markets. Specifically, the study considered impacts to natural gas supply, demand, and prices within the United States. To provide a fuller scope of analysis, DOE asked NERA to examine the net macroeconomic impact of domestic LNG exports on the U.S. economy. To conduct this analysis, NERA first modeled international demand for U.S. LNG utilizing its GNGM model. NERA then incorporated the results from the GNGM model into its N_{ew}ERA model, using the same parameters governing natural gas supply and demand that EIA used in the NEMS model.

NERA concluded that, in many cases, the global natural gas market would not accept the full amount of exports assumed in the EIA scenarios at export prices high enough to cover the U.S. wellhead prices calculated by EIA. In these cases, NERA replaced the export levels and price impacts found in the EIA scenarios with lower levels of exports (and prices) estimated by

the GNGM model. These lower export levels were applied to the NewERA model to generate projected impacts to the U.S. economy from LNG exports.

7. Key Assumptions and Parameters of the NERA Study

NERA implemented the following key assumptions and parameters, in part to retain consistency with EIA's NEMS model:

i. All scenarios were derived from the AEO 2011 and incorporated EIA's assumptions about energy and environmental policies, baseline coal, oil and natural gas prices, economic and energy demand growth, and technology availability and cost in the corresponding AEO cases.

ii. U.S. exports compete with LNG exports from other nations, who are assumed to behave competitively and to adjust their export quantities in response to prevailing prices. The single exception to this assumption is that the export decisions of the global LNG market's one dominant supplier, Qatar, were assumed to be independent of the level of U.S. exports.

iii. Prices for natural gas used for LNG production were based on the Henry Hub price, plus a 15 percent markup (to cover operating costs of the liquefaction process).

iv. The LNG tolling (or reservation) fee—paid by the exporter to the operator of the liquefaction terminal for the right to reserve capacity—was based on a return of capital to the operator.

v. All financing of investment was assumed to originate from U.S. sources.

The United States is assumed to have full employment, meaning that U.S. unemployment rates and the total number of jobs in the United States will not change across all cases.

8. Results of the NERA Study

As a result of its two-step analysis, the NERA Study yielded two sets of results, reported in five-year intervals beginning with 2015.[84] First, the GNGM model produced information regarding the conditions that will support exports of natural gas from the United States. Second, the N_{ew}ERA model provided information about the domestic macroeconomic impacts of natural gas exports. NERA found:

LNG exports would result in higher U.S. natural gas prices. NERA found that the United States would only be able to market LNG successfully with higher global demand or lower U.S. costs of production than in the Reference Cases. According to NERA, the market limits how high U.S. natural gas prices can rise under pressure of LNG exports because importers will not purchase U.S. exports if the U.S. wellhead price rises above the cost of competing supplies. In particular, under NERA's modeling, the U.S. natural gas price does not become linked to oil prices in any of the cases examined.

Macroeconomic impacts of LNG exports are positive in all cases. NERA found that the United States would experience net economic benefits from increased LNG exports in all cases studied. Only three cases had U.S. exports greater than the 12 Bcf/d maximum exports allowed in the cases analyzed by EIA.[85] NERA estimated economic impacts for these three cases with no constraint on exports, and found that even with exports reaching levels greater than

[84] These calendar years are not actual, but represent modeling intervals after exports begin. For example, if the United States does not begin LNG exports until 2016, one year should be added to the dates for each year that exports commence after 2015.

[85] The first case combined U.S. Reference natural gas production with an international supply and demand shock. The second combined the High EUR domestic case with an international demand shock. The third combined the High EUR domestic case with an international supply and demand shock. NERA Study at 6.

12 Bcf/d and associated higher prices than in the constrained cases, there were net economic benefits from allowing unlimited exports in all cases.

Across the scenarios, NERA projected that U.S. economic welfare would consistently increase as the volume of natural gas exports increased, including in scenarios with unlimited exports. The reason given was that even though domestic natural gas prices are pulled up by LNG exports, the value of those exports also rises so that there is a net gain for the U.S. economy measured by a broad metric of economic welfare or by more common measures such as real household income or real GDP. Although there are costs to consumers of higher energy prices and lower consumption and producers incur higher costs to supply the additional natural gas for export, these costs are more than offset by increases in export revenues along with a wealth transfer from overseas received in the form of payments for liquefaction services. The net result is an increase in U.S. households' real income and welfare. NERA noted, however, that net benefits to the U.S. economy could be larger if U.S. businesses were to take more of a merchant role. NERA assumed that foreign purchasers would take title to LNG when it is loaded at a U.S. port, so that any profits that could be made by transporting and selling in importing countries accrue to foreign entities. In cases where exports are constrained to maximum permitted levels, this business model sacrifices additional value from LNG exports that could accrue to the United States.

Sources of income would shift. NERA states that at the same time that LNG exports create higher total income in the United States, exports would shift the composition of income so that both wage income and income from capital investment decline. NERA's measure of total income is GDP measured from the income side, that is, by adding up income from labor, capital, and natural resources and adjusting for taxes and transfers. According to NERA, expansion of

LNG exports would have two major effects on income: it raises energy costs and, in the process, depresses both real wages and the return on capital in all other industries, but it also creates two additional sources of income. First, additional income would come in the form of higher export revenues and wealth transfers from incremental LNG exports at higher prices paid by overseas purchasers. Second, U.S. households also would benefit from higher natural gas resource income or rents. These benefits differentiate market-driven expansion of LNG exports from actions that only raise domestic prices without creating additional sources of income. According to NERA, the benefits that come from export expansion would more than outweigh the losses from reduced capital and wage income to U.S. consumers, and hence LNG exports would have net economic benefits in spite of higher natural gas prices. According to NERA, this is the outcome that economic theory describes when barriers to trade are removed.

Some groups and industries will experience negative effects of LNG exports. NERA concluded that, through retirement savings, an increasingly large number of workers will share in the higher income received by natural resource companies participating in LNG export-related activities. Nevertheless, impacts will not be positive for all groups in the economy. According to NERA, households with income solely from wages or transfers, in particular, might not participate in these benefits. NERA stated that higher natural gas prices can also be expected to have negative effects on output and employment, particularly in sectors that make intensive use of natural gas, while other sectors not so affected could experience gains. There clearly would be greater activity and employment in natural gas production and transportation and in construction of liquefaction facilities. Overall, NERA projected that declines in output in other sectors would be accompanied by similar reductions in worker compensation in those sectors, indicating that there will be some shifting of labor between different industries. However, even

in the year of peak impacts, the largest projected change in wage income by industry would be no more than one percent, and even if all of this decline were attributable to lower employment relative to the baseline, NERA concluded that no sector analyzed in its study would experience reductions in employment more rapid than normal turnover. In fact, NERA asserted that most of the changes in real worker compensation are likely to take the form of lower than expected real wage growth, due to the increase in natural gas prices relative to nominal wage growth.

Peak natural gas export levels (as specified by DOE/FE for the EIA Study) and resulting price increases are not likely. The export volumes selected by DOE/FE for the EIA Study define the maximum exports allowed in each scenario for the NERA macroeconomic analysis. Based on its analysis of global natural gas supply and demand, NERA projected achievable levels of exports for each scenario. The NERA scenarios that found a lower level of exports than the limits specified by DOE/FE are shown in Figure 5 of the NERA Study, as modified from Tcf/yr to Bcf/d below.

Table 5: NERA Export Volumes in Bcf/d,
Adapted from Figure 5 of the NERA Report

NERA Export Volumes (in Bcf/d)	2015	2020	2025	2030	2035
U.S. Reference Case with International Demand Shock and lower than Low/Slow export levels	***1.02***	2.69	3.92	3.27	***6.00***
U.S. Reference Case with International Demand Shock and lower than Low/Rapid export levels	2.80	2.69	3.92	3.27	3.76
U.S. Reference Case with International Supply/Demand Shock and lower than High/Slow export levels	***1.02***	6.00	10.77	***12.00***	***12.00***

U.S. Reference Case with International Supply/Demand Shock and lower than High/Rapid export levels	***3.02***	***8.00***	10.77	***12.00***	***12.00***
U.S. High Shale EUR with International Supply/Demand Shock at Low/Slowest export levels	***0.50***	2.69	3.92	3.27	3.76

The cells in bold italics indicate the years in which the model's limit on exports is binding. All scenarios hit the export limits in 2015 except the NERA export volume case with Low/Rapid exports. In no case does the wellhead price increase by more than $1.11/Mcf due to market-determined levels of exports. Even in cases in which no limits were placed on exports, competition between the United States and competing suppliers of LNG limits increases in both U.S. LNG exports and U.S. natural gas prices.

To match the characterization of U.S. supply and demand for natural gas in EIA's NEMS model, NERA calibrated its macroeconomic model so that for the same level of LNG exports assumed in the EIA Study, the NERA model reproduced the prices projected by EIA. Thus natural gas price responses were similar in scenarios where NERA export volumes were at the EIA export volumes. However, NERA determined that the high export limits were not economical in the U.S. Reference Case and that in these scenarios there would be lower exports than assumed by EIA. Because NERA estimated lower export volumes than were specified by DOE/FE for the EIA Study, U.S. natural gas prices do not reach the highest levels projected by EIA. NERA states that this implies no disagreement with the EIA Study. Instead, it reflects the fact that at the highest wellhead prices estimated by EIA, world demand for U.S. exports would fall far short of the levels of exports assumed in the EIA Study. Additionally, NERA found that U.S. wellhead prices would not become linked to oil prices in the sense of rising to oil price

parity in any of the cases analyzed, even if the United States were exporting to regions where natural gas prices are presently linked to oil. NERA asserts that costs of liquefaction, transportation, and regasification would keep U.S. prices well below those in importing regions.

Serious competitive impacts are likely to be confined to narrow segments of U.S. industry. NERA gave special attention to the potential impact of LNG exports on EITE industries. NERA examined impacts on manufacturing industries where energy expenditures are greater than 5 percent of the value of the output created and the industries face serious exposure to foreign competition. Such industries, according to NERA, comprise about 10 percent of U.S. manufacturing and employment in these industries is one-half of one percent of total U.S. employment. NERA did not project that such energy-intensive industries as a whole would sustain a loss in employment or output greater than one percent in any year in any of the cases examined and pointed out that such a drop in employment would be less than normal rates of turnover of employees in the relevant industries.

Even with unlimited exports, there would be net economic benefits to the United States. NERA estimated economic impacts associated with unlimited exports in cases in which even the High, Rapid limits were binding. In these cases, both LNG exports and prices were determined by global supply and demand. Even in these cases, NERA found that U.S. natural gas prices would not rise to oil parity or to levels observed in consuming regions, and net economic benefits to the U.S. increased over the corresponding cases with limited exports. To examine U.S. economic impacts under cases with even higher natural gas prices and levels of exports than in the unlimited export cases, NERA also estimated economic impacts associated with the highest levels of exports and U.S. natural gas prices in the EIA analysis, regardless of whether those quantities could actually be sold at the assumed netback prices. The price

received for exports in these cases was calculated in the same way as in the cases based on NERA's GNGM model, by adding the tolling fee plus a 15 percent markup over Henry Hub to the Henry Hub price. Even with the highest prices estimated by EIA for these hypothetical cases, NERA found net economic benefits to the United States, with the net economic benefits growing as export volumes rise. Addressing this finding, NERA explained that LNG export revenues from sales to other countries at those high prices would more than offset the costs of freeing that gas for export.

VI. APPLICANT'S PUBLIC INTEREST ANALYSIS

SPL states that NGA section 3(a) creates a rebuttable presumption that its proposed exports of natural gas are in the public interest. SPL contends that, even absent this statutory presumption in favor of approval, there is ample evidence in the record that its proposed exports are in the public interest. SPL further asserts that, in granting SPL's original request for non-FTA LNG export authorization in DOE/FE Order Nos. 2961 and 2961-A[86]—a conditional and final authorization, respectively, approving exports from Trains 1-4 of the Terminal—DOE/FE already has determined that exports of LNG from the Liquefaction Project are in the public interest. SPL maintains that this determination applies equally here. In each of its three Applications, SPL explicitly incorporates by reference the record in its prior non-FTA proceeding in FE Docket No. 10-111-LNG to support its current public interest analysis.[87] The summary of SPL's public interest analysis below is therefore supplemented with evidence from that proceeding to the extent appropriate.

[86] *Sabine Pass*, DOE/FE Order No. 2961; *Sabine Pass*, DOE/FE Order No. 2961-A.
[87] *See* SPL App. 1 at 5; *see also* SPL App. 2 at 5; SPL App. 3 at 6.

In support of its requested authorization, SPL appended a document, entitled *Further Discussion of the Projected Need for the Natural Gas to be Exported*, to each of its three Applications. These three appendices appear to be substantially similar, although the most recent data is contained in Appendix B to the Third Application.[88] Because Appendix B to the Third Application contains the most recent data, we focus on that data below.

Additionally, each of the appendices refers to the same natural gas supply study, entitled *U.S. Natural Gas Resources and Productive Capacity: Mid-2012*, commissioned by SPL and conducted by Advanced Resources International (ARI) (ARI Resource Report). As noted above in Section IV, SPL also submitted the 2014 NERA Study in its Second Supplement to bolster its public interest analysis.

Citing evidence of abundant natural gas supplies in the United States, the overwhelmingly positive economic benefits of the Liquefaction Expansion Project and associated LNG exports, and the competitive pricing mechanism of its contractual agreements with TGPNA and Centrica, among other evidence, SPL states that it has established that its proposed exports are in the public interest under NGA section 3(a).[89]

A. Domestic Natural Gas Supplies

SPL contends that the need for LNG export capability to be provided by the Liquefaction Expansion Project is supported by the existing and projected trends concerning U.S. gas demand and supply. SPL maintains that, since 2005, U.S. marketed natural gas production has grown

[88] Appendix B to the Third Application contains data from the Potential Gas Committee, dated April 2013, and the EIA's Annual Energy Outlook 2013. It contains the most recent comparable data among the three appendices. The earlier comparable data is discussed in Appendix C to the First Application and Appendix B to the Second Application.

[89] *See supra* § III.

26.9 percent to 24.04 trillion cubic feet (Tcf), or 65.9 Bcf/d in 2011, representing (as of that date) the highest production levels in U.S. history.

Next, SPL argues that increased drilling productivity has enabled domestic production to continue expanding despite a recent reduction in capital deployed in upstream development. Citing EIA data, SPL states that proved U.S. reserves of wet natural gas in 2011 expanded by 31.2 Tcf, or 9.8 percent, to 348.8 Tcf from the year before. SPL also notes that the Potential Gas Committee of the Colorado School of Mines raised its estimates of the U.S. technically recoverable gas resource base in April 2013 by 486 Tcf, or 25.6 percent, to 2,384 Tcf at year-end 2012—the highest resource evaluation in the group's 48-year history. According to SPL, the Potential Gas Committee determined that the United States possesses future available gas supply of 2,688 Tcf, and that most of the increase arose from the Potential Gas Committee's reevaluation of gas plays in the Gulf Coast, Atlantic, and Rocky Mountain areas.

SPL asserts that EIA's AEO 2013 (discussed above) shows that the domestic natural gas resources base continues to expand rapidly. According to SPL, AEO 2013 forecasts that domestic dry natural gas production will increase by an average 1.3 percent per year between 2011 and 2040, compared to expectations for long-term annual production growth of 1.0 percent in EIA's *Annual Energy Outlook* 2012 (AEO 2012). Citing data from AEO 2013, SPL states that U.S. dry natural gas production will total 33.14 Tcf (90.8 Bcf/d) by 2040, an increase of 10.14 Tcf (27.8 Bcf/d), or 44.1 percent from production levels of 23.0 Tcf (63.0 Bcf/d) in 2011.

The ARI Resource Report, according to SPL, provides additional independent analysis of the natural gas resource base in the United States. SPL states that the ARI Resource Report estimates that the United States has a technically recoverable natural gas resource base totaling 2,915 Tcf. This figure includes 1,904 Tcf of proved and technically recoverable unconventional

gas resources, plus 1,011 Tcf of recoverable conventional resources identified by EIA. Of this total, SPL states that 318 Tcf represent proved natural gas reserves and 2,597 Tcf comprise undiscovered or inferred resources. SPL further asserts that unconventional gas-bearing formations account for 65.3 percent of technically recoverable domestic gas resources, and include 1,219 Tcf of recoverable reserves from shale, 561 Tcf from tight sandstones, and 124 Tcf from coalbed formations.

SPL states that ARI's assessment of 2,915 Tcf of recoverable domestic natural gas reserves represents an increase of 330 Tcf, or 12.7 percent, from its resource estimate of 2,585 Tcf provided in August 2010. According to SPL, these estimates have increased due to improvements in drilling and oilfield service technologies, the addition of previously unidentified unconventional resources, and growth in estimates of associated natural gas resources in emerging unconventional fields. SPL asserts that this assessment level represents approximately 114 years of supply at recent domestic demand levels.

Citing the ARI Resource Report, SPL projects that technology gains will continue to drive production costs lower and augment recoverable natural gas reserves. As one example, SPL states that remaining recoverable domestic unconventional gas resources are projected to increase 17.7 percent, or 216 Tcf, by 2035 to 1,435 Tcf from the current estimate of 1,219 Tcf, due to steady improvements in well performance and technology progress. In comparison, SPL states that its proposed exports would represent only 2.8 percent of the additional resources that ARI projects will be gained through technological progress over the course of the forecast period.

Based on this data, SPL maintains that the ARI Resource Report, the 2013 Potential Gas Committee resource assessment, AEO 2013, and other publicly available information

demonstrate that the United States has sufficient natural gas resources available at modest prices to meet projected domestic demand over the next 25 years. Moreover, according to SPL, the availability of new natural gas reserves is likely to continue expanding into the future as new unconventional formations are discovered and the oil and gas industry continues to improve drilling and extraction techniques.

B. Domestic Natural Gas Demand

According to SPL, little growth is projected in the demand for natural gas in the United States. To support this claim, SPL cites data from the AEO 2013 Reference Case, which predicts that the domestic natural gas market will grow at a 0.7 percent rate through 2040, with demand projected to expand to 29.54 Tcf (80.9 Bcf/d) in 2040 from 24.37 Tcf (66.7 Bcf/d) in 2011.

SPL also projects limited demand expansion through 2040 based on a sector-by-sector analysis drawn from the AEO 2013, as summarized below:

- **Industrial sector:** SPL states that the AEO 2013 Reference Case projects U.S. industrial sector demand growth of 0.5 percent annually to total 7.9 Tcf (21.64 Bcf/d) in 2040 from 6.77 Tcf (18.55 Bcf/d) consumed in 2011.

- **Residential sector:** EIA forecasts a contraction in future residential consumption of natural gas as customer growth is offset by efficiency gains and household migration to milder climates. SPL states that the AEO 2013 Reference Case shows a decline in residential natural gas demand of 0.5 percent annually, to 4.14 Tcf (11.3 Bcf/d) in 2040 from 4.72 Tcf (12.93 Bcf/d) in 2011.

- **Commercial sector:** SPL maintains that commercial sector natural gas use is projected to experience modest annual growth of 0.4 percent in AEO 2013, reaching 3.60 Tcf (9.86) Bcf/d) in 2040 from 3.16 Tcf (8.66 Bcf/d) in 2011.

- **Electricity sector:** SPL states that demand by the electric generating sector is forecast to grow an average of 0.8 percent per year in AEO 2013, expanding to 9.5 Tcf (26.03 Bcf/d) in 2040 from 7.6 Tcf (20.82 Bcf/d) in 2011.

- **Transportation sector:** SPL states that natural gas consumed for residential and commercial transportation is a small portion of domestic demand. In 2011, 32.25 Bcf of natural gas was used in the United States for vehicle fuel, or approximately

> 0.1% of the total domestic gas market. According to SPL, the AEO 2013 forecasts that transportation sector demand will grow 11.9 percent annually to 1.04 Tcf (2.85 Bcf/d) in 2040.

Pointing to the supply-demand balance, SPL contends there is a lack of national and regional need for the natural gas proposed for export. SPL asserts that domestic natural gas production has been growing at more than twice the rate of domestic demand growth since 2005.[90] SPL argues that the inability of the U.S. market to absorb incremental supplies has slowed investments and forced the "shut-in" of actively producing wells in marginal natural gas fields, creating spare capacity and non-productive resources.

According to SPL, the Reference Case from AEO 2013 projects that domestic demand growth for natural gas will average 0.7 percent annually over the next 30 years, leading to a domestic market of 29.54 Tcf by 2040. Over the same time period, SPL maintains that domestic natural gas production is projected to grow by 1.3 percent per year on average, or approximately twice the rate of growth in domestic natural gas demand. SPL states that EIA anticipates that the United States will become a net exporter of natural gas after 2020. Domestic natural gas production is expected to exceed domestic consumption by 3.6 Tcf (9.86 Bcf/d) by 2040. SPL contends that this surplus of deliverable supply in excess of foreseeable U.S. market demand demonstrates that resources are available for export and exports would not interfere with the public interest.

According to SPL, the ARI Resource Report further demonstrates that available natural gas resources will exceed future domestic needs, and that spare productive capacity will remain available to meet future demand. The ARI Resource Report examines EIA's demand Reference

[90] SPL App. 3 at 20.

Case for AEO 2012 for the U.S. natural gas market through 2035. Using the AEO 2012 reference outputs and holding all other variables constant, ARI used its Technology Model for Unconventional Gas Supply to re-assess the outlook for domestic natural gas productive capacity in light of EIA's projected track for future U.S. natural gas prices.

SPL contends that the substitution of ARI's productive capacity assessment is appropriate given that EIA historically has underestimated the future contributions of unconventional natural gas to domestic markets. SPL notes that, as recently as the Annual Energy Outlook 2010, EIA projected that unconventional production from shale and coalbed wells would total less than 8 Tcf over the ensuing 25 years, but that production level was surpassed by over 1.5 Tcf the following year in 2011. In its *Annual Energy Outlook* 2011, EIA predicted dry unconventional gas production from shale and coalbed wells of 6.94 Tcf in 2011, 27 percent lower than indicated by finalized wellhead data two years later.

SPL notes that ARI estimates U.S. unconventional gas productive capacity alone will grow to 86.3 Bcf/d in 2035 from 42.5 Bcf/d in 2011. ARI subsequently merged its unconventional productive capacity findings with the AEO 2012 projections for conventional domestic dry gas production. According to SPL, the combined data demonstrate that U.S. natural gas productive capacity will grow to 103.0 Bcf/d in 2035 (from 65.3 Bcf/d in 2011) at the future market price track forecast by EIA—an increase of 57.7 percent. Further, SPL asserts that the rate of growth in domestic productive capacity will exceed EIA expectations for future annual U.S. demand growth of 0.4 percent presented in its AEO 2012 Reference Case. Under the modified supply case presented by ARI, SPL asserts that domestic natural gas productive capacity would exceed projected U.S. demand in the AEO 2012 by 6.6 Bcf/d in 2015, 10.3 Bcf/d in 2025, and 27.3 Bcf/d in 2035.

For these reasons, SPL maintains that the ARI Resource Report and other publicly-available information demonstrate that the United States has sufficient natural gas resources available at modest prices to meet projected domestic demand over the terms of the authorizations requested by SPL in its Applications. SPL therefore concludes that the natural gas resources proposed for export in its Applications will not be required to meet domestic needs.

C. Impact of the Proposed Exports on Domestic Prices of Natural Gas

SPL's analysis of the price impacts of LNG exports in Appendix B to the Third Application is based, in relevant part, on the 2012 NERA Study. According to SPL, the 2012 NERA Study concludes that the initial price impacts associated with LNG exports would likely range from zero to $0.33 per thousand cubic feet (Mcf), and that the largest price impacts after five years of growing LNG exports would range from $0.22 to $1.11 per Mcf. SPL notes that the high end of this range would result from an extreme demand scenario under which large volumes of export capacity are added at a rapid rate, owing to a global demand shock that occurs in conjunction with restrictions on supplies into the international market from other LNG-producing sources.

Next, SPL argues that the NERA Study uses certain assumptions that, in fact, overstate the price associated with LNG exports. Specifically, SPL notes that the 2012 NERA Study draws from AEO 2011 for its modeling scenarios. According to SPL, however, AEO 2013 projects a more favorable market outlook with greater volumes of future supply available at lower prices to consumers that will support not only exports but additional domestic demand. SPL states that, between 2013 and 2035, AEO 2013 projects 640.7 Tcf of total domestic gas production, which is 16.1 percent greater than the cumulative production of 551.6 Tcf estimated in AEO 2011. At the same time, AEO 2013 projects Henry Hub spot prices between 2013 and

2035 will average approximately $4.66 per MMBtu, a reduction of $1.04, or 17.3 percent, compared to the average of the future price incorporated in the 2012 NERA Study. Further, SPL notes that the revisions to the outlook in AEO 2013 from AEO 2011 represent an additional 89.1 Tcf of cumulative domestic gas production over the 2013-2035 period—17.7 percent more than the 32.8 Tcf upward adjustments in expectations for cumulative domestic consumption over the same period in the AEO 2013 forecast.

SPL maintains that EIA's projections in AEO 2013 demonstrate that larger volumes of natural gas have been identified and are available to meet consumer demand at lower prices than forecast by the 2012 NERA Study. According to SPL, it stands to reason that the increase in the price elasticity of U.S. supply between the AEO 2011 and AEO 2013 forecasts would result in lower price fluctuations associated with LNG exports than suggested by the 2012 NERA Study.

D. Local, Regional, and National Economic Benefits

As stated above, in each of the three Applications, SPL has incorporated by reference the record that it developed in FE Docket No. 10-111-LNG, in which it demonstrated the public interest benefits associated with exporting LNG in a volume equivalent to 2.2 Bcf/yr of natural gas from Trains 1-4 of the Sabine Pass LNG Terminal.[91] SPL identifies the following benefits to local, regional, and national economies, which it claims apply in this proceeding, as well:

- Manufacturing and supply of the required materials for the Liquefaction Project will result in an investment of over $400 million per LNG train, which equates to over $1.6 billion in domestic sourced materials;

- The Liquefaction Project will directly stimulate the economy of Southern Louisiana, particularly Cameron Parish and including areas that were "decimated" by Hurricanes Ike and Rita;

[91] *See* SPL App. 1 at 5; *see also* SPL App. 2 at 5; SPL App. 3 at 6.

- The Liquefaction Project will benefit other areas of Louisiana and the Gulf Coast;
- The Liquefaction Project, once operational, will generate significant tax revenues;
- The national economy will benefit indirectly from the Liquefaction Project's role in supporting natural gas exploration and production; and
- The Liquefaction Project indirectly will have a "profound multiplier effect" due to the wages, taxes, royalty, and lease payments in the natural gas supply chain.

E. Trade and Geopolitical Benefits

Citing the evidence it submitted in FE Docket No. 10-111-LNG, SPL asserts that its requested authorizations are supported by national policies favoring free trade; will yield a significant benefit by leveling the United States' balance of payments and reducing the nation's trade deficit by an estimated $6.7 billion; will enhance the diversity of global natural gas supply and contribute to the security interests of the United States and its allies; and will advance the current Administration's initiatives to promote investment in energy infrastructure in neighboring Caribbean and Central/South America nations.

SPL cites other geopolitical benefits associated with its proposed exports, including: the liberalization of the global gas market through increased liquidity and trade at prices established by market forces; advancement of national security interests and the security interests of U.S. allies through the diversification of global natural gas supplies; and—by introducing market-based price structures—an increased potential for global "decoupling" of the link between the pricing of natural gas and competing crude oil products in international markets.

VII. FERC PROCEEDING AND GRANT OF AUTHORIZATION

A. FERC's Pre-Filing Procedures

Authorizations issued by FERC permitting the siting, construction, and operation of LNG export terminals are reviewed under NGA section 3(a) and (e), 15 U.S.C. § 717b(a), (e). FERC's

approval process for such an application consists of a mandatory pre-filing process during which the environmental review required by NEPA commences,[92] and a formal application process that starts no sooner than 180 days after issuance of a notice that the pre-filing process has commenced.[93]

Sabine Pass filed a request with FERC for use of the pre-filing procedures on February 27, 2013. On March 8, 2013, in Docket No. PF13-8-000, the Director of the Office of Energy Projects at FERC granted Sabine Pass's request to commence the pre-filing review process. On June 7, 2013, FERC issued a Notice of Intent to Prepare an Environmental Assessment (NOI) of the Proposed Sabine Pass Liquefaction Expansion Project and Cheniere Creole Trail Pipeline Expansion Project.[94]

DOE agreed to participate as a cooperating agency in FERC's environmental review,[95] as set forth in the NOI.[96] Consistent with its practice, FERC published the NOI in the Federal Register and mailed it to federal, state, and local government representatives and agencies, elected officials, environmental and public interest groups, Native American Tribes, property owners in the vicinity of the proposed facilities, other interested parties, and local libraries and newspapers.[97] As part of FERC's public scoping process under NEPA, FERC held open houses and received comments from a variety of stakeholders on the NOI, which served to identify issues for FERC staff to address in the EA.

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[92] 18 C.F.R. § 157.21.
[93] 18 C.F.R. § 157.21(a)(2)(i-ii).
[94] *See supra* § I.
[95] 40 C.F.R. § 1501.6 ("In addition, any other Federal agency which has special expertise with respect to any environmental issue, which should be addressed in the statement may be a cooperating agency upon request of the lead agency."); *see also id*. § 1501.6(b) (responsibilities of a cooperating agency).
[96] *See* FERC NOI, 78 Fed. Reg. at 35,626.
[97] FERC Order at P 57.

B. FERC's Environmental Review

On September 30, 2013, Sabine Pass began the second part of FERC's approval process by filing its formal application in FERC Docket No. CP13-552-000 for authorization to site, construct, and operate the Liquefaction Expansion Project.[98] For purposes of hearing and decision, FERC reviewed Sabine Pass's application in conjunction with CCTPL's application for a certificate of public convenience and necessity to construct, own, and operate the Cheniere Creole Trail Pipeline Expansion Project. FERC issued the EA for both Expansion Projects on December 12, 2014, and placed the EA into the public record.[99] FERC provided a 30-day public comment period on the EA. During this time, FERC held a public meeting and accepted written comments on the EA from Sierra Club, several federal agencies, and interested individuals.[100]

The EA addresses numerous environmental issues, including potential impacts on geology, soils, water resources, wetlands, vegetation, fisheries, wildlife, threatened and endangered species, land use, recreation, visual resources, cultural resources, air quality, noise, safety, socioeconomics, and alternatives.[101] Based on its environmental analysis, FERC staff concluded that "the impacts associated with this Project can be sufficiently mitigated to support a finding of no significant impact and, thus, an EA is warranted."[102] FERC staff therefore recommended 64 mitigation measures for the Project. FERC staff further stated that, "approval of the Projects would not constitute a major federal action significantly affecting the quality of the human environment."[103]

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[98] *See supra* at 11 n.31.
[99] *See supra* at 12 n.34.
[100] FERC Order at P 60.
[101] *Id.* at P 59.
[102] EA at 5.
[103] *Id.* at 183.

C. FERC's Order Granting Authorization

On April 6, 2015, FERC issued its Order authorizing Sabine Pass and CCTPL to site, construct, and operate the Liquefaction Expansion Project and the Creole Trail Expansion Project, pursuant to NGA section 3(a) and 7(c), respectively.[104]

In granting this authorization, FERC observed that the proposed Liquefaction Expansion Project is located entirely within the footprint of the existing Sabine Pass LNG Terminal site. FERC reasoned that, because it will not require additional storage facilities or land acquisition, the Liquefaction Expansion Project will have "relatively small and well-defined environmental impacts."[105] Based on its consideration of the analysis in the EA, FERC determined that, "with the conditions we require, the Liquefaction Expansion Project would result in minimal environmental impacts and can be constructed and operated safely," and thus Sabine Pass's Liquefaction Expansion Project is not inconsistent with the public interest.[106] On this basis, FERC adopted all 64 mitigation measures recommended in the EA as environmental conditions of its Order, set forth in the Appendix.

In addition, FERC adopted its own additional Environmental Condition. After considering EPA's comments on the EA about the Chicot Aquifer, a sole-source aquifer in Louisiana, FERC agreed that Sabine Pass and CCTPL should consult with the EPA about additional sole-source aquifer consultation that may be required pursuant to the Safe Drinking Water Act.[107] FERC adopted this Environmental Condition as the 65th condition.

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[104] FERC Order at P 124.
[105] *Id.* at P 30.
[106] *Id.*
[107] *See id.* at P 79.

FERC also addressed the commenters' assertion that the EA failed to consider the indirect environmental impacts of the Project—specifically, the indirect effects of induced natural gas production in response to demand from Sabine Pass's customers.[108] Citing the CEQ's NEPA regulations, FERC observed that "[i]ndirect impacts are 'caused by the proposed action' and occur later in time or farther removed in distance than direct project impacts, but are still 'reasonably foreseeable.'"[109] FERC found that "potential environmental effects associated with shale gas development are neither sufficiently causally related to the Liquefaction and Creole Trail Expansion Projects to warrant a detailed analysis nor are the potential environmental impacts reasonably foreseeable, as contemplated by the CEQ regulations."[110]

FERC noted that shale production is "not an essential predicate for these projects," which will receive natural gas through interconnects with other natural gas pipelines that span states with shale as well as conventional gas formations.[111] Moreover, FERC reasoned that "the development of shale gas will likely continue regardless of whether the projects are approved."[112]

Even if a causal relationship were shown, FERC stated, "the scope of the *impacts* from any such induced production is not reasonably foreseeable as contemplated by CEQ's regulations and case law."[113] FERC also noted that the models recommended for use by Sierra Club will provide only generalized predictions about the potential location of any production which might be induced by exports. Thus, FERC concluded that there is not sufficient information available

[108] *See id.* at P 88.
[109] *See id.* at P 89 (quoting 40 C.F.R. § 1508.8(b)).
[110] *See supra* at 13 n.37.
[111] *See* FERC Order at P 89.
[112] *Id.*
[113] *Id.* at P 91 (emphasis in original).

regarding potential upstream impacts to develop an analysis which would assist it in either choosing between alternatives or developing mitigation measures.

In addition, FERC addressed claims by Sierra Club and others that the EA failed to adequately analyze direct, cumulative, and indirect impacts on climate change from GHG emissions. FERC rejected claims that it should consider DOE's LCA GHG Report, discussed herein, as part of its decision-making under NGA section 3. FERC stated that, while it had reviewed the LCA GHG Report, that Report provided no basis to alter the conclusions of the EA because the information provided is "too general to assist us in our consideration of the specific proposal before us."[114] FERC also observed that potential GHG emissions associated with the Liquefaction Expansion Project and impacts on water and air resources were, in fact, addressed in the EA; the EA concludes that construction and operation of the Liquefaction Expansion Project will not significantly impact these resources.[115]

Next, FERC rejected Sierra Club's and EPA's recommendation that FERC consider and disclose the GHG emissions associated with the production, transport, and combustion of the natural gas as part of the decision-making process. FERC reasoned that "there is no standard methodology to determine whether, and to what extent, a project's incremental contribution to GHGs would result in physical effects on the environment, either locally or globally," and concluded that it does not believe such emissions are causally related to its action in approving the Liquefaction Expansion Project.[116]

FERC also rejected the claim that it should have based its analysis on CEQ's recently-issued *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts*

[114] *Id.* at PP 94-95.
[115] *See id.* at P 96.
[116] *Id.* at 97.

(Revised Guidance).[117] FERC noted that the Revised Guidance was not issued until December 18, 2014, after the Sabine Pass EA was issued on December 12, 2014. FERC also rejected Sierra Club's claim that it should use the "social cost of carbon tool" to estimate the comprehensive cost associated with the Liquefaction Expansion Project's GHG emissions. While recognizing the availability of the tool, FERC found that it would not be appropriate or informative to use the social cost of carbon tool for this Project for the following reasons:

> (1) the EPA states that "no consensus exists on the appropriate [discount] rate to use for analyses spanning multiple generations"[118] and consequently, significant variation (between 300 and 400 percent) in output can result; (2) the tool does not measure the actual incremental impacts of a project on the environment; and (3) there are no established criteria identifying the monetized values that are to be considered significant for NEPA purposes.[119]

As such, FERC concluded that social cost of carbon tool is not appropriate for estimating a specific project's impact or informing analysis under NEPA.

Next, FERC rejected Sierra Club's assertion that an EIS rather than an EA should have been prepared for the Project. FERC regulations provide that an EA, rather than EIS, will be prepared first "if [FERC] believes that a proposed action . . . may not be a major federal action significantly affecting the quality of the human environment." [120] Then, "[d]epending on the outcome of the EA, an EIS may or may not be prepared."[121] FERC noted that the EA addressed this comment and explained that an EIS is not warranted for several reasons: the Liquefaction Expansion Project will be adjacent to the existing Sabine Pass LNG Terminal within the existing leased 853-acre terminal site; the pipeline project will be co-located to the extent practicable for

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[117] *See supra* at 13 n.43.
[118] FERC Order at P 101 (citing *Fact Sheet: Social Cost of Carbon* issued by EPA in November 2013, *available at* http://www.epa.gov/climatechange/Downloads/EPAactivities/scc-fact-sheet.pdf).
[119] *See id.*
[120] *See id.* at P 105 (quoting 18 C.F.R. § 380.6(b) (2014)).
[121] *See id*.

the majority of the route; and the impacts associated with these projects can be sufficiently mitigated.[122]

FERC similarly rejected claims by Sierra Club that a programmatic EIS that considers the cumulative impacts of all LNG export terminals that are pending or approved by DOE/FE should be developed. FERC noted that the EA addressed the cumulative impacts of construction and operation of other proposed LNG export projects in the vicinity of the Expansion Project and found them acceptable. Moreover, FERC considers each LNG export project application on its own merits; there is no FERC or multi-agency "program" for considering the environmental impacts of a group of LNG export projects.[123] FERC emphasized that the Expansion Project does not fall into the category of "'broad Federal actions such as the adoption of new agency programs or regulations' that might require preparation of a programmatic EIS."[124]

Finally, FERC found that the EA properly reviewed available alternatives to the proposed Projects, including the "no action" alternative, alternative energy sources, and the alternatives proposed by Sierra Club. FERC noted that it had already addressed Sierra Club's same proposed alternatives in its order on rehearing of the 2012 Order Granting Authorization and observed that many alternatives involved broad, nation-wide policy proposals that are the DOE Secretary's delegated prerogative, not FERC's. [125]

In sum, FERC stated that it had reviewed the information and analysis contained in the EA and concluded that, with the 65 environmental conditions required by its Order (of which 64

[122] *Id.* at 106.
[123] *See id.* at P 107 (citing *Cameron LNG, LLC*, 147 FERC ¶ 61,230, at PP 70-72 (2014)).
[124] *Id.* (citing 40 C.F.R. § 1503.30 (2014)).
[125] *See id.* at P 117 (citing 2012 FERC Order at PP 28, 31-32).

were recommended in the EA), the Liquefaction Expansion Project would not constitute a major federal action significantly affecting the quality of the human environment.[126]

On May 6, 2015, Sierra Club timely requested rehearing of the FERC Order, and FERC denied that request on June 23, 2015. *See supra* § I.

VIII. CURRENT PROCEEDING BEFORE DOE/FE

A. Overview

DOE/FE received timely filed motions to intervene in both FE Docket Nos. 13-30-LNG and 13-42-LNG from TGPNA, AEA, API, Centrica, IECA, and Sierra Club. The submissions in FE Docket Nos. 13-30-LNG and 13-42-LNG by AEA and IECA contained comments on the Applications, and the submission by Sierra Club contained comments and a protest of those Applications. In FE Docket No. 13-121-LNG, DOE received timely filed motions to intervene from APGA, Sierra Club, and API. APGA's submission in FE Docket Nos. 13-121-LNG also included comments, and the submission in the same docket from Sierra Club included both comments and a protest.

B. FE Docket Nos. 13-30-LNG and 13-42-LNG

1. TGPNA's Motions to Intervene

TGPNA filed separate Motions to Intervene in FE Docket Nos. 13-30-LNG and 13-42-LNG on September 20, 2013. TGPNA states that it is an indirect wholly owned subsidiary of TOTAL, S.A., a large, publicly traded integrated international oil and gas company and a leading player in the liquefied natural gas sector. TGPNA states that it has storage and regasification capacity for LNG imports at the Sabine Pass LNG Terminal, and has contracted to purchase LNG produced by SPL for export from Trains 3 and 5 of the Terminal. TGPNA maintains that,

[126] *Id.* at P 122.

as the buyer under the SPA for which SPL is seeking export authorization in FE Docket No. 13-30-LNG, it has a direct and substantial interest in and will be directly affected by the outcome of both FE Docket Nos. 13-30-LNG and 13-42-LNG. TGPNA further states that its interests cannot be represented by any other party.

2. Motions to Intervene and Comments Submitted by AEA and IECA

a. AEA's Motion to Intervene

On September 30, 2013, AEA filed a single motion to intervene and comments in FE Docket Nos. 13-30-LNG and 13-42-LNG. AEA states that it is a trade association representing many of the world's leading manufacturers and commodity producers, as well as publicly owned natural gas local distribution companies in the United States. AEA states that its member companies are active purchasers of natural gas and therefore have substantial interests in the distribution and sale of domestically produced natural gas. AEA maintains that SPL's Applications in FE Docket Nos. 13-30-LNG and 13-42-LNG could affect its members' interests, and that no other party to these proceedings can adequately represent those interests.

b. IECA's Motion to Intervene

On September 23, 2013, IECA filed a single motion to intervene and comments in FE Docket Nos. 13-30-LNG and 13-42-LNG. IECA states that it is a nonpartisan association of leading manufacturing companies with $1.3 trillion in annual sales, over 1,500 facilities nationwide, and more than 1.7 million employees worldwide. IECA's stated purpose is to promote the interests of manufacturing companies. IECA further asserts that the availability, use, and cost of energy, power, or feedstock play a significant role in its members' ability to compete in domestic and world markets. IECA states that its members are significant consumers of natural gas, natural gas liquids, and electricity fueled by natural gas. IECA submits that it has

a substantial interest in U.S. domestic supplies and prices of natural gas, and that SPL's Applications could affect those interests. Moreover, IECA states that no other party to these proceedings can adequately represent its interests and those of its member companies.

c. AEA and IECA Comments

In their motions, AEA and IECA assert that the legal standards used by DOE/FE to analyze the public interest under NGA section 3(a) in its review of non-FTA export authorizations are not adequate, appropriate, or sustainable. Specifically, AEA and IECA argue that LNG exports "raise unique economic, environmental, and other strategic concerns that cannot be adequately and specifically addressed by simply replacing the word 'import' in the 1984 [G]uidelines with the word 'export.'"[127] AEA and IECA urge DOE to develop public interest criteria that will establish objective standards for reviewing LNG export applications, including SPL's Applications, and to define the process by which DOE/FE will apply these standards to its review of each application. AEA and IECA contend that a rulemaking (or a similar process involving public comment) would be the best method through which to establish standards for DOE/FE's review of LNG export applications.

AEA and IECA also express concern over DOE/FE's reliance on the 2012 NERA Study in support of its decision-making. According to AEA and IECA, the 2012 NERA Study allegedly: (i) overstates the ability of domestic supplies of natural gas to match the growth of domestic demand with stable prices; (ii) downplays or ignores the impact that short-term price volatility can have on major capital investment decisions by the manufacturing sector; (iii)

[127] America's Energy Advantage, Inc., Comments & Mot. to Intervene, FE Docket Nos. 13-30-LNG & 13-42-LNG, at 5 (Sept. 9, 2013) [hereinafter AEA Mot. to Intervene]; *see also* Industrial Energy Consumers of America, Mot. to Intervene & Comments, FE Docket Nos. 13-30-LNG & 13-42-LNG, at 5 (Sept. 23, 2013) [hereinafter IECA Mot. to Intervene] .

overstates any supposed net positive impact that LNG exports will have on employment and the trade balance; and (iv) is based on outdated data. AEA and IECA state that, even with its flaws, the 2012 NERA Study purports to identify only very small net positive effects on the U.S. GDP, with one sector of the economy receiving a windfall that is largely offset by disadvantages that are spread across other sectors. AEA and IECA maintain that the NERA Study concedes that rising LNG exports "would harm the vast bulk of people in the United States,"[128] and contend that DOE/FE has an obligation as part of its public interest determination to avoid this sort of disparity.

3. API's Motions to Intervene

On September 23, 2013, API filed substantially similar motions to intervene in FE Docket Nos. 13-30-LNG and 13-42-LNG.[129] API states that it is a national trade association representing more than 500 member companies involved in all aspects of the oil and natural gas industry in the United States, including owners and operators of LNG import and export facilities in the United States and around the world, as well as owners and operators of LNG vessels, global LNG traders, and manufacturers of essential technology and equipment used all along the LNG value chain. API further states that its members have extensive experience with the drilling and completion techniques used in producing domestic natural gas resources. For these reasons, API states that it has a direct and immediate interest in these proceedings that cannot be adequately protected by any other party.

[128] AEA Mot. to Intervene at 7; IECA Mot. to Intervene at 7.
[129] As discussed below, API also filed a substantially similar motion to intervene in FE Docket Nos. 13-121-LNG.

4. Centrica's Motions to Intervene

Centrica filed separate motions to intervene in FE Docket Nos. 13-30-LNG and 13-42-LNG. Centrica states that it is an international energy company with affiliates in the United Kingdom and the United States. Centrica maintains that its affiliates include British Gas, which serves over 12 million customers in the United Kingdom, and Direct Energy, which serves over six million customers in North America. Centrica further states that it conducts—either directly or indirectly through affiliates—a wide range of energy supply and service operations in the United Kingdom, North America, Europe, and South America. Centrica states that, pursuant to its SPA with SPL, it has agreed to purchase 91.25 MMBtu per year of LNG from proposed Train 5 of the Sabine Pass LNG Terminal. As the contractual buyer of LNG from Train 5, Centrica maintains that it has a unique and substantial interest in the outcome of the Applications filed in FE Docket Nos. 13-30-LNG and 13-42-LNG. Centrica states that it supports SPL's Application in FE Docket No. 13-30-LNG, and that it will be directly affected by the outcome of the proceeding in FE Docket No. 13-42-LNG. Accordingly, Centrica requests that it be permitted to intervene in both dockets.

5. Sierra Club's Motion to Intervene, Protest, and Comments

Sierra Club filed a motion to intervene, protest, and comments in FE Docket Nos. 13-30-LNG and 13-42-LNG on September 23, 2013. Sierra Club states that its members live and work throughout the area that will be affected by SPL's export plan and claims to have members who live in the domestic gas fields that likely will see increased production as a result of the exports. Specifically, Sierra Club states that, as of May 2013, it had 2,819 members in Louisiana and 601,150 members overall. Sierra Club maintains that these members will be affected by the increased natural gas prices that would result from completion of the Liquefaction Expansion

Project. Sierra Club further asserts that its members' interests extend, in relevant part, to the environmental consequences of any natural gas exports from the Liquefaction Expansion Project; and to the environmental and economic consequences of any expansion or change in natural gas production (especially in shale gas plays) as a result of increased natural gas exports.

Sierra Club states that it has protested the applications in FE Docket Nos. 13-30-LNG and 13-42-LNG because they are not in the public interest and are not supported by adequate environmental and economic analysis. Sierra Club contends that DOE/FE must consider environmental factors in the course of conducting the public interest analysis under NGA section 3(a),[130] and argues that NEPA also requires DOE/FE to carefully consider the environmental impacts of a proposal before taking action. Sierra Club further maintains that DOE/FE cannot proceed with SPL's Applications until the NEPA process is completed.[131]

Sierra Club asserts that the Applications in FE Docket Nos. 13-30-LNG and 13-42-LNG are silent as to important environmental impacts. Sierra Club argues that the construction and operation of proposed Trains 5 and 6, the proposed pipeline expansion, and other proposed infrastructure will directly impact the environment; the Liquefaction Expansion Project will induce additional unconventional gas sources, with associated environmental harms; and the Project will result in increased natural gas prices and an increase in coal-fired electricity generation, thereby increasing emissions of greenhouse gases, as well as emissions of conventional and toxic air pollutants.

[130] *See* Sierra Club Mot. at 4 (citations omitted).
[131] *See id*. Insofar as Sierra Club is arguing that DOE/FE may not grant SPL's requests for a conditional export authorization until the NEPA process is completed, that issue has been mooted by issuance of this final authorization after completion of the NEPA process.

Sierra Club argues that the NGA and NEPA, as well as the Endangered Species Act and the National Historic Preservation Act, impose obligations upon DOE which must be considered before it can authorize the proposed exports of LNG. In this regard, Sierra Club argues that DOE/FE must reject the position allegedly adopted in *Sabine Pass* (DOE/FE Order No. 2961) that domestic need is the only factor to be considered in the public interest analysis. Sierra Club maintains that DOE/FE must likewise reject SPL's reliance on the 1984 Policy Guidelines because those Guidelines dealt with natural gas imports, and the primary issue addressed by the Guidelines was whether to directly regulate prices at which natural gas could be imported from Canada. According to Sierra Club, the willingness of a foreign consumer to purchase natural gas exported from the United States does not provide a presumptive indication of the domestic need for the natural gas and is independent of the environmental impacts that will result from the gas production.

Sierra Club maintains that DOE/FE's analysis must not be confined only to the local, direct effects of SPL's Applications, but must also consider the indirect and cumulative effects from SPL's proposal and all other LNG export proposals currently pending before DOE/FE and FERC. Sierra Club asserts that this broader backdrop must inform the NEPA alternatives analysis. In this regard, Sierra Club asserts that, because there is a substantial question as to the severity of impacts, the Liquefaction Expansion Project proposal requires a full EIS rather than the EA conducted by FERC.

Furthermore, Sierra Club maintains that DOE/FE can best conduct such an analysis by preparing a programmatic EIS that considers the cumulative impacts of all potential future exports from the Sabine Pass LNG Terminal, plus all other natural gas export proposals currently approved and pending before DOE/FE. In support of this position, Sierra Club argues that

DOE/FE can only exclude analysis of an event when it is so remote and speculative as to reduce the effective probability of its occurrence to zero.[132] Sierra Club further states that it would be a mistake to rely on the 2012 NERA Study's prediction of export volumes. The NERA Study, according to Sierra Club, understated the market for likely exports by concluding that exports would only occur when the spread between U.S. gas prices and prices in potential foreign markets exceeded the cost of liquefying, transporting, and re-gasifying domestic production. Sierra Club contends that NERA overstated these transaction costs, particularly the costs of exporting from proposed West Coast terminals, and ignored the ways in which "take-or-pay" contracts are likely to distort the market.

Next, Sierra Club argues that NEPA and the NGA require DOE/FE to consider a broad range of alternatives to SPL's Applications, including but not limited to: whether DOE/FE should allow LNG exports but on a smaller-scale and a slower time-table; whether the source of exported gas should be restricted to certain plays, formations, or regions; whether to delay, deny, or condition exports based upon their effect on the U.S. utility market; and whether to deny export proposals altogether as contrary to the public interest.

Sierra Club maintains that the construction and operation of the additional liquefaction and export facilities proposed in the Applications in FE Docket Nos. 13-30-LNG and 13-42-LNG will have a range of adverse local environmental effects. Sierra Club states that it cannot thoroughly discuss these impacts because their precise nature and extent will depend on the final site design and plan of the Liquefaction Expansion Project (which, at that time, SPL had not yet provided).

[132] Sierra Club Mot. at 15 (citations omitted).

Nevertheless, Sierra Club charges that both construction and operation of the planned facilities will emit harmful quantities of carbon monoxide, nitrogen oxides, volatile organic chemicals, and GHGs, and also will likely emit harmful sulfur dioxides and particulate matter. Sierra Club asserts that each of these types of emissions will have injurious environmental and health impacts. According to Sierra Club, Sabine Pass's filings in the FERC proceeding acknowledged these types of releases but provided insufficient discussion of their harmful effects. Sierra Club also argues that Sabine Pass's previously approved liquefaction trains (Trains 1-4) fail to use appropriate pollution control technology that would limit these types of emissions. If the Liquefaction Expansion Project uses similar designs, Sierra Club asserts that the regional air quality will be adversely affected.

In addition to air emissions, Sierra Club maintains that the proposed project will likely have deleterious environmental impacts on local water quality, fish and wildlife, and other environmental resources. The likely water impacts identified by Sierra Club include the effects of water withdrawals necessary for construction of the terminal expansion and pipeline pressure testing, additional stormwater runoff from the expanded facility, and discharge and suspension or re-suspension of sediment as a result of dredging and ship transits.

Furthermore, Sierra Club argues that the export of additional volumes of LNG from the Liquefaction Expansion Project likely will have environmental impacts greater than the local impacts because the planned exports will induce additional natural gas production in the United States. Sierra Club asserts that these impacts are reasonably foreseeable, and that NEPA and the NGA require DOE/FE to consider the effects of this additional production. Sierra Club points out that the EIA Study concluded that roughly 63 percent of natural gas demand created by exports will be met with new production. In the context of this proceeding, Sierra Club states

that this data equates to an additional 0.36 Bcf/d of natural gas production. Sierra Club observes that SPL does not dispute that additional natural gas production will result from the proposed exports and, in fact, SPL identifies this additional production in the Applications as a benefit that will mitigate price increases that otherwise would occur. Sierra Club maintains that available tools enable DOE/FE to predict where this increased production will occur, specifically citing the NEMS model employed by EIA in the EIA Study. Sierra Club states that a model employed by Deloitte Marketpoint is also capable of identifying the geographic region in which additional production will occur.[133]

Sierra Club asserts that much of the induced production will come from shale gas and other unconventional sources, citing the EIA Study for EIA's projection that 72 percent of the increased production will come from shale gas, 13 percent from tight gas, and 8 percent from coalbed sources.

Sierra Club states that air pollution is emitted during all stages of natural gas production. Sierra Club claims that natural gas production operations emit methane (CH4), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur dioxide (SO2), hydrogen sulfide (H2S), particulate matter (PM), and significant quantities of hazardous air pollutants (HAPs) that contribute to cancer risks and other acute public health problems.

Sierra Club asserts that methane is the dominant pollutant from the oil and gas sector and that EPA has identified natural gas systems as the largest contributor to anthropogenic methane emissions in the United States. Sierra Club argues that methane is a potent greenhouse gas that substantially contributes to global climate change. Sierra Club points out that, due to methane's

[133] *See* Sierra Club Mot. at 28-29.

effects on climate, EPA has found that methane, along with five other greenhouse gases, endangers the public health and welfare within the meaning of the Clean Air Act. Sierra Club states that methane also reacts in the atmosphere to form ozone, which is a major public health threat linked to a wide variety of maladies and damages vegetation, agricultural productivity, and cultural resources.

Sierra Club states that the natural gas industry is also a major source of VOCs and NOx. Sierra Club asserts that, as a result of significant VOC and NOx emissions associated with oil and gas development, numerous areas of the country with heavy concentrations of drilling are now suffering from serious ozone problems. Sierra Club identifies the Dallas-Fort Worth area in Texas, the Wyoming Upper Green River Basin, and the Uintah Basin in Northeastern Utah in particular as ozone non-attainment areas where there is a significant concentration of oil and gas production activities. As another example, Sierra Club states that, in 2008, the Colorado Department of Public Health and Environment concluded that the smog-forming emissions from oil and gas operations exceeded vehicle emissions for the entire state. According to Sierra Club, smog pollution harms respiratory systems and has been linked to premature death, heart failure, chronic respiratory damage, and premature aging of the lungs. Sierra Club states that significant ozone pollution also damages plants and ecosystems. Sierra Club asserts that as oil and gas development moves into new areas, particularly as a result of the boom in shale resources, ozone problems are likely to follow. Moreover, Sierra Club charges that VOCs are likely to be co-emitted with HAPs (such as benzene) which are carcinogenic and endocrine disrupters.

Sierra Club argues that oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants, and that some natural gas in the United States contains hydrogen sulfide. Sierra Club reports that EPA has concluded that the potential for hydrogen sulfide

emissions from the oil and gas industry is "significant." According to Sierra Club, hydrogen sulfide can be emitted during all stages of development, including exploration, extraction, treatment and storage, transportation, and refining. Sierra Club asserts that, although direct monitoring of hydrogen sulfide emissions is limited, there is evidence that these emissions may be substantial. Sierra Club states that people living near gas wells that have been exposed to hydrogen sulfide have reported eye, nose, and throat irritation, nose bleeds, dizziness, and headaches. Although hydrogen sulfide was originally included in the Clean Air Act's list of hazardous air pollutants, Sierra Club acknowledges that it has since been removed from the list, but disputes that the removal was appropriate.

Sierra Club states that the oil and gas industry is also a major source of PM pollution, which is generated by heavy equipment used to move and level earth during well pad and road construction. According to Sierra Club, PM emissions from the oil and gas industry are leading to significant pollution problems. For example, according to Sierra Club, monitors in Uintah and Duchesne Counties in Utah have repeatedly measured wintertime PM concentrations above federal standards. Sierra Club maintains that these elevated levels of PM have been linked to oil and gas activities in the Uinta Basin.

Sierra Club maintains that EPA's new source performance standards and standards for HAPs will reduce some of the pollution problems from natural gas production but will not solve them. Sierra Club states that the new EPA standards do not address some pollutants and do not control emissions from most transmission infrastructure or from existing sources of air pollution. Nor, according to Sierra Club, will the new standards affect the alleged tendency to increase the use of coal due to natural gas exports. Consequently, Sierra Club argues that DOE/FE may not

rely on EPA's rules to avoid the obligation to fully weigh and disclose the air pollution impacts associated with the proposed Liquefaction Expansion Project.

Sierra Club argues that SPLs current proposals, taken together, will induce significant production-related air emissions. Specifically, Sierra Club asserts that SPL's proposals will induce an additional 131.2 Bcf/yr of natural gas demand. Assuming a 1.5 percent leak rate, this new natural gas demand allegedly will be responsible for the incremental emission of 40,934 tons per year (tpy) of methane, 5,972 tpy of VOCs, and 434 tpy of HAPs.[134]

Next, Sierra Club states that increased natural gas production will transform the landscape of regions overlying shale gas plays, bringing industrialization to previously rural landscapes and significantly affecting ecosystems, plants, and animals. According to Sierra Club, land use disturbance associated with natural gas development impacts plants and animals through direct habitat loss (where land is cleared for natural gas uses) and indirect habitat loss (where adjacent land loses some of its important characteristics).[135]

Sierra Club argues that natural gas production also poses risks to ground and surface water. Sierra Club notes that most of the increased production will involve hydraulic fracturing, a process of injecting various chemicals into gas-bearing formations at high pressures to fracture rock and release natural gas. According to Sierra Club, each step of this process presents a risk to water resources. Sierra Club states that hydraulic fracturing requires large quantities of water and that the large water withdrawals could drastically impact aquatic ecosystems and human communities. Sierra Club also contends that hydraulic fracturing poses a serious risk of groundwater contamination from the chemicals added to the drilling mud and fracturing fluid

[134] *See* Sierra Club Mot. at 43 (Table 1).
[135] *See id*. at 43.

and from naturally occurring chemicals in deeper formations mobilized during the hydraulic fracturing process. Sierra Club asserts that contamination can occur through several methods, including where the well casing fails or where the fractures created through drilling intersect an existing, poorly sealed well. Sierra Club asserts that hydraulic fracturing has resulted in groundwater contamination in at least five documented instances. According to Sierra Club, EPA has investigated groundwater contamination likely resulting from hydraulic fracturing in Pavillion, Wyoming, and Dimock, Pennsylvania, concluding that surface pits previously used for storage of drilling wastes and produced/flowback waters were a likely source of contamination for shallower waters, while hydraulic fracturing likely explained deeper contamination.

Sierra Club states that natural gas production, particularly hydraulic fracturing, produces liquid and solid wastes, including drilling mud, drill cuttings, "flowback" (the fracturing fluid that returns to the surface after the hydraulic fracturing is completed), and produced water (a mixture of water naturally occurring in the shale formation and lingering fracturing fluid). Sierra Club argues that these wastes must be managed and disposed. Sierra Club states that drilling mud, drill cuttings, flowback, and produced water are often stored on site in open pits that can have harmful air emissions, can leach into shallow groundwater, and can fail and result in surface discharges. Sierra Club also notes that flowback and produced water must be disposed offsite, with a common method being underground injection wells. Sierra Club claims that underground injection of hydraulic fracturing wastewater appears to have induced earthquakes in several regions—a phenomenon known as "induced seismicity."

Sierra Club states that, in addition to the above-described production-related impacts, SPL's export proposal will increase air pollution by increasing the amount of coal used for domestic electricity production. Citing the EIA Study, Sierra Club states that exports will cause

natural gas prices to rise, leading to increased electricity generation from coal. Specifically, Sierra Club maintains that EIA projected that 72 percent of the decrease in natural gas-fired electricity production due to gas exports will be replaced by coal-fired production, which, according to Sierra Club, will increase emissions of both traditional air pollutants and greenhouse gases. Sierra Club argues that if DOE/FE allows exports of LNG, national efforts to control global warming will be frustrated and the public health and welfare will be endangered.

Sierra Club argues that LNG exports will increase greenhouse gas emissions not only domestically but also internationally. Sierra Club contends that a recent study by the International Energy Agency predicts that international trade in LNG will lead many countries to use natural gas in place of renewables instead of displacing fossil fuels and to increase their levels of energy consumption. Additionally, Sierra Club claims that the liquefaction, transportation, and regasification process is energy intensive and increases the lifecycle GHG emissions of LNG compared to methods of consumption where the natural gas remains in a gaseous phase. Sierra Club argues that, for these reasons, LNG has little, if any, advantage over coal, and thus it is unlikely LNG exports would reduce global GHG emissions. Moreover, even if imported LNG were to displace other fossil fuels, Sierra Club asserts that the resulting reductions will be much less than those needed to stabilize atmospheric GHG emissions below a catastrophic level. Sierra Club contends that DOE/FE must investigate policy options that would encourage the emissions reductions necessary to avert climate disaster.

Addressing economic consequences, Sierra Club contends that SPL has offered two mistaken arguments as to why its proposed exports will not adversely affect U.S. natural gas prices and supply. First, according to Sierra Club, SPL has argued that those entities planning to import the natural gas have the option to decline delivery and, therefore, exports will not occur if

the gas is required by consumers in the United States. Sierra Club maintains that this argument only shows that SPL welcomes U.S. consumers willing to outbid foreign purchasers. Second, Sierra Club states that SPL has argued that domestic gas supplies will exceed domestic demand and, therefore, the proposed exports will be consistent with the public interest. In response, Sierra Club maintains that the ARI supply forecasts submitted as part of the Applications are an insufficient basis on which to draw this conclusion. According to Sierra Club, the EIA data in the AEO 2013 shows that, for a significant fraction of the proposed authorization period, domestic consumption will exceed domestic production. Sierra Club concludes that domestic natural gas prices will increase if the proposed exports are approved, and the fact that a foreign buyer is willing to pay more than a domestic buyer for the natural gas does not demonstrate that there is not a domestic need for the natural gas.

Second, Sierra Club contends that the Liquefaction Expansion Project will harm U.S. workers and the domestic economy. Referring to its comments on the NERA Study, Sierra Club maintains that the available evidence shows that the proposed exports in FE Docket Nos. 13-30-LNG and 13-42-LNG will decrease wages and make most U.S. families worse off financially. Even in regions where exports spur additional natural gas production, Sierra Club contends that the resulting temporary growth in jobs likely will lead to long-term economic decline, as the regions suffer from the "resource curse" and" boom-bust" cycle that plague extractive economies. Moreover, Sierra Club contends that LNG exports will promote a regressive transfer of wealth, in contradiction to the Obama Administration's executive policy.

For these reasons, Sierra Club contends that DOE/FE cannot rely on the 2012 NERA Study's broad conclusion that the United States will experience net economic benefits from LNG exports. Sierra Club states that this conclusion rests on a forecast of net gross domestic product

(GDP) growth. Sierra Club submits that other economic studies found that exports would cause a net reduction in GDP and maintains that the NERA Study excluded certain factors that would drive down GDP. These excluded factors, according to Sierra Club, include the environmental impacts (and associated costs) of natural gas production, processing, and liquefaction.

Based on the preceding arguments, Sierra Club asserts that DOE/FE cannot rationally approve SPL's Applications. If DOE/FE nonetheless approves the Applications, Sierra Club argues that DOE/FE must impose rigorous monitoring conditions, to include monitoring of regional and national economic dislocations and disruptions caused by natural gas extraction, national increases in natural gas and electricity prices (and resulting shifts to more polluting fuels), and related environmental impacts.

6. API's Letter in Response to AEA and IECA Motions

On October 4, 2013, API filed substantially similar letters in FE Docket Nos. 13-30-LNG and 13-42-LNG in response to AEA's and IECA's motions to intervene. In the letters, API urges DOE/FE to deny the request from AEA and IECA that DOE/FE institute a rulemaking to promulgate regulations that specifically define the factors it will use when evaluating whether an application to export LNG is inconsistent with the public interest. According to API, such a rulemaking is unnecessary and will serve only to delay DOE/FE processing of pending LNG export applications.

In particular, API rejects AEA's and IECA's assertion that the 1984 Policy Guidelines are an insufficient basis upon which to review the proposed exports of LNG under NGA section 3(a). API contends that the 1984 Policy Guidelines and DOE/FE's regulations are intended to provide room for market forces to shape domestic natural gas markets, including energy production, consumption, and pricing. API states that these regulations and policies are robust,

and that AEA and IECA have failed to cite any impacts or rationale for their requested regulatory reform.

7. Answer of Applicant and Replies of Protestors

On October 8, 2013, SPL filed an answer in opposition to the motions of AEA, IECA, and Sierra Club to intervene, protest, and comments in FE Docket Nos. 13-30-LNG and 13-42-LNG (First Answer).[136] On October 23, 2013, Sierra Club filed a motion to reply and reply to SPL's First Answer.

a. SPL's Answer in Opposition to Motions to Intervene, Protest, and Comments to AEA, IECA, and Sierra Club

In its First Answer, SPL argues that DOE/FE should not grant intervention to AEA, IECA, or Sierra Club. SPL contends that these organizations have not articulated a sufficient interest in these proceedings to warrant intervention. Specifically, SPL asserts that neither AEA nor IECA submitted scoping comments in response to FERC's notice of intent to prepare an EA for the Liquefaction Expansion Project. SPL also claims that it would be duplicative and unnecessary to allow Sierra Club to intervene in these proceedings because Sierra Club submitted comments in FERC's environmental review.

Further, SPL states that AEA and IECA assert merely a generalized interest in DOE/FE's approach to the public interest inquiry under NGA section 3 and a "major concern" over DOE/FE's continued reliance on the 2012 NERA Study. SPL argues that intervention in these proceedings is unnecessary to advance those interests. According to SPL, AEA and IECA had two opportunities to submit comments on the NERA Report. IECA did so, while AEA did not.

[136] Sabine Pass Liquefaction LLC, Answer in Opposition to Motions to Intervene, Protest, and Comments to AEA, IECA, and Sierra Club, FE Docket Nos. 13-30-LNG & 13-42-LNG (Oct. 8, 2013) [hereinafter SPL Answer 1].

In sum, SPL asserts that AEA and IECA have failed to advance any particularized interests that warrant intervention in these proceedings.

(1) SPL's Response to AEA and IECA

On the merits, SPL disputes AEA's and IECA's contention that DOE should institute a rulemaking or similar process to establish appropriate standards for reviewing LNG export applications.[137] SPL asserts that these proceedings are not a proper forum for a rulemaking request; rather, the proper forum is a petition for rulemaking under the Administrative Procedures Act, 5 U.S.C. § 553(e).

Next, SPL argues that these proceedings are an improper forum for AEA's and IECA's request that DOE/FE reassess, modify, and/or rescind certain previously-granted LNG non-FTA export authorizations. SPL maintains that those export authorizations are unrelated to the current Applications.

(2) SPL's Response to Sierra Club

In addition to the foregoing arguments, SPL argues that Sierra Club's protest should be rejected because Sierra Club has failed to provide any new relevant studies or other evidence that would warrant denying the Applications. SPL states that Sierra Club's arguments merely repeat arguments previously rejected by DOE/FE in other proceedings. SPL incorporates by reference the responses that it and its affiliates have made in other proceedings to Sierra Club's arguments.[138]

Additionally, SPL contends that Sierra Club's environmental arguments are unsupported by facts, regulations, and precedent. First, SPL states that Sierra Club is incorrect that DOE/FE

[137] *Id.* at 8.
[138] First Answer at 12.

must prepare a programmatic EIS to consider the direct and indirect impacts of all proposed export projects. According to SPL, the rationale for a programmatic EIS is that a coordinated federal program is likely to generate disparate but related impacts. SPL counters that, in this case, these proposed LNG projects are not part of a coordinated federal program, and individually are not part of an orchestrated series of projects directed by a single decision-maker such as the Federal Government.

SPL also urges DOE/FE to reject Sierra Club's contention that the environmental effects of induced natural gas production must be considered under NEPA and the NGA. According to SPL, both FERC and DOE have had previous opportunities to consider this argument and have consistently rejected this position on the grounds that shale development and its associated effects were not sufficiently causally related to the proposed LNG export activities. Additionally, SPL states that FERC has found that the environmental effects of natural gas production activities were neither "reasonably foreseeable," nor an "effect," for purposes of a cumulative impacts analysis within the meaning of applicable NEPA regulations.

Finally, SPL disputes Sierra Club's economic arguments. SPL states that Sierra Club fails to present adequate evidence to rebut the presumption that the Liquefaction Expansion Project will provide economic benefits to the public. SPL states that the positive economic effects of the Liquefaction Expansion Project are presented in its FERC Application and are supported by positive key findings related to the macroeconomic impacts of LNG exports in the NERA Study.

b. Sierra Club's Motion to Reply and Reply

Sierra Club filed its motion to reply and reply on October 23, 2013, in response to SPL's First Answer. Sierra Club notes that its motion to intervene was timely filed.

Sierra Club contends that DOE/FE must reject SPL's argument that Sierra Club's motion should be denied because DOE/FE may have decided the issues in prior proceedings. According to Sierra Club, DOE/FE is not bound to follow those orders here and, moreover, the prior SPL authorization in DOE/FE Order No. 2961-A was based on a much slimmer evidentiary record than the one now available.

Sierra Club reasserts the position set forth in its motion that DOE/FE must consider environmental impacts, including induced production of natural gas. Sierra Club maintains that if the NEPA analysis prepared by FERC is inadequate to fully inform DOE/FE's decision-making under NEPA or the NGA, DOE/FE must still meet its substantive obligation to consider environmental impacts as part of its NGA decision and statutory responsibilities.

Next, Sierra Club rejects SPL's argument that projected demands from its proposed exports are not "sufficiently causally related" to shale development and its associated effects. Sierra Club notes that SPL does not dispute that its proposed Liquefaction Expansion Project will require an increase in natural gas production. Sierra Club maintains that SPL's proposed expansion can be traced to new sources of natural gas with sufficient precision to support environmental analysis.

With regard to Sierra Club's insistence that a programmatic EIS is required, Sierra Club asserts again that SPL's reading of the term "program" in 10 C.F.R. § 1021.104(b) is overly cramped. Sierra Club argues that, even though DOE/FE is not programmatically initiating the applications for NGA section 3 authority, DOE/FE has taken programmatic steps in its evaluation of LNG non-FTA export applications, as demonstrated by DOE/FE's commissioning of the 2012 EIA and NERA export studies. Sierra Club maintains that DOE/FE likewise must adopt a programmatic approach to the environmental impacts of the pending applications.

Sierra Club also continues to assert that SPL's exports will increase the price of domestic natural gas and would adversely affect the domestic economy, by raising the amount households pay for energy and by eliminating jobs in energy intensive industries. Sierra Club cites a Purdue University study that concluded that LNG exports would cause a net decline in domestic GDP. Sierra Club also states that the NERA Study, although predicting a slight increase in GDP, agrees with the Purdue study that most Americans will be worse off financially. According to Sierra Club, the NERA Study predicts a net loss of up to 270,000 jobs each year and projects that all persons who derive income from wages will be economically worse off.

Finally, Sierra Club asserts that under any reasonable interpretation of the NGA's public interest analysis, these broad environmental and economic impacts must be considered. Therefore, Sierra Club argues, DOE/FE must reject SPL's assertions that these impacts should be excluded from DOE/FE's deliberations.

C. FE Docket No. 13-121-LNG

1. APGA's Motion for Leave to Intervene and Protest

a. Motion for Leave to Intervene

On April 14, 2014, APGA timely filed a motion for leave to intervene in this proceeding. APGA asserts that it is the national, non-profit association of publicly-owned natural gas distribution systems, with approximately 700 members in 36 states. APGA states that its membership covers 950 not-for-profit retail distribution entities that are owned by, and accountable to, the citizens they serve, including municipal gas distribution systems, public utility districts, county districts, and other public agencies that have natural gas distribution facilities. APGA maintains that its members are active participants in the domestic market for natural gas where they secure the supplies of natural gas to serve their end users. APGA states

that it has a direct and substantial interest in this proceeding that cannot be adequately represented by any other party.

b. Protest

APGA asserts that SPL's request for authority to export domestic LNG to non-FTA Nations is inconsistent with the public interest and should be denied. APGA argues that the proposed exports will increase domestic natural gas prices, burdening households and jeopardizing potential growth in the U.S. manufacturing sector, as well as the nation's transition away from more environmentally damaging fossil fuels. APGA maintains that the EIA Study concluded that LNG exports will increase prices, with higher volumes causing more drastic increases. APGA also maintains that the NERA Study found that exports would yield net economic benefits but would raise domestic natural gas prices. According to APGA, this would burden the U.S. consumers who can least afford the increase and disadvantage domestic manufacturing. APGA argues that DOE/FE must go beyond the EIA and NERA studies to consider the tradeoffs entailed by exporting an increasingly valuable U.S. fuel, rather than supporting and enhancing the use of natural gas domestically.

APGA states that the current increased production of natural gas and resulting low prices of natural gas in the United States provides the nation with an unprecedented opportunity to pursue energy independence and sustained economic growth through a manufacturing renaissance grounded in plentiful, low cost natural gas. Price increases due to exports, APGA contends, will both (i) jeopardize the viability of natural gas as a "bridge-fuel" in the transition away from carbon-intensive and otherwise environmentally problematic coal-fired electric generation, and (ii) inhibit efforts to foster natural gas as a major transportation fuel. AGPA

claims that these steps are necessary to wean the United States from its historic, high-risk dependence on foreign oil.

At the same time, APGA contends that SPL's plan to export natural gas will not prove economically viable. APGA believes that economically recoverable domestic natural gas may prove less robust than projected, especially given associated environmental costs and concerns regarding the long-term productivity of shale gas wells. These matters aside, APGA states that foreign alternatives will soon remove the price arbitrage opportunity that SPL (and others) seek to take advantage of, as natural gas reserves from shale formations and export capacity expand around the world.

In support of its Protest, APGA points out that as of March 24, 2014, DOE/FE had received 37 applications for LNG export authority and the total applied-for export capacity would have the effect of increasing the daily demand for natural gas by roughly 54 percent.

2. Sierra Club's Motion to Intervene, Protest, and Comments

Sierra Club's Motion to Intervene, Protest, and Comments in FE Docket No. 13-121-LNG raises the same arguments in substance as those offered in its Motion to Intervene, Protest, and Comments in FE Docket Nos. 13-30-LNG and 13-42-LNG, detailed above.

3. API's Motion to Intervene

API's Motion to Intervene in FE Docket No. 13-121-LNG is substantially similar to the motions to intervene that it filed in FE Docket Nos. 13-30-LNG and 13-42-LNG, as described above.

4. SPL's Answer

On April 29, 2014, SPL filed an answer in opposition to APGA's motion for leave to intervene and protest and Sierra Club's motion to intervene and protest (Second Answer)[139] Neither APGA nor Sierra Club filed motions to reply in response to SPL's Second Answer.

In the Second Answer, SPL opposes the intervention of APGA and Sierra Club and contends that their arguments fail to rebut the presumption that SPL's proposed exports are in the public interest under NGA section 3(a). SPL's arguments challenging Sierra Club's motion in the Second Answer are substantially similar to the arguments set forth in the First Answer, described above.

As to AGPA's motion, SPL asserts that APGA merely raises generalized arguments concerning LNG "exports by SPL and others."[140] SPL notes the focus of APGA's arguments in arguing that prior DOE/FE orders authorizing LNG exports were wrongly decided. SPL asserts that this proceeding is not the proper forum for asking DOE/FE to re-visit previously-issued orders that are unrelated to the current Applications.

SPL rejects APGA's reliance and arguments on AEO 2013 and the 2012 NERA Study. Citing DOE/FE precedent, SPL states that the AEO 2013 Reference Case projects domestic supply and demand conditions that are more, not less favorable to exports. SPL also argues that APGA oversimplifies supply/demand dynamics, rending its arguments internally inconsistent. Specifically, SPL argues that APGA's focus on certain industry sectors is misplaced because DOE/FE's role is not to favor one particular use of natural gas over another, or otherwise to

[139] Sabine Pass Liquefaction, LLC, Answer in Opposition to the Motion for Leave to Intervene and Protest of the APGA Filing and Sierra Club's Motion to Intervene, Protest, and Comments, FE Docket No. 13-121-LNG (Apr. 29, 2014) [hereinafter SPL Answer 2].
[140] *Id.* at 8.

select winners among various market sectors. In sum, SPL asserts that APGA's arguments fail to overcome the statutory presumption in favor of granting the requested authorizations.

IX. COMMENTS ON THE LNG EXPORT STUDY AND DOE/FE ANALYSIS

In the NOA, DOE/FE sought public comment on the EIA and NERA studies, including the modeling scenarios used in both studies. DOE/FE specifically invited comment on "the impact of LNG exports on: domestic energy consumption, production, and prices, and particularly the macroeconomic factors identified in the NERA analysis, including Gross Domestic Product (GDP), welfare analysis, consumption, U.S. economic sector analysis, and … any other factors included in the analyses."[141] DOE noted that, "[w]hile this invitation to comment covers a broad range of issues, the Department may disregard comments that are not germane to the present inquiry."[142]

As explained above, DOE/FE spent several months reviewing the more than 188,000 initial and 2,700 reply comments received in response to the NOA. Given the volume of comments, it is neither practical nor desirable for DOE/FE to summarize each of them. Therefore, DOE/FE identifies below both: (i) the pertinent arguments by topic, with reference to representative comments, and (ii) DOE/FE's basis for the conclusions that it drew in reviewing those comments. In so doing, DOE/FE will respond to the relevant, significant issues raised by the commenters.[143]

[141] 77 Fed. Reg. at 73,629.
[142] *Id.*
[143] *See, e.g., Public Citizen v. F.A.A.*, 988 F.2d 186, 197 (D.C. Cir. 1993).

A. Data Inputs and Estimates of Natural Gas Demand

1. Comments

Several commenters, including Sierra Club,[144] Dow Chemical Company (Dow), along with U.S. Representative Edward Markey, U.S. Senator Ron Wyden, Alcoa, Save Our Supplies, the Industrial Energy Consumers of America (IECA), and Jannette Barth, challenge the data used as inputs to the LNG Export Study. Most of these commenters assert that NERA should have used projections from AEO 2012 or AEO 2013, rather than from AEO 2011, to produce a more accurate picture of the current and likely future state of the natural gas market and the likely macroeconomic impacts of LNG exports. These commenters assert that the AEO 2011 projections significantly underestimate actual and future demand for natural gas, especially in the U.S. electric, manufacturing, and transportation sectors, and in international markets. Some commenters identify additional factors, other than the vintage of the AEO 2011 data, to support their arguments that NERA underestimated present and future demand for natural gas. For example, Save Our Supplies argues that NERA underestimated international demand because the GNGM model did not appear to account for the continued growth of international LNG import infrastructure. Together, these commenters assert that the NERA Study underestimated future demand for natural gas and, consequently, underestimated the likely increases to natural gas prices from LNG exports.

A number of commenters, including Sierra Club, Dow, Senator Wyden, Representative Markey, Jannette Barth, and Save Our Supplies maintain that, as compared to AEO 2011, the

[144] For purposes of this discussion, Sierra Club filed comments on the LNG Export Study on behalf of itself and a coalition of non-profit organizations, including Catskill Citizens for Safe Energy, Center for Biological Diversity, Clean Air Council, Columbia Riverkeeper, Delaware Riverkeeper, Lower Susquehanna Riverkeeper, Shenandoah Riverkeeper, and Upper Green River Alliance [hereinafter Sierra Club].

AEO 2013 Early Release Overview projects a substantial increase in demand for natural gas in the industrial manufacturing sector.[145] Dow claims that there has been a manufacturing renaissance since completion of AEO 2011 involving announcements of approximately 100 capital investments representing some $95 billion in new spending and millions of jobs driven largely by the supply and price outlook for natural gas. These investments, according to Dow, will add about 5 million new jobs and 6 Bcf/d of industrial gas demand by 2020, which Dow states is nearly a 30 percent increase in industrial demand relative to 2009, the baseline year for AEO 2011.

Dow also asserts that projections of future natural gas demand by industry are more than double the demand predicted in AEO 2011's High EUR case, which includes significantly higher demand than the Reference Case. In addition to significantly higher projections of demand for manufacturing, Dow refers to projections from Wood Mackenzie, CERA, and others that indicate a potential increase of transportation demand from 0.2 to 1.5 Bcf/d from 2013 to 2020. This compares to AEO 2011's projection of a modest increase for natural gas demand in the transportation sector of 0.1 to 0.2 Bcf/d of natural gas. Dow states that the higher level of demand derived from Wood Mackenzie and CERA is the result of a projection of fleet vehicles converting to LNG and compressed natural gas.

According to Dow, AEO 2011 projects that natural gas demand for power generation will decrease through the end of the decade, whereas Wood Mackenzie and CERA predict that

[145] During the time of the comment period on the LNG Export Study, the AEO 2013 Early Release was the most current AEO available, and is therefore discussed in many of the comments. On May 2, 2013, after the comment period had closed, EIA issued its final AEO 2013 projections. *See* U.S. Energy Information Administration, *Annual Energy Outlook 2013 with Projections to 2040* (April 2013), *available at* http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf [hereinafter AEO 2013]. This Order references both the final projections from AEO 2013 and more recent EIA projections, as noted.

natural gas use in the power sector will increase 14 percent by 2020, ultimately resulting in 24.7 Bcf/d of power sector demand. This projected increase is due to unidentified, anticipated changes in carbon policy, renewables policy, and nuclear policy favoring the use of natural gas in the power sector.

In addition to criticizing the projections of demand based on AEO 2011, Dow maintains that the level of exports authorized to date and additional exports that may be authorized in the future will drive up demand levels even higher. Specifically, Dow asserts that NERA's conclusion that prices will not increase by more than $1.11/Mcf is based on a faulty assumption that natural gas exports will never rise above 6.72 Tcf/yr, or roughly 18.5 Bcf/d by 2025. Dow points out that authorized exports to FTA nations as of January 1, 2013 had already reached approximately 28 Bcf/d. Dow complains that NERA did not consider what would happen if exports attained the authorized levels. In that event, Dow asserts that domestic gas prices undoubtedly would spike. Other commenters, such as Citizens Against LNG, make similar arguments. Citizens Against LNG alleges that the NERA Study is flawed because it failed to estimate the impact of the full potential volume of exports of approximately 31.41 Bcf/d to FTA nations and 24.80 Bcf/d to non-FTA nations.

Contrary to the above arguments, several commenters, such as Dominion Cove Point LNG, LP, Lakes Charles Exports, and Gulf LNG Liquefaction Company, LLC (Gulf LNG), argue that NERA reasonably relied on data from AEO 2011. These commenters state that NERA used the AEO 2011 data because the EIA portion of the LNG Export Study used that data, and DOE/FE sought to ensure consistency across both parts of the LNG Export Study. Further, a number of commenters, including America's Natural Gas Alliance, Exxon Mobil Corporation (ExxonMobil), Golden Pass Products LLC, American Petroleum Institute, former

Secretary of Energy Spencer Abraham, Carl Foster, and the Western Energy Alliance, argue that NERA's use of the AEO 2011 data does not undermine the results of the LNG Export Study. These commenters contend that the AEO 2013 Early Release data show higher production of natural gas and a more elastic supply of natural gas than the AEO 2011 data used by NERA, indicating that the domestic resource base could more easily accommodate increasing domestic demand as well as demand from new LNG export projects.

With respect to Dow's claim that there is $95 billion of new investment in domestic manufacturing, Lake Charles Exports, LLC and Secretary Abraham argue that many of the projects listed by Dow are currently under consideration and not projected to commence operation until far into the future. These commenters assert that Dow provided no information as to when or whether these projects will materialize. The commenters conclude that there is no reasonable basis to believe that these domestic manufacturing investments will lead to an additional 6 Bcf/d in domestic natural gas demand as claimed by Dow.

2. DOE/FE Analysis

a. Use of AEO 2011 Projections

DOE's basis for relying on AEO 2011. The LNG Export Study was based on AEO 2011 projections, which were the most recent, final projections available in August 2011 when DOE commissioned the EIA Study, and also in October 2011 when DOE commissioned the NERA Study. As explained above, the NERA Study was designed so that NERA would use the results from the EIA Study as inputs to the NERA model to ensure congruence between the two studies, which together formed the single LNG Export Study. If both studies had not relied on the same data, meaningful comparison and cross-analysis of the two studies would have been impossible.

Although some commenters have asserted that DOE should have required EIA and NERA to use newer projections than those in AEO 2011, this argument does not acknowledge either the timing of the AEO publication cycles, or the lead time required of EIA and NERA to conduct their work. Using the final AEO 2011 projections, EIA published its study on January 19, 2012. Only four days later, on January 23, 2012, EIA published the 2012 AEO "Early Release Overview," which was a preliminary, abridged version of EIA's forthcoming AEO 2012. It would not have been possible for EIA to use the 2012 Early Release projections in its study without starting over once that data had been published.

Indeed, EIA did not publish the final AEO 2012 until June 2012, six months after EIA had published its study for this proceeding. By that time, the NERA Study was well underway. NERA published its final report in December 2012—the same month that EIA released the AEO 2013 Early Release Overview. As stated above, EIA did not publish the final AEO 2013 projections until May 2, 2013.

In an undertaking of this scope and magnitude, it was perfectly reasonable to base the LNG Export Study on AEO 2011, which contained the best, most authoritative economic projections available when DOE/FE commissioned the EIA and NERA studies. Once both studies were underway, a decision to use AEO 2012 or AEO 2013 Early Release projections would have required EIA and NERA to abandon their existing work and redo much, if not all, of their analyses.

Courts have repeatedly recognized that agencies are not required to redo a study simply because newer data become available, "particularly given the many months required to conduct

full [analysis] with … new data."[146] Requiring DOE to start over with new data "would lead to significant costs and potentially endless delays."[147] Moreover, under the commenters' rationale, DOE's LNG Export Study and administrative process would run indefinitely, as DOE would have to start over with new AEO projections whenever they became available. As the Supreme Court has observed, if an agency were required to rehear new evidence before it issues a final administrative decision, "there would be little hope that the administrative process could ever be consummated in an order that would not be subject to reopening."[148]

No material change using post-AEO 2011 projections. Further, we are not persuaded that using post-AEO 2011 EIA projections would have materially affected the findings of the LNG Export Study. Commenters point to the fact that AEO 2012 and the AEO 2013 Early Release Overview forecast greater domestic natural gas consumption in the years ahead than did AEO 2011. The commenters are correct in this observation, but it is also true that AEO 2012 and the AEO 2013 Early Release Overview projected much greater domestic natural gas production than did AEO 2011. For example, in the LNG Export Study proceeding, Jordan Cove submitted an analysis from Navigant correctly noting the increasing gas production projections in the later EIA analyses: For the period of 2013-2035, there was an average percentage increase in forecast total domestic natural gas consumption between AEO 2011 and AEO 2013 of 5.6 percent, while the increase in forecast total natural gas production was 16 percent. This important context helps explain why the AEO 2013 assumptions actually indicate the beneficial

[146] *Theodore Roosevelt Conserv. P'ship v. Salazar*, 616 F.3d 497, 511 (D.C. Cir. 2010) (quotations and citations omitted) (alteration in original).
[147] *Sierra Club v. U.S. Envtl. Prot. Agency*, 356 F.3d 296, 308 (D.C. Cir. 2004) (upholding EPA's decision to use an existing computer model in lieu of a newly-released version).
[148] *Vermont Yankee Nuclear Power Corp. v. Natural Res. Def. Council*, 435 U.S. 519, 554-55 (1978).

market impacts that come from LNG exports.[149]

Using the later-published final AEO 2013 Reference Case (see Table 6 below) illustrates that, although total natural gas consumption projected for 2035 was projected to increase by 6 Bcf/d between AEO 2011 and 2013 (from 72.7 Bcf/d to 78.7 Bcf/d), total domestic dry gas production was projected to increase by more than twice that amount, increasing by 13.8 Bcf/d (from 72.1 Bcf/d to 85.9 Bcf/d). In addition, the projected 2035 Henry Hub price declined from $7.07/MMBtu to $6.32/MMBtu, despite net exports (including both pipeline and LNG exports) rising from -0.5 Bcf/d in AEO 2011 to +7.0 Bcf/d in AEO 2013. Although the data used in Table 6 for "AEO 2013 Reference Case" refer to the final AEO 2013 projections, the data are unchanged from EIA's projections in the AEO 2013 Early Release Overview. As the table shows, the final AEO 2013 Reference Case projects domestic supply and demand conditions that are more, not less, favorable to exports.

Likewise, on April 14, 2015, EIA issued its most recent update, the Annual Energy Outlook 2015 (AEO 2015), with projections to 2040.[150] As depicted in Table 6, projections from that report reflect net LNG exports from the United States in a volume equivalent to 9.0 Bcf/d of natural gas in 2035.[151] This estimate compares with projected net LNG imports of 0.4 Bcf/d in the lower-48 states for 2035 in the AEO 2011 Reference Case. The 2035 Henry Hub price in the AEO 2015 Reference Case is $6.50/MMBtu, down from $7.31/MMBtu in the AEO 2011 Reference Case (both in 2012 dollars).

[149] Comments of Navigant Consulting, Inc., at 6 (attached to Initial Comments of Jordan Cove Energy Project, L.P.).
[150] U.S. Energy Information Administration, *Annual Energy Outlook 2015* (April 14, 2015), *available at* http://www.eia.gov/forecasts/aeo/ [hereinafter AEO 2015].
[151] *See* AEO 2015 at A-27, Table A13.

Table 6 also compares the AEO 2015 Reference Case to the AEO 2013 Reference Case, indicating that:

- Total natural gas consumption for 2035 is projected to increase by 0.3 Bcf/d, from 78.7 Bcf/d to 79.0 Bcf/d;
- Net exports (including both pipeline and LNG exports) are projected to increase by 7.2 Bcf/d, from 7.0 Bcf/d to 14.2 Bcf/d; and
- The projected 2035 Henry Hub price is projected to increase by $0.17/MMBtu, from $6.43/MMBtu to $6.50/MMBtu (in 2012 dollars).

Indeed, in comparing the AEO 2015 Reference Case and AEO 2013 Reference Case projections, total domestic dry gas production is projected to rise by 7.6 Bcf/d of natural gas, from 85.9 Bcf/d to 93.5 Bcf/d. For these and other reasons, these post-AEO 2011 projections in no way undermine our conclusion regarding the consistency of the proposed exports with the public interest.

Table 6: Comparison of AEO Cases

Projections for 2035	**AEO 2011 Reference Case**	**AEO 2012 Reference Case**	**AEO 2013 Reference Case**	**AEO 2015 Reference Case**	**AEO 2011 High Shale EUR Case**
Total Natural Gas Consumption (Bcf/d)	72.7	73.0	78.7	79.0	81.2
Electric Power Sector Consumption (Bcf/d)	21.6	24.5	25.9	25.1	26.4
Transportation Sector Consumption (Bcf/d)	0.4	0.4	1.6	0.8	0.7
Domestic Dry Gas Production (Bcf/d)	72.1	76.5	85.9	93.5	82.5
Net Natural Gas Exports by Pipeline (Bcf/d)	-0.1	1.9	3.0	5.2	1.9
Net Natural Gas Exports as LNG (Bcf/d)	-0.4	1.8	4.0	9.0	-0.4
Henry Hub Price, $/MMBtu (Reference Basis)	$7.07 (2009$)	$7.37 (2010$)	$6.32 (2011$)	$6.60 (2013$)	$5.35 (2009$)
Henry Hub Price (2012$ Basis)	$7.31/MMBtu	$7.62/MMBtu	$6.43/MMBtu	$6.50/MMBtu	$5.53/MMBtu

We again note that NERA also modeled a wide range of possible future supply and demand conditions, thereby reducing the dependence of its results on the accuracy of the AEO 2011 Reference Case. The AEO 2011 High Shale EUR case, for example, is represented in the table above showing EIA's AEO 2011 assumption of no new LNG exports. The AEO 2011 High Shale EUR case projected natural gas consumption growth that was even greater than the AEO 2013 Reference Case and domestic natural gas production growth that was less than the AEO 2013 Reference Case. Using the AEO 2011 High Shale EUR as a baseline, NERA modeled LNG exports across a range of international market conditions and found positive economic benefits to the U.S. economy in all cases where LNG exports were economically

viable.[152] The inclusion of the AEO 2011 High Shale EUR case in NERA's analysis reinforces our conclusion that there is no reason to believe that using AEO 2013 Reference Case projections (or the more recent AEO 2015 projections) would have altered the central conclusion of the LNG Export Study.

Further, as reflected in the comments submitted by Lake Charles Exports[153] and Secretary Abraham,[154] Dow does not substantiate its claim that $95 billion of new investment in the manufacturing sector has led (or will lead) to an increase of 6 Bcf/d in incremental domestic consumption of natural gas by 2020. In making these estimates, Dow includes many projects that merely have been announced or that are under consideration with start dates far into the future. Dow provides no information as to when or whether these projects will be constructed or will begin operations.

b. Significance of Prior FTA Authorizations

Dow argues that the 28 Bcf/d of exports authorized to FTA countries (as of the date of Dow's comment) shows that the LNG Export Study underestimated future demand for natural gas.[155] However, the volume of authorized exports to FTA countries is by no means a reliable predictor of the number and capacity of LNG export facilities that will ultimately be financed, constructed, and placed in operation.[156] Indeed, while many of the FTA authorizations have

[152] NERA Study at 6.
[153] Reply Comments of Lake Charles Exports, LLC at 12-13.
[154] Reply Comments of Secretary Spencer Abraham at 8.
[155] As of the date of this Order, DOE/FE has authorized the export of 37.63 Bcf/d of natural gas to FTA countries.
[156] As America's Natural Gas Alliance explains, when domestic gas supply was forecast to be insufficient to meet domestic demand, many LNG import facilities were proposed, but few were constructed. Specifically, from 2000 through 2010, over 40 applications to build new LNG import facilities were submitted to federal agencies, but only eight new facilities were built. The increase in domestic natural gas production had reduced the need for imported LNG. Further, of those import facilities constructed, public records show their use has declined. In 2004, the United States imported 244 cargoes of LNG at the four terminals existing at that time. By comparison, in 2013, only 36 cargoes were imported at five of the 12 then-existing terminals (note that the U.S. Department of

been in place for several years, DOE/FE is aware of only one application submitted to date in which a liquefaction facility was planned with the sole purpose of exporting LNG to FTA countries. Therefore, we are not persuaded that the current FTA authorizations undermine the assumptions of the LNG Export Study.

We note also that applicants typically request both FTA and non-FTA export authorizations for the entire output capacity of their proposed export facilities. Thus, as we explained above, the FTA and non-FTA authorizations are not additive. Citizens Against LNG contends that the NERA Study failed to consider the full potential volume of exports of 31.41 Bcf/d to FTA nations and 24.80 Bcf/d to non-FTA nations, but this argument is incorrect insofar as Citizens Against LNG is claiming that FTA and non-FTA authorization volumes must be added to calculate demand caused by LNG exports. Nevertheless, it bears mention that NERA did remove export constraints in its model for several of the cases evaluated. NERA found that, at the price required in the United States to free up 55 Bcf/d for export, there would be zero global demand for U.S. exports under any combination of domestic and international supply and demand conditions evaluated. Thus, the 55 Bcf/d case was found to be infeasible and was not included in the macroeconomic analysis.

Transportation's Maritime Administration terminated the license for Gulf Gateway Energy Bridge on June 28, 2013). Seven of the 12 existing terminals did not receive any cargoes in 2013. *See* http://www.marad.dot.gov/ports_landing_page/deepwater_port_licensing/deepwater_port_licensing.htm; http://www.ferc.gov/industries/gas/indus-act/lng.asp; *Natural Gas Imports and Exports Fourth Quarter Report 2004*, DOE/FE-0485, Office of Natural Gas Regulatory Activities, Office of Fossil Energy, U.S. Department of Energy; *Natural Gas Imports and Exports Fourth Quarter Report 2013*, DOE/FE-0563, Office of Natural Gas Regulatory Activities, Office of Fossil Energy, U.S. Department of Energy;http://energy.gov/fe/listings/lng-reports.

B. Distributional Impacts

1. GDP Versus Welfare

a. Comments

Several commenters, including Sierra Club, allege that the NERA Study overstated the likely macroeconomic benefits from LNG exports. The National Resources Defense Council (NRDC), Sierra Club, and Clean Ocean Action, among others, maintain that NERA incorrectly conflated growth in GDP with growth in welfare. By concluding that LNG exports would create a net benefit to the economy, NERA also allegedly relied too much on the fact that exports would increase GDP and failed to give adequate weight to projected natural gas price increases and to deleterious socio-economic, sectoral, and regional impacts on consumers, households, and the middle class, including wage-earners.

A number of other commenters, including American Petroleum Institute, Paul Eikelboom, Gary Lambert, and Helen Rice, however, assert that LNG exports will create jobs and boost the economy. For example, American Petroleum Institute states that a report by ICF International shows that LNG exports will result in a net gain in employment in the United States and that the job impacts of LNG exports will grow larger as export volumes rise.

b. DOE/FE Analysis

The NERA Study presented the macroeconomic impacts of LNG exports using the different statistical measures noted above—price, welfare, GDP, aggregate consumption, aggregate investment, natural gas export revenues, sectoral output, and wages and other household incomes. NERA did not confuse the concepts of welfare growth and GDP growth. The study clearly shows that NERA distinguished these concepts and separately

examined the macroeconomic impacts of LNG exports using both measures.[157] Welfare is a term of art in economics that measures the well-being of consumers and reflects changes in the value placed on consumption and leisure by individuals. NERA calculated welfare in the study as the "equivalent variation," which measures the amount of money that, if taken away from the average household, would make the household no better off with LNG exports than without.[158] GDP, as NERA explained, is "another economic metric that is often used to evaluate the effectiveness of a policy by measuring the level of total economic activity in the economy."[159] NERA thus acknowledged the distinction between GDP and welfare, yet used both metrics, among others, to ensure that its conclusions were robust across various measures.

2. Sectoral Impacts

a. Comments

Numerous commenters debate whether LNG exports will impact the domestic EITE sectors disproportionately, at too high of a cost to the U.S. economy to justify exporting LNG. Specifically, Dow, the Fertilizer Institute, Alcoa, and other commenters assert that higher natural gas prices caused by the demand for LNG exports will make it difficult for U.S. manufacturing to compete in global markets, reversing the gains these industries have made in recent years due to low domestic gas prices. According to these commenters, LNG exports will lead to lost jobs and lower wages in the EITE sectors—such as the chemical, fertilizer, and primary metal manufacturing sectors. These commenters, together with the Aluminum Association, the American Iron and Steel Institute, and others, contend that EITE jobs tend to be high-paying, highly-skilled, and of strategic national importance, whereas they allege that jobs created due to

[157] NERA Study at 6.
[158] *Id*.
[159] *Id*. at 56.

LNG exports will be short-lived and potentially of lower value to the U.S. economy. In this regard, Alcoa, Representative Markey, and IECA, among others, charge that NERA failed to analyze the unique tradeoffs between the domestic natural gas industry—which obviously stands to benefit from LNG exports—and EITE industries, which they argue will feel the brunt of higher gas prices and price volatility brought on by LNG exports.

In addition, Dow argues that the NERA model should have addressed industry-specific impacts. Dow submits that NERA erred by positing that the impact of expanded natural gas exports will affect the chemical, paper, and plastic industries in the same ways. It contends that the single bundled sector represented in the NERA model as the energy intensive sector is actually comprised of five sectors, and that NERA mistakenly assumed that average behavior from the EITE sector is representative of each of the five sectors:

> By bundling these industries, NERA applies the same labor, capital, fuel, and other material inputs in the same way across industries. Such an aggregation mutes the true impact to the industries, especially the chemical products industry. The chemical products subsector varies significantly from the other four industries in terms of value added to the economy (GDP) and energy consumption by fuel source ….[160]

According to Dow, the chemical industry is composed of dozens of different business models with different inputs and outputs. Consequently, Dow contends that "[s]hoe horning the chemical industry into an aggregated EIS [energy intensive sector] is not appropriate for studying the impact of LNG exports on the economy."[161]

More broadly, Dow maintains that NERA gave significant weight to a narrow economic benefit from LNG exports, but did not consider the greater economic value (the "value-added

[160] Initial Comments of Dow Chem. Co. at 27.
[161] *Id*. at 28.

multiplier effect") when natural gas is used in the United States to manufacture finished goods for export, instead of being exported as LNG. Similarly, the Fertilizer Institute offers a study prepared at its request by Charles Rivers Associates to support its claim that NERA underestimated the economic value of the fertilizer industry to the broader economy. Dow also contends that "take-or-pay" contracts used in the international trade of LNG will cause export activities to continue even if not economically warranted, thereby prolonging higher domestic gas prices.[162]

Senator Wyden, Representative Markey, Dow, and others contend that NERA misinterpreted a government-prepared 2009 Interagency Report that evaluated the effects of proposed greenhouse gas cap-and-trade legislation on EITE industries. According to these commenters, the findings in the Interagency Report led Congress to conclude that it was unacceptable to raise energy prices on EITE manufacturers because of the adverse employment implications across the economy. These commenters charge that the NERA Study, while borrowing heavily from the Waxman-Markey congressional debate, did not address the predictions of adverse employment impacts. Dow cites statistics from the Bureau of Economic Analysis indicating that, in 2011, total employment in the oil and gas industry was 171,000 while the chemical industry employed 785,000, the plastic and rubber industry employed 635,000, and the paper industry employed 388,000.[163] In addition, the Fertilizer Institute claims that the NERA Study should have assumed that the fertilizer industry directly supported 7,565 jobs while the NERA Study states that there were 3,920 jobs directly supported by the fertilizer industry.

[162] *Id*. at 16-17.
[163] *Id*. at 28 (Dow table citing figures from the U.S. Bureau of Economic Analysis, *Gross Domestic Product by Industry Data*).

On the other hand, a number of commenters, including ExxonMobil, American Petroleum Institute, the Energy Policy Research Foundation, Inc., and General Electric Oil & Gas, dispute these arguments. They specifically challenge the notion that an LNG export industry cannot co-exist with a growing domestic manufacturing base, and that EITE industries should be given priority, whether directly or indirectly, over the LNG industry.

ExxonMobil supports NERA's conclusion that exports will yield net economic benefits to the United States, and states that, in fact, NERA understated those benefits because (among other reasons) NERA did not factor in the greater supply of NGLs that will be produced in conjunction with increased natural gas production due to exports. The Institute for 21st Century Energy (an affiliate of the U.S. Chamber of Commerce) and the American Petroleum Institute, among others, note that additional production of NGLs will benefit chemical companies with U.S. plants because NGLs, such as ethane, are critical feedstock in chemical manufacturing processes. These commenters state that an increase in the supply of NGLs will exert downward price pressure on the cost of manufactured goods that use NGLs as a feedstock, thereby at least in part offsetting for those industries (primarily EITE industries) any increases in domestic natural gas prices associated with LNG exports.

ExxonMobil, American Petroleum Institute, Shell Oil Company, and many other commenters emphasize the size and productivity of the U.S. natural gas resource base, stating that there is an abundance of natural gas to support both LNG export demand and continued growth in the EITE industries. According to ExxonMobil, Western Energy Alliance, Energy Policy Research Foundation, Inc., and others, the vast supply of natural gas in the United States will continue to support current gains in domestic manufacturing, even as LNG exports take place. They state that LNG exports will both sustain and increase domestic production of natural

gas, which, in turn, will provide EITE industries with a greater supply of natural gas at more stable prices, allowing them to stay globally competitive. According to these commenters, opponents of LNG exports are incorrect in speculating that natural gas used for export otherwise would be used for domestic manufacturing when, in fact, the natural gas likely would not be extracted if there is not increased demand created by LNG exports.

Further, 110 members of the U.S. Congress,[164] ExxonMobil, and others maintain that there would be serious consequences to hindering the export of LNG. If exports are prohibited or constrained, they believe the United States will lose economic benefits that other countries will capture as those countries begin extracting their shale gas resources and competing in the global LNG export market. Numerous commenters, including ExxonMobil, the National Association of Manufacturers, and the Energy Policy Research Foundation, Inc., similarly assert that it would not be in the public interest for DOE to limit LNG exports, in contravention of U.S. free trade principles. As noted above, these commenters state that restricting exports of natural gas would subsidize domestic manufacturing at the expense of the larger U.S. economy. They contend that the U.S. Government should not suppress trade in one industry to benefit other industries.

b. DOE/FE Analysis

With respect to the argument that natural gas confers greater value on the U.S. economy when used in manufacturing than when produced for export, we observe that more natural gas is likely to be produced domestically if LNG exports are authorized than if they are prohibited. There is no one-for-one trade-off between gas used in manufacturing and gas diverted for export.

[164] 110 members of the U.S. House of Representatives filed a single set of comments in support of LNG exports.

Although commenters are correct that such a trade-off may exist at the margin, this competition between the demand for natural gas for domestic consumption and the demand for natural gas for export is captured in the N_{ew}ERA model. The model projected that under the majority of scenarios examined, no exports would occur, thereby indicating that, for those scenarios, the gas was of greater value to domestic consumers than to foreign ones. On the other hand, in supply and demand conditions where exports were projected to occur and were not prohibited or limited, the model found that greater economic value was being placed on the LNG by foreign markets and, at the same time, greater economic benefits, both in terms of welfare and GDP accrued to the U.S. economy due to those exports.

NERA grouped the U.S. economy into a workable number of supply and demand sectors as appropriate for a macroeconomic model of this nature. NERA divided the EITE industries into five categories: paper and pulp manufacturing, chemical manufacturing, glass manufacturing, cement manufacturing, and primary metal manufacturing, including iron, steel and aluminum. NERA projected that the overall impact across these categories will be relatively muted, with no individual industry experiencing a dramatic negative impact:

Serious competitive impacts are likely to be confined to narrow segments of industry. About 10 percent of U.S. manufacturing, measured by value of shipments, has both energy expenditures greater than 5 percent of the value of its output and serious exposure to foreign competition. Employment in industries with these characteristics is about one-half of one percent of total U.S. employment. LNG exports are not likely to affect the overall level of employment in the U.S. There will be some shifts in the number of workers across industries, with those industries associated with natural gas production and exports attracting workers away from other industries. In no scenario is

the shift in employment out of any industry projected to be larger than normal rates of turnover of employees in those industries.[165]

Some commenters contend that NERA grouped the EITE industries too broadly and assert that greater economic harms could have been identified by focusing more narrowly on the most gas-dependent industries. While we take these concerns seriously, ultimately we are guided by the principle that the public interest requires us to look to the impacts to the U.S. economy as a whole, without privileging the commercial interests of any industry over another. Similarly, with respect to the argument that some industries derive greater economic value from natural gas than others, we continue to be guided by the long-standing principle established in our Policy Guidelines that resource allocation decisions of this nature are better left to the market, rather than the Department, to resolve.

The Fertilizer Institute charges that the industry-specific employment data used by NERA is erroneous. The Fertilizer Institute claims that NERA underestimated employment directly supported by the nitrogen fertilizer industry and should have used a figure of 7,565 positions. However, NERA drew industry-specific employment data from the U.S. Census Bureau's Economic Census for 2007, which remains the most recent Economic Census data available. In estimating 3,920 positions directly supported by the nitrogen fertilizer industry, NERA selected a figure that is reasonably supported by an authoritative source.[166]

With respect to the Interagency Report prepared for the Waxman-Markey bill, we note that NERA used that report solely as a means of identifying industry segments that would be most acutely affected by higher energy costs, not as a way of determining the magnitude of such

[165] NERA Study at 2.
[166] *Id*. at 69.

impacts. Therefore, although we acknowledge that the Interagency Report was prepared in a different context, we find nothing unreasonable in NERA's use of the Interagency Report.

3. Household and Distributional Impacts

a. Comments

Several commenters maintain that, for most citizens, the macroeconomic benefits of LNG exports, if any, will be minimal. These commenters contend that the main beneficiaries of LNG exports will be a narrow band of the population, chiefly wealthy individuals in the natural gas industry, foreign investors, and those holding stock or having retirement plans invested in natural gas companies.

Other commenters assert that a majority of Americans will experience negative economic impacts, such as higher gas and electric bills, due to LNG exports. Senator Wyden, Dow, and Sierra Club, among others, contend that the NERA Study examined impacts on the labor market in terms of wages but failed to consider employment levels in terms of job equivalents or employment income. According to Clean Ocean Action, Dow, and Sierra Club, NERA also incorrectly assumed full employment and overestimated the positive job impacts associated with LNG exports. Dow, among others, charge that the NERA Study failed to adequately consider the cost of LNG exports in terms of lost jobs in the manufacturing sector and the cost of retraining workers for the LNG industry.

Several commenters support the LNG Export Study and argue that the macroeconomic impacts of LNG exports favor the public interest. ExxonMobil, the Center for Liquefied Natural Gas, and others, including several applicants for LNG export authorizations, submit that the NERA Study is comprehensive and rigorous and that LNG exports are in the public interest. ExxonMobil supports NERA's conclusion that exports will yield net economic benefits but

asserts that the study understates the potential employment benefits from LNG exports. ExxonMobil argues that, because the NERA model assumed full employment, it did not identify the positive impact LNG exports would have on jobs. ExxonMobil observes that the economy is far from full employment, with forecasts prepared by the Congressional Budget Office in 2012 showing the unemployment rate above a full employment level through most of this decade. By exporting LNG, ExxonMobil argues, the U.S. economy can reach full employment faster than it can without exports. ExxonMobil also contends that the lingering effects of the recession mean that capital is underutilized today; and that, where there is significant slack in the economy, there is no necessary trade-off between jobs in one sector versus another.

b. DOE/FE Analysis

NERA examined three components of household income directly affected by natural gas exports: income from wages, income from capital holdings (stocks, etc.), and income from resource ownership (royalties, rents, etc.). The NERA Study projected that for the economy as a whole, increases in resource income earned in the natural gas production process more than offset reductions in wage and capital income earned from all other activities outside of the natural gas production process. The NERA Study acknowledged, however, that exports would be accompanied by a shifting of income sources, and stated that some segments of the economy are likely not to participate in the benefits of LNG exports but are likely to face increased energy costs.

DOE believes that the public interest generally favors authorizing proposals to export natural gas that have been shown to lead to net benefits to the U.S. economy. While there may be circumstances in which the distributional consequences of an authorizing decision could be shown to be so negative as to outweigh net positive benefits to the U.S. economy as a whole, we

do not see sufficiently compelling evidence that those circumstances are present here. None of the commenters advancing this argument has performed a quantitative analysis of the distributional consequences of authorizing LNG exports at the household level. Given the finding in the LNG Export Study that exports will benefit the economy as a whole, and absent stronger record evidence on the distributional consequences of authorizing SPL's proposed exports, we cannot say that those exports are inconsistent with the public interest on these grounds.

4. Regional Impacts

a. Comments

Many commenters addressed the issue of negative and positive regional impacts potentially associated with LNG exports. Commenters including Alice Zinnes, Keith Schue, Jannette Barth, APGA, Alex Bomstein, and Sierra Club assert that shale gas production associated with increasing LNG exports will trap local communities in a "boom-and-bust" cycle associated with extractive natural gas drilling. In a phenomenon they refer to as the "resource curse," they argue that natural gas production will cause long-term economic damage to local communities, leaving the communities poorer once the gas resource is depleted. Jennifer Davis, Dina DeWald, Andrew Goff, and others agree that shale gas development and production will have a negative impact on local industries that are incompatible with extraction-related activities, such as agriculture and tourism. Numerous commenters, including Hope Punnett, Robert M. Ross, the Environmental Working Group, Citizens Against LNG, and Sierra Club, enumerate specific ways in which they allege local communities near shale gas production areas or pipelines could be adversely affected if LNG exports lead to increased natural gas production.

They cite increased noise, property devaluation, degradation of infrastructure, environmental and public health issues, and safety risks, among other issues.

Many other commenters seek to rebut these concerns by identifying the positive regional benefits associated with LNG exports, both in regions where shale development and production occur, and the regions in which LNG export terminals may be located. Commenters including Freeport LNG Expansion, L.P., *et al.* (also called FLEX), the Independent Petroleum Association of America, and scores of local, state, and federal political leaders—including 110 Members of the U.S. House of Representatives and several U.S. Senators[167]—cite regional economic benefits associated with each LNG project, including the potential for thousands of new jobs, substantial direct and indirect business income, and millions of dollars in new tax revenue. Further, U.S. Representative Charles W. Boustany, Jr., 14 members of the Ohio House of Representatives, and numerous other commenters assert that authorizing exports of LNG will help to sustain natural gas exploration and production efforts, which will mitigate any local "boom-bust" cycle.

Finally, several other commenters, including Southern LNG Company, L.L.C., and Gulf LNG, assert that any general consideration of regional impacts is outside the scope of the NERA Study and is most appropriately considered by DOE/FE in reviewing individual export applications.

b. DOE/FE Analysis

We agree with the commenters who contend that a general consideration of regional impacts is outside of the scope of the LNG Export Study, and that regional impacts are appropriately considered by DOE/FE on a case-by-case basis during the review of each LNG

[167] U.S. Senators James Inhofe, Lisa Murkowski, David Vitter, Mary Landrieu, Heidi Heitkamp, and John Cornyn submitted comments generally supporting LNG exports.

export application. The case-specific issue of regional impacts is discussed *infra* at Section XII.B.2.

C. Estimates of Domestic Natural Gas Supplies

1. Comments

Several commenters assert that, in addition to underestimating the demand for domestically produced natural gas, the NERA Study overestimated future domestic supplies of natural gas. Representative Markey, for example, argues that current projections provide for only 20 to 40 years of domestic natural gas supplies but NERA did not adequately consider these projections. Senator Wyden, the Fertilizer Institute, and others maintain that the NERA Study purports to treat the United States and Canada as a single North American market, but its assumptions ignore the potential effect of Canadian LNG exports to international markets.[168] These commenters are largely concerned that NERA has overestimated domestic supplies and that having lower supplies than estimated will exacerbate the likely price increases due to exports.

Contrary to these arguments, many commenters, such as American Petroleum Institute and Shell, argue that the United States has abundant domestic natural gas reserves. Center for LNG and Cheniere Energy argue that EIA and NERA underestimated the domestic natural gas resource base and, therefore likely overestimated the price impacts of LNG exports.

Dow, however, is concerned about certain indirect impacts that could arise if domestic supplies are exported. It asserts that domestic gas production would be unable to keep up with

[168] In his comments, Senator Wyden stated that Canada's National Energy Board has approved two LNG export projects in British Columbia and is considering a third. According to Senator Wyden, these projects could begin in 2014 and result in LNG exports totaling 9 Bcf/d. DOE/FE notes that Canada has approved the third LNG export project mentioned by Senator Wyden—the Royal Dutch Shell Plc project.

the demand required to meet unlimited LNG exports and that one-third of new shale gas production will be required to replace a decline in conventional gas production. Dow maintains that, as a consequence, gas production will have to ramp up significantly and this development will mean that gas supply will be diverted away from domestic industrial and other sectors of the economy:

> There would need to be rapid deployment of new drilling rigs, increased steel pipe manufacturing and an expanded work force throughout the value chain to be able to service such unprecedented growth in [natural gas] production. With an already well-documented skills shortage in the labor market, basic supply and demand economics will prevail and drive labor prices higher, which would in turn have a chilling impact on investment in the manufacturing sector.[169]

Other commenters take a somewhat longer view of the potential indirect impacts of LNG exports on domestic energy supplies. These commenters contend that, to become energy independent, the United States must preserve its supply of finite domestic energy resources, not export them. They argue that authorizing LNG exports will hasten the depletion of this country's natural gas resource base, the size of which is uncertain. Moreover, they assert, investment in LNG exports will take away from potential investment in renewable energy supplies, which will compound this country's dependency on fossil fuels.

Some commenters, such as Dow, IECA, and Citizens Against LNG, maintain that the NERA Study does not address significant policy changes that could impact domestic natural gas supply. These comments are focused in two areas: availability of energy production tax credits and uncertainty surrounding future environmental regulation regarding hydraulic fracturing. Specifically, Dow points to the possible elimination of energy production tax credits and states that elimination of this tax credit could result in a 5 percent decline in natural gas production and

[169] Initial Comments of Dow Chem. Co. at 16.

the loss of nearly 60,000 barrels per day of oil production. Dow, along with Jannette Barth, IECA and Citizens Against LNG, argue that potential state and federal environmental regulations pertaining to hydraulic fracturing should have been considered by NERA. These commenters assert that these potential additional regulatory costs and could lower supply, increase demand, and raise prices of natural gas.

2. DOE/FE Analysis

a. Measures of Supply

Before turning to a consideration of the specific comments, it is important to clarify the various measures of supply used by commenters. DOE/FE notes that, by three measures of supply, there are adequate natural gas resources to meet demand associated with SPL's requested authorization. Because these supply estimates have changed over time, however, DOE/FE will continue to monitor them to inform future decisions. These estimates include:

i) AEO natural gas estimates of production, price, and other domestic industry fundamentals. As shown in Table 6 above, the Reference Case projection of dry natural gas production in 2035 increased significantly (by 21.4 Bcf/d) in AEO 2015 compared with AEO 2011, while projections of domestic natural gas consumption in 2035 also increased in AEO 2015 compared with AEO 2011 (by 6.3 Bcf/d). Even with higher production and consumption, the 2035 projected natural gas market price in the Reference Case declined from $7.31/MM Btu (2012$) in AEO 2011 to $6.50/MM Btu (2012$) in AEO 2015. The implication of the latest EIA projections is that a greater quantity of natural gas is projected to be available at a lower cost than estimated four years ago.

ii) Proved reserves of natural gas. Proved reserves of natural gas have been increasing. Proved reserves are those volumes of oil and natural gas that geologic and

engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. The R/P ratio measures the number of years of production (P) that proved reserves (R) represent at current production rates. Typically industry maintains proved reserves at about 10 years of production, but as Table 7 below demonstrates, reserves have increased from 9.2 years of production in 2000 to 13.7 years of production in 2010, the latest year statistics are available. Of particular note is that, since 2000, proved reserves have increased 72 percent to 304,625 Bcf, while production has increased only 16 percent, demonstrating the growing supply of natural gas available under existing economic and operating conditions.

Table 7: U.S. Dry Natural Gas Proved Reserves[170]

	Proved Reserves (R)		**U.S. Dry Natural Gas Estimated Production (P)**		
Year	**(Bcf)**	**Percent change versus year 2000**	**(Bcf)**	**Percent change versus year 2000**	**R/P Ratio - Years**
2000	177,427	--	19,219	--	9.2
2005	204,385	15	18,458	-4	11.1
2010	304,625	72	22,239	16	13.7

iii) Technically recoverable resources (TRR). Technically recoverable resources have also increased significantly. Technically recoverable resources are resources in accumulations producible using current recovery technology but without reference to economic profitability. They include both proved reserves and unproved resources.[171]

[170] EIA, *U.S. Dry Natural Gas Proved Reserves* (Aug. 2, 2012), *available at* http://www.eia.gov/dnav/ng/ng_enr_dry_dcu_nus_a.htm (additional calculations conducted to produce percentage change and R/P ratios).

[171] Unproved resources are generally less well known and therefore less precisely quantifiable than proved

DOE/FE notes that EIA's natural gas TRR estimates have varied from below 2,000 Tcf in AEO 2010 to more than 2,500 Tcf in AEO 2011 and 2,266 Tcf in AEO 2015.[172] These TRR estimates include proved and unproved TRR shale gas resources, which have fluctuated in recent AEOs, as the EIA continues to monitor and estimate this resource base. For example, in AEO 2010, unproved shale gas TRR was estimated at 347 Tcf, which increased to 827 Tcf in AEO 2011, and was revised to 489 Tcf in AEO 2015.

b. Supply Impacts

Although TRR estimates in AEO 2011 were higher than the AEO 2015 estimates, we do not agree that NERA employed overly optimistic projections of domestic gas supply. The EIA and NERA studies conclude that for the period of the analysis, the United States is projected to have ample supplies of natural gas resources that can meet domestic needs for natural gas and the LNG export market. Additionally, most projections of domestic natural gas resources extend beyond 20 to 40 years. While not all TRR is currently economical to produce, it is instructive to note that EIA's recent estimate of TRR equates to nearly 90 years of natural gas supply at the 2014 domestic consumption level of 27.12 Tcf. Moreover, given the supply projections under each of the above measures, we find that granting the requested authorization is unlikely to affect adversely the availability of natural gas supplies to domestic consumers such as would negate the net economic benefits to the United States.

We further find that, given these estimates of supply, the projected price increases and increased price volatility that could develop in response to a grant of the requested LNG export

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reserves, and their eventual recovery is less assured.

[172] *See* U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2014* (June 2014), Table 9.2. Technically recoverable U.S. dry natural gas resources as of January 1, 2012, at 114, *available at*: http://www.eia.gov/forecasts/aeo/assumptions/pdf/0554(2014).pdf.

authorization are not likely to negate the net economic benefits of the exports. This issue is further discussed below. With regard to the adequacy of supply, however, it bears noting that while Dow contends that U.S. natural gas production would not be able to meet unlimited LNG exports and domestic demand, the NERA Study supports a different conclusion. The NERA Study included scenarios in which LNG exports were unconstrained. In these cases, LNG exports from the United States compete with LNG exports from all other international natural gas sources. Should the U.S. resource base be less robust and more expensive than anticipated, U.S. LNG exports would be less competitive in the world market, thereby resulting in lower export levels, and, in some instances, no exports, from the United States. By way of example, NERA modeled a number of Low EUR scenarios, which had U.S. resources that were less robust and more expensive than other cases. In these Low EUR scenarios, U.S. wellhead natural gas prices were driven up by higher production costs to meet domestic demand, and in those cases prices increased to a level that choked off demand for exports so that LNG exports were limited or disappeared, leaving the available natural gas for domestic use. In other unconstrained cases evaluated with the High EUR scenarios, domestic natural gas production was able to keep up with the demand required to meet the unconstrained LNG export scenario. In this case, the EIA scenarios reflect the changes that would occur in the domestic market and reflect the limitations, as modeled in the NEMS model, of domestic natural gas production and consumption by different sectors of the economy. In all of these cases, the supply and price response to LNG exports did not negate the net economic benefit to the economy from the exports.

c. Supply Impacts Related to Alternative Energy Sources

To the degree that natural gas prices may increase, alternative sources of energy will become more attractive to consumers and investors. Accordingly, in nearly every year in which

natural gas exports were reflected in the EIA Study, electricity from renewable energy resources increased compared to the no export case. Therefore, we do not agree with the suggestion that LNG exports would diminish investment in renewable energy.

d. Supply Impacts Related to Canadian LNG Exports

DOE/FE also disagrees with the argument that the NERA Study erred in its treatment of potential Canadian LNG exports to international markets. Although DOE/FE did not ask NERA to evaluate potential LNG exports from Canada, we note that LNG exports from Canada would compete with U.S. exports, thereby most likely reducing U.S. exports. Therefore, treating U.S. and Canadian LNG exports as those from a single market is a reasonable assumption, and would be consistent with the unconstrained LNG export cases evaluated by NERA, with the price impact more or less in line with the cases evaluated by NERA. DOE/FE would expect that benefits estimated to accrue to the United States from U.S. LNG exports likely would be similar to the benefits that would accrue to Canada resulting from Canadian LNG exports.

The LNG Export Study did not evaluate the steps to become energy independent, as that was not part of the criteria evaluated. However, the NERA Study concluded that the United States has ample supplies of natural gas resources that can both meet domestic needs for natural gas *and* allow for participation in the LNG export market, without a significant impact on supplies or prices for the period of the analysis under the assumptions made.

e. Supply Impacts Related to Tax Law and Environmental Policy

NERA stated that the NewERA macroeconomic model includes a simple tax representation in which indirect taxes are included in the output values and not explicitly

modeled.[173] NERA thus assumed no changes specific to existing law governing production tax credits. EIA did the same. On the other hand, at DOE/FE direction, NERA and EIA accounted for potential variability in domestic natural gas supply such as would occur due to changes in environmental regulation and other factors, including changes to production tax credits. They did so by incorporating the High EUR and Low EUR scenarios into their model.[174]

We find that it was reasonable for EIA and NERA to use the High EUR and Low EUR cases to capture a range of factors that may impact domestic natural gas supply. We further find that, given the range of scenarios studied, the decision not to specifically model the possible revocation of production tax credits or changes to environmental regulation does not lessen the reliability of the EIA or NERA studies. As a practical matter, EIA and NERA were required to establish certain key assumptions as a foundation for their studies. They reasonably evaluated alternative scenarios that would capture possible changes that would affect natural gas supplies.

D. Modeling the LNG Export Business

1. Comments

Some commenters complain that NERA failed to capture accurately the business model being employed by those involved in the business of LNG exports. Sierra Club states that NERA erroneously modeled the fossil fuel industry by assuming a zero-profit condition. Some commenters, including NRDC, maintain that NERA failed to consider that LNG exports will take place pursuant to long-term, *e.g.*, 25-year, contracts containing take-or-pay provisions, rather than contracts containing flexible or market-sensitive pricing provisions. IECA makes a similar argument in its reply comments. According to these commenters, the take-or-pay

[173] NERA Study at 110.
[174] *Id.* at 25.

provisions in long-term contracts will inhibit the free flow of price signals. The commenters argue that NERA incorrectly assumed that: (1) exports of LNG from the United States would cease if the gap in prices between domestic and foreign supplies is closed; and (2) a foreign country will cease purchases of U.S.-sourced LNG if the country gains access to less expensive supplies. These commenters maintain that take-or-pay provisions in long-term contracts will have the effect of driving LNG exports even under circumstances when it would be more economical for the same natural gas to be sold in the domestic market. In this regard, Dow criticizes NERA's assertion that the global market for natural gas will limit how high U.S. natural gas prices can rise as a result of export activity because importing nations will not purchase U.S. supplies if U.S. wellhead prices rise above the cost of competing supplies. Dow contends that this arbitrage phenomenon may occur in competitive markets but does not make sense in the global LNG market due to the broad use of long term take-or-pay contracts.

Additionally, several commenters, including Representative Markey, NRDC, Sierra Club, Citizens Against LNG, and Alcoa, charge that NERA incorrectly assumed that the financing of investments in natural gas supplies for export and in the LNG export projects that will be used for export operations would originate from U.S. sources. These commenters assert that, in fact, a substantial portion of the investment is being made by foreign entities and these foreign entities, not domestic corporations, will reap the benefits of export activity in the form of royalties, tolling fees, income, and tax proceeds from the resale of LNG overseas. Contrary to these arguments, FLEX and Lake Charles Exports argue that foreign financing of LNG export projects is beneficial. These commenters argue that foreign direct investment in the U.S. LNG industry frees up domestic capital for other investments. These commenters conclude that, as a result,

NERA's results likely underestimate the benefits to the U.S. economy that will result from LNG exports.

Another commenter, Save Our Supplies, contends that the structure of international markets for natural gas and LNG and the high cost of building international LNG export infrastructure will give a cost advantage to U.S. LNG exports. This cost advantage, coupled with greater international demand than projected by NERA, allegedly will exacerbate the projected price increases within the United States due to LNG exports. More generally, Save Our Supplies claims that NERA made a series of incorrect assumptions concerning the structure of international natural gas markets. These include erroneously assuming that international natural gas markets are competitive. Save Our Supplies identifies the following three considerations: (1) the international market is not perfectly competitive because there are barriers to entry, trade, and foreign investment due in part to the participation of state-sponsored enterprises; (2) there is an international oligopoly in oil that, because of a link between the international price of oil and the international price of natural gas in certain markets, makes it impossible for the international market in natural gas to be perfectly competitive; and (3) NERA erroneously assumed that natural gas is a "perfect substitute" for oil in all circumstances.[175] Based on these comments, Save Our Supplies challenges the NERA Study for allegedly assuming that Qatari and Russian suppliers of natural gas will cut their prices to compete with the lower priced supplies available from the United States. Save Our Supplies argues that such price competition will not be significant and, therefore, that there will be greater demand for U.S.-exported LNG. According to some commenters, NERA's asserted underestimate of international demand for natural gas

[175] Initial Comments of Save Our Supplies at 34, 41.

was also exacerbated by its failure to account for the construction of natural gas infrastructure on a global basis. According to these commenters, NERA appears to underestimate both the supply cost of international LNG projects and the magnitude and trajectory of global LNG demand. NERA also appears to underestimate U.S. natural gas demand and potentially the elasticity of the U.S. natural gas supply curve.

A number of commenters take an opposing position by arguing that the domestic natural gas resource base is sufficient to meet both the domestic and international demand for U.S. natural gas. Center for LNG, Cheniere, and others go further by arguing that EIA and NERA underestimated the size of the resource base, and therefore overestimated the potential domestic price impacts of LNG exports. Dominion Cove Point LNG, America's Natural Gas Alliance and others argue that the international market will constrain the total volume of natural gas exported from the United States.

Several commenters, including Sierra Club and Dow, argue that NERA overestimated LNG transaction costs (*e.g.*, costs of liquefaction, transportation, and insurance). Sierra Club argues that NERA overstated the transportation costs associated with the export of U.S. gas by assuming all LNG would be exported from the Gulf Coast. Sierra Club states that several export terminals are planned for the West Coast, where it will be less expensive to transport gas to the Asian market than it would be from the Gulf Coast. Dow states that NERA's estimate of transportation and insurance costs for shipping LNG to Asia would be on the order of $2.60/Mcf. Dow claims that official trade statistics published by the U.S. Census Bureau, however, establish that these costs would be closer to $0.50/Mcf. Commenters such as Dow and Sierra Club state that had NERA properly accounted for LNG transaction costs, the foreseeable volumes of LNG exports would have exceeded those predicted by NERA, thereby intensifying the impact of LNG

exports on U.S. natural gas prices. For this reason Sierra Club and Dow argue that NERA's projected price ceiling on domestic natural gas is too low. In addition, numerous individual members of the Sierra Club contend that NERA appears to have misrepresented the amount of natural gas used by LNG terminals in the liquefaction process, which understates the demand associated with exports.

2. DOE/FE Analysis

As explained below, we find that the NERA Study reflects an accurate understanding of the contractual terms and market environment affecting the fossil fuel industry and, more narrowly, provides a plausible future scenario of international trade in LNG with U.S. exports. It is DOE/FE's view also that NERA's conclusions of the impact of LNG exports would not have materially changed with alternative international market assumptions. In this regard, we note that NERA included one scenario in which LNG exports reached 23 Bcf/d, with a positive impact on the U.S. economy. We find as follows:

a. Zero Profit Condition

Sierra Club's charge that NERA erroneously modeled the fossil fuel industry by assuming a zero-profit condition appears to reflect a misunderstanding of the term "zero-profit" as used by NERA. The "zero-profit condition" assumed in the NERA Study does not mean that firms in the natural gas industry will not make a "profit" as that word is ordinarily used. Rather, the zero-profit condition means only that firms will not make a profit above the risk-adjusted cost of capital. The assumption of a zero-profit condition is another way of saying that the model assumes a competitive market for natural gas, because in competitive markets new firms can enter and drive any profits above a risk-adjusted cost of capital down to zero. The assumption of a competitive market for natural gas production in the United States is valid given

that natural gas wellhead prices have been deregulated for more than 30 years.[176] Moreover, Sierra Club and other commenters have not provided any evidence to suggest a lack of competition in the market for U.S. natural gas production.

b. Contract Terms

We disagree with the contention that NERA erred in the assumptions it used to model the export contracts that will be used by authorization holders. NERA assumed that these contracts will include payments to the exporting facility in the form of a tolling charge that is fixed based on the total export capacity reserved under the tolling agreement plus 115 percent of the Henry Hub price for each unit of gas that is liquefied. These assumptions correspond closely with the 20-year tolling agreement filed publicly with DOE by SPL on April 2, 2013. In that filing, the tolling agreement carries a tolling fee (or "reservation charge") with a per unit liquefaction charge of 115 percent of the Henry Hub price.[177]

Because there is neither a throughput obligation nor a fixed commodity price in the commercial arrangements assumed by NERA (or in the publicly filed SPL contract), the supplies of natural gas or LNG subject to the contracts are not locked up for the export market. Instead, as NERA has properly assumed for purposes of its model, foreign and U.S. purchasers will compete for domestically produced supplies and, if the domestic price rises, the owners of the gas (in most cases, either the authorization holder or the foreign purchasers that are party to the export-related contracts) will have an incentive to sell the gas into the domestic market rather than the international market.

[176] Natural Gas Policy Act of 1978, 15 U.S.C. § 3301, *et seq.* (establishing a policy for phasing out the regulation of wellhead prices).
[177] *Sabine Pass Liquefaction LLC*, LNG Sale and Purchase Agreement with Centrica PLC, FE Docket No. 13-42-LNG at 51-52 (Apr. 2, 2013).

Commenters criticizing NERA's model on these assumptions have not submitted evidence to support their position that contracts will lock up natural gas for export. Moreover, we find it unlikely that a broad cross-section of commercial parties would lock themselves permanently into arrangements whereby LNG will be exported from the United States even when it is uneconomical to do so. Even contracts entered improvidently may be amended when there is a possibility for mutual benefit in doing so, as there would be in a case where domestic gas prices exceed netback prices.

c. Foreign Direct Investment

As described above, several commenters charge that the NERA Study incorrectly assumed that the financing of investments in natural gas supplies for export and in LNG liquefaction and export facilities would come from domestic sources. An examination of the NERA Study indicates that claim is not valid as to natural gas supplies. Early in the study, NERA noted as follows:

> Net benefits to the U.S. economy could be larger if U.S. businesses were to take more of a merchant role. Based on business models now being proposed, this study assumes that foreign purchasers take title to LNG when it is loaded at a United States port, so that any profits that could be made by transporting and selling in importing countries accrue to foreign entities. In the cases where exports are constrained to maximum permitted levels, this business model sacrifices additional value from LNG exports that could accrue to the United States.[178]

On the other hand, the commenters are correct to the extent they argue that the NERA Study assumed that the financing for the liquefaction and export facilities associated with LNG exports would come solely from domestic sources. The NERA Study indicates that the timing of macroeconomic effects could be affected as a consequence:

[178] NERA Study at 6-7.

> In this report it is assumed that all of the investment in liquefaction facilities and in increased natural gas drilling and extraction come from domestic sources. Macroeconomic effects could be different if these facilities and activities were financed by foreign direct investment ("FDI") that was additional to baseline capital flows into the U.S. FDI would largely affect the timing of macroeconomic effects, but quantifying these differences would require consideration of additional scenarios in which the business model was varied.[179]

In the above statement, NERA has indicated that the timing of the impacts of LNG exports could change due to FDI. On the other hand, NERA has not stated that the nature of the impacts will change and no commenter has introduced evidence that FDI will produce negative economic benefits. Indeed, Lake Charles Exports explains why FDI may enhance the economic benefits to the United States:

> NERA thus acknowledged the possibility that investment necessary for LNG exports may come from foreign sources. The NERA model's assumption of domestic investment explicitly fails to capture the macroeconomic benefits that will result from the injection of any foreign investment into natural gas production and infrastructure.
>
> The United States has the leading economy in the world in part because the US is the leading destination of international flows of capital. Each dollar of new foreign investment capital into the US results in an equivalent increase in US GDP. The main positive components of GDP are private consumption, investment, government expenditures, and exports. Any foreign direct investment stemming from the development of a US LNG industry would not decrease domestic capital investment, but would merely free up such domestic capital for other investments. Therefore the total amount of investment in the US would increase, dollar-for-dollar, with foreign investment, increasing US GDP by the same amount. If that foreign investment earns a return and, after taxation by US local, state and federal governments, some of that return is repatriated, this reflects a small countervailing outflow (which seems to be what, for example, Representative Markey is focusing on). Nonetheless, foreign direct investment remains a major net contributor to the US economy. The 2012 LNG Export Study's simplifying assumption regarding the source of investment in LNG production infrastructure fails to capture the benefits of any capital provided from

[179] *Id.* at 211.

> foreign sources and thus understates the impact of such investment on US GDP.[180]

Accordingly, while FDI may be used to finance purchases of natural gas for export as LNG and the construction of LNG liquefaction and export facilities, we are not persuaded that the inflow of foreign capital for these purposes would be inconsistent with the public interest or would lessen the net economic benefits projected in the LNG Export Study.

d. International Natural Gas Markets

We are not persuaded by Save Our Supplies' claim that a projected cost advantage to exports of LNG from the United States as opposed to exports from other gas producing nations will necessarily exacerbate projected price increases within the United States due to LNG exports. This argument assumes that LNG will be available for export at a landed price overseas that is competitive with the international price set by foreign competitors. But NERA concluded that in many cases, the world natural gas market would not accept the full amount of exports assumed in the EIA scenarios at prices high enough to cover the U.S. wellhead domestic prices calculated by the EIA. Alternatively, foreign competitors supplying natural gas and LNG in international markets may match or, possibly, undercut the landed price of LNG exported from the United States.

With respect to the competitiveness of global LNG markets, NERA assumed that the production decisions of the world's dominant producer, Qatar, would be fixed no matter what the level of U.S. exports and that, generally, "there is a competitive market with exogenously determined export limits chosen by each exporting region and determined by their liquefaction

[180] Reply Comments of Lake Charles Exports at 31 (citations omitted).

capacity."[181] NERA described these assumptions as a "a middle ground between assuming that the dominant producer will limit exports sufficiently to maintain the current premium apparent in the prices paid in regions like Japan and Korea, or that dominant exporters will remove production constraints because with U.S. entry their market shares fall to levels that do not justify propping up prices for the entire market."[182] We find this to be a reasonable simplifying assumption and note further that even imperfectly competitive markets are not static. The arrival of new entrants, such as U.S.-based LNG exporters, may well have a disruptive impact on markets where competition may presently be constrained.

Finally, we note that NERA also modeled a "supply shock" case that assumed key LNG exporting regions did not increase their exports above current levels. NERA found positive economic benefits to the United States in each supply shock scenario in which the United States exports LNG. These results strengthen our conclusion that the prospect of non-competitive behavior in global LNG markets is unlikely to have a material impact on the central conclusions of the LNG Export Study.

e. Estimates of LNG Transaction Costs

We disagree with the comments from Sierra Club and Dow arguing that NERA overestimated LNG transaction costs, including liquefaction, transportation, insurance, and the like. NERA based its liquefaction, shipping costs and regasification costs on a review of publicly available literature, including the International Group of LNG Importers 2010 LNG Industry report and other sources referenced in the NERA Study.[183]

[181] NERA Study at 34.
[182] *Id*. at 34-35.
[183] *Id*. at 84-90.

With respect to transportation costs, Dow states that NERA's estimate of shipping cost to Asia was on the order of $2.60/Mcf, while statistics presented by Dow claim these to be $0.50/Mcf. In presenting this figure, Dow relies on trade statistics reported by the U.S. Census Bureau based on the average cost of insurance and freight expenses associated with U.S. *imports* of LNG in 2010 and 2011. As NERA points out, however, LNG transportation costs in large measure are a function of the distance traveled. Therefore, data on LNG imports, which largely travel shorter distances,[184] do not furnish a reliable basis for drawing inferences regarding transportation costs for LNG exports to Asia. Further, NERA provided a detailed description of the assumed transportation cost buildup, which is based on a daily charter rate of $65,000, and other reasonable assumptions.[185] Dow does not provide evidence challenging the accuracy of the information used by NERA or NERA's method of calculating transportation costs. Nor does Dow provide other evidence of daily charter rates.

As for the cost of natural gas consumed in the liquefaction process, NERA's model assumes a consumption level equal to 9 percent of the natural gas feedstock, a cost that is included in the NERA model. NERA based this assumption on publicly available information of liquefaction costs. Similarly, EIA assumed that 10 percent of feedstock was consumed in the liquefaction process.

Therefore, we find that NERA's cost build-up is appropriate and that the estimated costs for delivering LNG to end users considered in the NERA Study are reasonable.

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[184] DOE/FE statistics show that the majority of LNG imports to the United States for 2010 and 2011 came from Atlantic Basin/North African sources. More than one-third of U.S. LNG imports in 2010 and 2011 came from Trinidad and Tobago, and none came from East Asia. *See* DOE/FE 2010 LNG Import Annual Report and DOE/FE 2011 LNG Import Annual Report, *available at* http://fossil.energy.gov/programs/gasregulation/publications/.

[185] NERA Study at 87.

E. Cost of Environmental Externalities

1. Comments

Sierra Club, along with Delaware Riverkeeper Network,[186] Jannette Barth, NRDC, Dow, and Save Our Supplies, among others, maintain that LNG exports will increase demand for natural gas, thereby increasing negative environmental and economic consequences associated with natural gas production. These commenters assert that NERA failed to consider the cost of environmental externalities that would follow such exports. The externalities identified by these commenters include:

- Environmental costs associated with producing more natural gas to support LNG exports, including the costs, risks, and impacts associated with hydraulic fracturing and drilling to produce natural gas;
- Opportunity costs associated with the construction of natural gas production, transport, and export facilities, including the costs of investing in shale gas infrastructure to support LNG exports, as opposed to investing in renewable or sustainable energy infrastructure;
- Costs and implications associated with eminent domain necessary to build new pipelines to transport natural gas; and
- Potential for switching from natural gas-fired electric generation to coal-fired generation, if higher domestic prices cause domestic electric generation to favor coal-fired generation at the margins.

2. DOE/FE Analysis

Insofar as relevant to this proceeding, we have addressed these issues in the Discussion and Conclusions below. *See infra* § XII.

[186] Delaware Riverkeeper Network filed comments on behalf of itself and more than 80 other organizations.

F. Prices and Volatility

1. Natural Gas Price Volatility

a. Comments

Several commenters, such as Huntsman Corporation, address potential natural gas price volatility associated with LNG exports. Janette Barth, Dow, Sierra Club, and Save Our Supplies, among others, state that NERA did not account for price volatility. Sierra Club points to the results of the LNG Export Study, which project higher domestic natural gas price impacts when exports phase in rapidly. Additionally, Sierra Club argues that, pending the pace of DOE/FE approvals, demand for domestic natural gas may increase more rapidly than production, leading to periods of scarcity and price spikes. Sierra Club also contends that there is little evidence that domestic natural gas price volatility will be reduced by LNG exports.

America's Natural Gas Alliance argues that there is no evidence that LNG exports will increase volatility. According to the Alliance, LNG exports will lead to increased investment in domestic gas production, which will help protect against price volatility. American Petroleum Institute contends that the NERA and Brookings studies project natural gas prices to remain in a narrow, low range through 2030 in all scenarios. Further, American Petroleum Institute points out that in October 2009, a Dow representative testified before the Senate Energy and Natural Resources Committee that the U.S. chemical industry could operate successfully if natural gas prices remain in the $6-8 MMBtu range. American Petroleum Institute asserts that recent studies projecting natural gas prices—even with high, unconstrained levels of LNG export—do not forecast natural gas prices higher than that range. Several commenters, including America's Natural Gas Alliance and American Petroleum Institute, further assert that the market will have significant advanced notice of LNG export facilities. As a result, natural gas producers will be

able to adjust supply to meet anticipated increases in demand. American Petroleum Institute also argues that, because the facilities and liquefaction trains at each facility will be built in sequence, a market buffer will be created where supply will grow incrementally and supply shocks will not be created in the market. Additionally, Lake Charles Exports argues that Dow's analysis of domestic natural gas exports is incorrect, and the additional investment in domestic natural gas reserve development associated with increases in LNG exports will insulate the United States from natural gas price volatility.

The Bipartisan Policy Center, through its own analysis, forecasts that LNG exports are unlikely to result in large domestic price impacts. The Bipartisan Policy Center states that the results of its analysis indicate that LNG exports are likely to have only modest impacts on domestic natural gas prices—and that LNG export levels will adjust as domestic prices rise or fall.

b. DOE/FE Analysis

Natural gas price volatility can be measured in terms of short term changes—daily or monthly volatility—or over longer periods. Short term volatility is largely determined by weather patterns, localized service outages, and other factors that appear unlikely to be affected substantially by DOE export authorization decisions. Moreover, NERA's study was a long-term analysis covering a 20-year period that correctly did not focus on short term shocks or volatility.

To the extent commenters are concerned about the risk of large upward price spikes sustained over longer periods, such as those that occurred in 2005 and 2008, we do not agree that LNG exports will necessarily exacerbate this risk. First, as noted above, when domestic wholesale gas prices rise above the LNG netback price, LNG export demand is likely to diminish, if not disappear altogether. Therefore, under some international market conditions,

LNG export facilities are likely to make natural gas demand in the United States more price-elastic and less conducive to sustained upward spikes. Second, in light of our findings regarding domestic natural gas reserves explained above, we see no reason why LNG exports would interfere with the market's supply response to increased prices. In any capital intensive industry, investments are made based on observed and anticipated market signals. In natural gas markets, if prices or expected prices rise above the level required to provide an attractive return on investment for new reserves and production, industry will make that investment to capture the anticipated profit. These investments spur development of reserves and production and increase availability of natural gas, exerting downward pressure on prices. This is part of the normal business cycle that has been captured in EIA's supply curves and, consequently, in NERA's analysis. On balance, we are not persuaded that LNG exports will substantially increase the volatility of domestic natural gas prices.

2. Linking the Domestic Price of Natural Gas to World Prices

a. Comments

Several commenters, including APGA, Dow, and IECA, argue that LNG exports could link domestic natural gas prices to the price of natural gas in the world market, and that this could exacerbate the potential increase in domestic natural gas prices as well as increase price volatility. A number of other commenters, however, contend that domestic prices would not become linked to world prices. Citing the importance of the domestic natural gas price in determining the level of exports, the Bipartisan Policy Center and Southern LNG Company argue that domestic natural gas prices will remain independent of international prices.

In its reply comments, Dow expands on its argument that domestic natural gas prices will become linked to international prices. Dow argues that exports to Asia, where natural gas prices

are "oil-indexed," will invariably lead to increases in domestic price. Dow also argues that it is incorrect to assume liquefaction, transportation and regasification costs will act as a buffer against world prices, pointing to the experience in Australia in which LNG exports resulted in a tripling of domestic natural gas prices. In reply comments, American Petroleum Institute and several LNG export applicants (and/or authorization holders) argue that natural gas prices will not rise to global prices because the market will limit the amount of U.S. natural gas that will be exported, since liquefaction, transportation and regasification costs act as a cushion. These commenters argue that if this cushion disappears and the U.S. export price rises to the global LNG price, market forces will bring U.S. exports to a halt. Several LNG export applicants also contend that the availability of bi-directional terminals will serve to limit domestic price increases.

b. DOE/FE Analysis

The NERA Study examined whether LNG exports from the United States will cause domestic prices to rise to the level of international prices and found that such a result is unlikely. NERA asserts that there will always be a difference between the international LNG price and the U.S. market price. That difference will be represented by the cost of inland transportation, liquefaction, shipping, and regasification. NERA's model assumes competition among different suppliers such that Asian buyers would have no incentive to buy natural gas from the United States if the delivered price after liquefaction and transportation is higher than the alternative delivered LNG price from other sources. DOE/FE agrees that a competitive market would behave in this manner and U.S. natural gas prices would be lower than international LNG prices in such a market by at least the costs previously described. Further, the introduction of LNG exported from the United States into the international market would tend to exert downward

pressure on the prevailing higher delivered price for LNG in those foreign markets and could weaken the "oil-indexed" pricing terms.

In addition, all proposed LNG exports from the United States in applications DOE/FE has received to date would be pursuant to long-term contracts. To the extent that these contracts supply end-users in foreign markets, these exports represent a base-load demand for U.S. natural gas. As a base load, the United States market would adjust to this increased demand through increases in production, and plan for its delivery utilizing the significant production and storage infrastructure that exists. On average, prices would rise to levels that provide incentives for full marginal cost recovery for the incremental production of natural gas needed to meet this demand.

Hence we agree with those commenters, such as the Bipartisan Policy Center, that maintain that LNG exports from the United States will have difficulty competing with LNG exports from other countries unless domestic U.S. natural gas can be produced much cheaper. They point out that the international supply of natural gas is growing, and the mobility of that supply is increasing as other countries develop their own LNG export capabilities. Further, there is no evidence before us that demonstrates that the prices of natural gas or LNG in the international market are more volatile than the prices in the U.S. domestic market.

G. Integrity of the LNG Export Study

1. Comments

Several commenters, such as Clean Ocean Action and Sierra Club, argue that DOE/FE cannot rely on the NERA report unless DOE/FE discloses more details about the process by which DOE/FE selected NERA to conduct the study, DOE/FE's funding mechanism for paying NERA, and DOE/FE's involvement (if any) in guiding the study or reviewing drafts of the study prior to publication. In addition to Sierra Club, commenters Eugene Bruce, Ellen Osuna, Dow,

and IECA assert that DOE/FE cannot rely on the study because NERA has not disclosed all technical details of its proprietary N_{ew}ERA model to the public. According to Sierra Club, DOE/FE "has refused to make [all of] this information available for review during the public comment period."[187] Further, Sierra Club, Save Our Supplies and several other commenters argue that, due to this alleged lack of transparency, DOE/FE should conduct a new study of the potential cumulative impacts of granting LNG export licenses for shipment to non-FTA countries. Sierra Club and other commenters also contend that NERA and/or NERA's Vice President (and the principal author of the NERA Study) Mr. David Montgomery may be biased in favor of LNG exports, which they argue necessitates a new study by a different contractor.

2. DOE/FE Analysis

DOE has evaluated all submissions in this proceeding on their own merits, including the LNG Export Study and the arguments and analyses submitted by commenters. NERA conducted the study within DOE/FE's requested parameters (which are included as Appendix F to the NERA Study) and provided detailed information regarding its assumptions, model design and methodology, and results. This information is set forth at length in the NERA Study and is discussed in Section VI.B.2 and 5 of this Order. As evidenced by the number of detailed comments received, including additional studies offered by several of the commenters, NERA's explanation of its modeling design, methodology, and results has provided a sufficient basis both for the public to provide meaningful comments and for the Department to evaluate NERA's conclusions.

[187] Reply Comments of Sierra Club at 20.

H. Peer Review

1. Comments

Dow, along with Eugene Bruce, IECA, and others, charge that the NERA Study is invalid because NERA failed to validate its proprietary N_{ew}ERA model by means of technical peer review. These commenters argue that technical peer review is required by the Office of Management and Budget's (OMB) guidance entitled, "Final Information Quality Bulletin for Peer Review" (OMB Bulletin).[188] The OMB Bulletin establishes that "important scientific information shall be peer reviewed by qualified scientists before it is disseminated by the Federal government." Dow asserts that the NERA Study should be considered "highly influential scientific information," subject to the highest standards outlined in the OMB Bulletin, and/or subject to internal DOE peer review guidelines. Due in part to these concerns, several commenters, including Sierra Club and Save Our Supplies, urge that DOE/FE commission a new study by another independent contractor.

Cameron LNG, LLC, in its reply comments, counters that the OMB Bulletin does not apply to adjudications or permit proceedings such as this one. Cameron LNG therefore asserts that the public comment period held by DOE/FE on the LNG Export Study is more than adequate for DOE/FE to obtain constructive review of both the EIA and NERA studies.

2. DOE/FE Analysis

The OMB Bulletin establishes a framework for independent, expert review of influential scientific information before the information is publicly disseminated. It defines "scientific information" as "factual inputs, data, models, analyses, technical information, or scientific

[188] Final Information Quality Bulletin for Peer Review, 70 Fed. Reg. 2664 (Jan. 14, 2005).

assessments based on the behavioral and social sciences, public health and medical sciences, life and earth sciences, engineering, or physical sciences."[189] "Scientific information" does not include opinions where the presentation makes it clear the information is "opinion rather than fact or the agency's views."[190] Further, the OMB Bulletin, while applicable to rulemakings, provides that "official disseminations that arise in adjudications and permit proceedings" are exempt from peer review, unless "the agency determines that peer review is practical and appropriate …."[191]

We have considered commenters' request for peer review in light of the OMB Bulletin. Because this proceeding is an adjudication, peer review is not required unless DOE/FE determines that such review is appropriate. After consideration, we find that peer review is not required because the conclusions reached in the LNG Export Study are in the nature of expert opinion, not scientific fact, and also because the principal purpose of peer review of government-sourced documents—ensuring the government is well-informed by independently produced expert analyses—was accomplished in this proceeding.

Both the EIA and NERA studies use market assumptions to project a range of possible future results. No claim is made by the authors of either study that the studies contain scientific fact. To the contrary, both studies caution the reader on the limits to their economic projections. The EIA Study states: "The projections in this report are not statements of what *will* happen but of what *might* happen, given the assumptions and methodologies used."[192] Similarly, the NERA

[189] *Id*. at 2675.
[190] *Id.*
[191] *Id*. at 2677.
[192] EIA Study at ii.

Study was developed around assumptions of future scenarios and repeatedly acknowledges the uncertainties that could shift the results within the range of likely outcomes.[193]

Further, the procedures followed by DOE/FE in this proceeding have allowed numerous commenting parties and third-party experts to offer differing analyses. The comments included several expert studies critiquing the LNG Export Study. For example, Professor Wallace Tyner of Purdue University submitted results from a study that shows different results from NERA's. Sierra Club submitted a study by Synapse Energy Economics, Inc., that examined NERA's study and pointed out alleged "problems and omissions" in NERA's analysis.[194] Conversely, Southern LNG Company, Gulf LNG, and Jordan Cove Energy Project each submitted a study by Navigant that concluded that NERA's analyses were sound.[195]

DOE/FE has carefully weighed these competing analyses and viewpoints, and has conducted its own internal review of the LNG Export Study. In so doing, DOE/FE has recognized that its ultimate decision on the pending export applications would benefit from a public exchange of judgments and expert opinions.[196] The major purpose motivating the OMB Bulletin—to ensure that the government is well-informed by independent, expert analysis—was accomplished in this proceeding without the need for peer review.

[193] *See*, *e.g.*, NERA Study at 25-26.
[194] Synapse Energy Economics, Inc., *Will LNG Exports Benefit the United States Economy?* (Jan. 23, 2013), at 1, submitted with Initial Comments of Sierra Club.
[195] *See*, *e.g.*, Navigant Consulting, Inc. and Navigant Economics, Analysis of the Department of Energy's LNG Export Study (Jan. 24, 2013), App. A of Initial Comments of Gulf LNG.
[196] *See* 77 Fed. Reg. at 73,628 ("The LNG Export Study and the comments that DOE/FE receives … will help to inform our determination of the public interest in each case.")

I. Procedural Arguments

1. Comments

Several commenters, including Sierra Club, Senator Wyden, NRDC, and others argue that the current public interest standard, which focuses on meeting the nation's "essential domestic needs" for natural gas, is too narrow and that DOE/FE must undertake a rulemaking to establish criteria for making such a determination under the NGA. Similarly, Sierra Club, Alcoa, IECA, and CarbonX Energy Company, Inc., argue that DOE/FE should articulate, in the context of a separate rulemaking proceeding, the framework it will use in making its public interest determinations for individual export applications. Dow makes a related comment, stating that each of the individual LNG export dockets contains an insufficient record on which to base a public interest determination on the cumulative impact of LNG exports, and therefore DOE/FE is required to conduct a notice and comment rulemaking before it decides on any of the pending LNG export applications.

Dow, Sierra Club, Save Our Supplies, and other commenters contend that DOE/FE should conduct a public hearing regarding the applicable public interest standard in light of the cumulative impacts of LNG exports. Additionally, several commenters request that DOE/FE reopen the dockets of LNG export applicants to solicit additional public comment. Commenter Mary Altmann argues that DOE/FE should invite public comment on individual LNG applications before approving exports. IECA argues that many commenters could not reasonably have been expected to intervene in individual license proceedings at the time license applications were filed, since they had no way of anticipating that more than 20 applications would eventually be filed. IECA argues that DOE/FE, therefore, has no alternative other than to allow every interested party to intervene in each proceeding. Along these same lines, CarbonX

requests that its comment on the LNG export study be incorporated into the dockets for each pending LNG export applications.

Several commenters raise issues associated with their ability to comment on economic studies conducted by third parties and whether DOE/FE may rely on such studies in making a determination. Regarding DOE/FE's request for public comment in the NOA, Sierra Club, IECA, and others argue that DOE/FE narrowly instructed parties to address only the EIA and NERA studies. Proponents of this argument assert that DOE/FE cannot assess whether it is in the public interest to issue additional LNG export permits by addressing only one aspect of the public interest analysis (*i.e.*, potential impacts on energy costs). Similarly, Sierra Club, IECA, CarbonX, and others, assert that citations to third-party studies in the record do not discharge DOE/FE's responsibility to evaluate the public interest because the studies are based on undisclosed proprietary data and models with limited information regarding their development and age.

Other commenters argue that DOE/FE should act now to decide each pending export application. These commenters contend additional administrative process is neither necessary nor appropriate as DOE/FE has already provided the "opportunity for hearing" required under NGA section 3(a) to make its public interest determination. Commenters such as ExxonMobil and the Center for Liquefied Natural Gas argue that the initial and reply comments submitted in response to the LNG Export Study do not change the NGA statutory and regulatory requirements that place the burden of proof on opponents to demonstrate, with sufficient evidence, that each application is inconsistent with the public interest. These commenters argue that the record before DOE/FE regarding each individual application is sufficient for DOE/FE to determine whether LNG exports have been shown to be inconsistent with the public interest.

2. DOE/FE Analysis

Fundamentally, all of the above requests for procedural relief challenge the adequacy of the opportunity that we have given to the public to participate in this proceeding and the adequacy of the record developed to support our decision in this proceeding.

With respect to opportunity for public participation, we find that the public has been given ample opportunity to participate in this proceeding, as well as the other pending LNG export proceedings. Within this proceeding, the Notices of Application contained a detailed description of each Application, and invited the public to submit protests, motions to intervene, notices of intervention, and comments.[197] As required by DOE regulations, similar notices of application have been published in the Federal Register in each of the other non-FTA export application proceedings. Additionally, in December 2012, DOE/FE published the NOA in the Federal Register.[198] As explained above, the NOA described the content and purpose of the EIA and NERA studies, invited the public to submit initial and reply comments, and stated that these comments will be part of the record in each individual docket proceeding.[199] DOE/FE thus has taken appropriate and necessary steps by offering the public multiple opportunities to participate in the non-FTA LNG export proceedings.

We also find the record is adequate to support the action we are taking in this Order. DOE/FE has reviewed all of the submissions made in this proceeding. Moreover, this Order sets out the reasons that support each of the determinations contained herein. Consequently, we do not find it is necessary or appropriate to delay issuance of this Order to augment the record, either through a rulemaking or public hearing. In this regard, we note that DOE/FE retains broad

[197] *See supra* at 5-6, nn.11-12 (Notice of First App.; Notice of Second App.; Notice of Third App.).
[198] 77 Fed. Reg. at 73,627.
[199] *Id*. at 73,628.

discretion to decide what procedures to use in fulfilling its statutory responsibilities under the NGA,[200] and our view is that the record is sufficient to support the actions that we are taking. The requests for additional procedures summarized above are denied.

X. DOE/FE *ADDENDUM TO ENVIRONMENTAL REVIEW DOCUMENTS CONCERNING EXPORTS OF NATURAL GAS FROM THE UNITED STATES*

On June 4, 2014, DOE/FE published the Draft Addendum for public comment. The purpose of the Addendum, DOE/FE explained, was to provide information to the public regarding the potential environmental impacts of unconventional natural gas production. Although not required by NEPA, DOE/FE prepared the Addendum in an effort to be responsive to the public and to provide the best information available on a subject that had been raised by commenters in this and other LNG export proceedings. The 45-day comment period on the Draft Addendum closed on July 21, 2014. DOE/FE received 40,745 comments in 18 separate submissions, and considered those comments in issuing the Addendum on August 15, 2014.[201] DOE provided a summary of the comments received and responses to substantive comments in Appendix B of the Addendum.[202] DOE/FE has incorporated the Draft Addendum, comments, and final Addendum into the record in this proceeding.

The Addendum focuses on the environmental impacts of unconventional natural gas production, which primarily includes production from shale formations, but also includes tight gas and coalbed methane production. DOE/FE elected to focus the Addendum on unconventional production because such production is considered more likely than other forms of production to increase in response to LNG export demand. EIA's 2012 Study, published as part of the LNG

[200] *See*, *e.g.*, *Process Gas Consumers v. FERC*, 930 F.2d 926, 929 (D.C. Cir. 1991).
[201] Addendum at 3.
[202] *Id*. at 79-151.

Export Study, projected that more than 90 percent of the incremental natural gas produced to supply LNG exports would come from these unconventional sources.[203]

Although the 2012 EIA Study made broad projections about the types of resources from which additional production may come, the Addendum stated that DOE cannot meaningfully estimate where, when, or by what particular method additional natural gas would be produced in response to non-FTA export demand. Therefore, the Addendum focuses broadly on unconventional production in the United States as a whole, making observations about regional differences where appropriate.

The Addendum discusses several categories of environmental considerations—Water Resources, Air Quality, Greenhouse Gas, Induced Seismicity, and Land Use Impacts—each of which is summarized briefly below.

A. Water Resources

1. Water Quantity

Natural gas production from shale resources requires water at various stages of development, approximately 89 percent of which is consumed through the process of hydraulic fracturing.[204] The Addendum presents information regarding water usage for shale gas production both in comparison to other energy sources and other regional uses. Although production of natural gas from shale resources is more water-intensive than conventional natural gas production, it is substantially less water-intensive than many other energy sources over the long term after the well has been put into production. As shown in the Addendum, Table 8 below captures differences in water intensity across energy sources.

[203] *See* LNG Export Study – Related Documents, *available at* http://energy.gov/fe/services/natural-gas-regulation/lng-export-study (EIA 2012 Study) at 11 (total from shale gas, tight gas, and coalbed sources).
[204] Addendum at 10.

Table 8: Water Intensity[205]

Energy Source	Range in Water Intensity (gallons/mmBtu)
Conventional Natural Gas	~0
Shale Gas	0.6 – 1.8
Coal (no slurry transport)	2 – 8
Nuclear (uranium at plant)	8 – 14
Conventional oil	1.4 – 62
Oil Shale Petroleum (mining)	7.2 – 38
Oil Sands Petroleum (*in situ*)	9.4 – 16
Synfuel (coal gasification)	11 – 26
Coal (slurry transport)	13 – 32
Oil Sands Petroleum (mining)	14 – 33
Syn Fuel (coal Fischer-Tropsch)	41 – 60
Enhanced Oil Recovery	21 – 2,500
Fuel ethanol (irrigated corn)	2,500 – 29,000
Biodiesel (irrigated soy)	13,800 – 60,000

The Addendum also explains that, despite its relatively low long-term water intensity, shale gas production could impact water supply in specific areas, particularly arid regions such as the Eagle Ford Shale play in Texas. The Addendum notes that the relationship between shale gas production and water quantity is principally a local issue, and that the degree of impact depends on "the local climate, recent weather patterns, existing water use rates, seasonal fluctuations, and other factors."[206] The following Table 9 shows the variation in the proportion of water usage by activity in shale gas regions:

[205] *Id*. at 11 (Table 2).
[206] *Id*. at 12.

Table 9: Water Usage in Shale Gas Regions[207]

Play	Public Supply (%)	Industry & Mining (%)	Power Generation (%)	Irrigation (%)	Livestock (%)	Shale Gas (%)	Total Water Use (Bgals/yr)*
Barnett 1	82.7	4.5	3.7	6.3	2.3	0.4	133.8
Eagle Ford[2]	17	4	5	66	4	3 – 6	64.8
Fayetteville[1]	2.3	1.1	33.3	62.9	0.3	0.1	378
Haynesville[1]	45.9	27.2	13.5	8.5	4.0	0.8	90.3
Marcellus[1]	12.0	16.1	71.7	0.1	0.01	0.06	3,570
Niobrara[3]	8	4	6	82		0.01	1,280

[*Bgal/yr = billion gallons per year]

2. Water Quality

Observing that water quality concerns may have received more attention than any other aspect of unconventional natural gas production, the Addendum addresses water quality issues arising from four aspects of unconventional natural gas production: construction, drilling, use of hydraulic fracturing fluids, and handling of flowback and produced waters.

Runoff from the construction of access roads and other earth-disturbing activities can lead to temporary increases in turbidity and sedimentation in surface waters when well sites are being developed. However, the Addendum states that "when standard industry practices and preventative measures are deployed, only minor impacts are likely to result."[208]

Drilling in unconventional natural gas production requires penetrating shallower fresh water aquifers. Referring to NETL's *Modern Shale Gas Development in the United States: A Primer*, the Addendum briefly explains the manner in which such drilling can be undertaken to

[207] *Id.* at 12 (Table 3) (citations omitted).
[208] *Id.* at 13.

protect fresh water aquifers.[209] The Addendum acknowledges, however, that while unconventional natural gas formations are thousands of feet below aquifers associated with public water supply or surface hydrological connection, poor construction practices may cause failure of a casing or cement bond. This failure, in turn, could lead to potential contamination of an aquifer. The Addendum also observes that drilling may create connections with existing fractures or faults, or improperly plugged or abandoned wells, allowing contaminants to migrate through the subsurface.[210]

The fluid used for hydraulic fracturing consists of over 98 percent water, but also may include several different chemical compounds.[211] These compounds can vary from well to well based on site specific geological information. The Addendum describes federal and state efforts to gather information and require disclosure of the types of chemical additives being used in hydraulic fracturing. The risks posed by the use of these fluids may come from spills and leakages during transport to the well, storage on the well pad, or during the chemical mixing process.[212] Further, chemical additives may contaminate groundwater should the integrity of the casing or cement seal of the well be compromised.[213]

The Addendum considers the potential environmental impacts associated with produced water recovered during flowback operations. Produced water may contain elevated levels of total dissolved solids, salts, metals, organics, and natural occurring radioactive materials, as well as the chemicals included in the fracturing fluid noted above. The Addendum discusses the three

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[209] Addendum at 13-14 (citing GWPC and ALL Consulting. 2009. *Modern Shale Gas Develop. In the United States: A Primer.* Nat'l Energy Tech. Lab.; *available at*: http://www.netl.doe.gov/File%20Library/Research/Oil-Gas/Shale_Gas_Primer_2009.pdf).
[210] *Id.* at 14.
[211] *Id.* at 14-15.
[212] *Id.* at 18.
[213] *Id.*

principal ways of mitigating the impacts associated with produced water: minimization of the quantity of water used, recycling and re-use of produced water, and disposal.

Concluding its discussion of water resources, the Addendum observes that "[u]nconventional natural gas production, when conforming to regulatory requirements, implementing best management practices, and administering pollution prevention concepts, may have temporary, minor impacts to water resources."[214] Further, risks may arise when best practices are not employed: "[I]mproper techniques, irresponsible management, inadequately trained staff, or site-specific events outside of an operator's control could lead to significant impacts on local water resources."[215]

B. Air Quality

The Addendum discusses air pollutants emitted at different stages of the natural gas production process. These emissions and their sources are captured in Table 10 below:

[214] Addendum at 19.
[215] *Id.* at 19.

Table 10: Source Categories of Airborne Emissions from Upstream Natural Gas Activities (EPA, 2013)[216]

Category	Type of Emissions	Sources of Emissions
Combustion Emissions	NO_x and carbon monoxide (CO) resulting from the burning of hydrocarbon (fossil) fuels. Air toxics, PM, un-combusted VOCs, and CH_4 are also emitted.	Engines, heaters, flares, incinerators, and turbines.
Vented Emissions	VOCs, air toxics, and CH_4 resulting from direct releases to the atmosphere.	Pneumatic devices, dehydration processes, gas sweetening processes, chemical injection pumps, compressors, tanks, well testing, completions, and workovers.
Fugitive Emissions	VOCs, air toxics, and CH_4 resulting from uncontrolled and under-controlled emissions.	Equipment leaks through valves, connectors, flanges, compressor seals, and related equipment and evaporative sources including wastewater treatment, pits, and impoundments.

The Addendum describes the existing regulatory framework relating to such emissions, as well as the U.S. Environmental Protection Agency's (EPA) 2012 New Sources Performances Standards for hydraulically fractured natural gas wells[217] and EPA's 2013 update to those standards covering storage tanks.[218] The Addendum also summarizes the existing literature on each significant category of air pollutant and describes the potential contribution of oil and gas production activities to ground-level ozone pollution and reduced visibility in sensitive areas.

The Addendum concludes its discussion of air quality by stating that natural gas development leads to both short- and long-term increases in local and regional air emissions, especially methane, VOCs, and HAPs. According to the Addendum, the intermittent nature of air

[216] *Id*. at 23 (Table 6).
[217] *Id*. at 20-22.
[218] *Id*. at 22.

emissions from sources such as wells makes it difficult to analyze impacts at the regional level. As more data become available, a better understanding of trends in local and regional air quality and potential impacts may emerge.[219]

C. GHG Emissions

Separate from the LCA GHG Report described below in Section IX, the Addendum includes a discussion of GHG emissions associated with unconventional natural gas production—principally methane and carbon dioxide. The Addendum describes the nature of GHG emissions from each phase of the production process, including: well drilling and completion; gas production; well re-completions, workovers, and maintenance; gas processing; and gas transmission and storage.

The Addendum also summarizes regulations affecting GHG emissions from upstream natural gas activity. As in the air quality section, the Addendum discusses EPA's 2012 New Source Performance Standards regulations. The Addendum also describes EPA's publication in April 2014 of five technical white papers on potentially significant sources of emissions in the oil and gas sector, including completions and ongoing production of hydraulically fractured oil wells, compressors, pneumatic valves, liquids unloading, and leaks.[220] EPA stated that it will use these white papers, along with input from peer reviewers and the public to determine how best to pursue emissions reductions from these sources, possibly including the development of additional regulations.[221]

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[219] *Id*. at 32.
[220] Addendum at 22 (*citing* U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *White Papers on Methane and VOC Emissions*, *available at*: http://www.epa.gov/airquality/oilandgas/whitepapers.html) (released April 15, 2014).
[221] *Id*. at 44.

Finally, the Addendum summarizes the existing literature estimating GHG emissions and methane leakage rates from the upstream natural gas industry, noting that most studies suggest that "emissions of GHGs from the upstream industry are of similar magnitude for both conventional and unconventional sources."[222]

D. Induced Seismicity

The Addendum provides information on induced seismicity across various types of energy resource activities, namely the production of natural gas, gas condensates, and oil from currently targeted unconventional plays. More specifically, it provides greater detail about the potential for induced seismicity from hydraulic fracturing and wastewater disposal via injection, which is one method of disposing of produced water. Because the duration of injection of hydraulic fracturing fluids is generally minutes or hours and the quantity of injected fluid is relatively low, the Addendum states that "the probability of injecting enough fluid into a natural fault to trigger a felt earthquake is relatively low."[223] By contrast, the Addendum states that the "incidence of felt earthquakes is higher for wastewater disposal via wastewater injection wells because a large volume of water is injected over a longer period of time without any withdrawal of fluids, with the result that fluid pressures can be increased within a large area surrounding the injection well."[224] The Addendum identifies seismic events thought to have been triggered by wastewater disposal into injection wells in Oklahoma, Colorado, Arkansas, and Ohio.

Addressing the severity of seismic events induced by natural gas activities, the Addendum cites a 2013 National Research Council report characterizing the risk of induced seismicity as

[222] *Id.* at 40.
[223] *Id.* at 51.
[224] *Id*. at 52.

principally one of alarm to the public and minor property damage, as opposed to significant disruption.[225]

E. Land Use

The Addendum addresses potential land use impacts resulting from unconventional natural gas production. Land use impacts arise from the construction and development of new access roads, heavy truck traffic on existing local roadways, well pads, pipeline rights of way, and other structures such as compressor stations. The Addendum includes discussions of increased vehicle traffic, habitat fragmentation, reflective light pollution, noise, and other impacts associated with these land use changes. According to the Addendum, "[t]he real issue with land use impacts is not the minor impacts related to each well pad, access road, or pipeline."[226] Rather, "[w]hen the impacts from these individual components of shale gas development are considered in aggregate, or cumulatively, the impacts become magnified on an ecosystem or regional scale."[227] The Addendum identifies siting and design considerations that may minimize land use impacts, as well as traffic and road way impacts associated with large vehicles and concerns for vehicular safety for the motoring public.

XI. DOE/FE *LIFE CYCLE GREENHOUSE GAS PERSPECTIVE ON EXPORTING LIQUEFIED NATURAL GAS FROM THE UNITED STATES*

A. Description of LCA GHG Report

In January 2014, DOE/FE commissioned NETL to undertake a study analyzing the life cycle emissions of greenhouse gases (GHG), including carbon dioxide (CO_2) and methane (CH_4), associated with natural gas produced in the United States and exported as LNG to other countries

[225] *Id* at 55-56 (citing *Induced Seismicity Potential in Energy Technologies*. National Research Council. The National Academies Press, Washington, D.C. (2013) at 5).
[226] Addendum at 62.
[227] *Id*.

for use in electric power generation. The study was intended to inform DOE/FE's decision-making under NGA section 3(a) and to provide additional information to the public. The study—entitled *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (LCA GHG Report)—estimated the life cycle GHG emissions of domestically produced LNG (also referred to as U.S. LNG) exports to Europe and Asia, compared with alternative fuel supplies (such as regional coal and other imported natural gas), for electric power generation in the destination countries.

NETL published the LCA GHG Report on May 29, 2014, as well as a 200-page supporting document entitled, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.[228] On June 4, 2014, DOE/FE provided notice of the documents in the *Federal Register* and invited public comment.[229] The 45-day public comment period closed July 21, 2014. In this section, we summarize the scope of the LCA GHG Report, as well as its methods, limitations, and conclusions. Below, we summarize the public comments on the Report and respond to those comments. *See infra* § IX.B.

1. Purpose of the LCA GHG Report

The LCA GHG Report was designed to answer two principal questions:

- How does LNG exported from the United States compare with regional coal (or other LNG sources) used for electric power generation in Europe and Asia, from a life cycle GHG perspective?

[228] *See* Dep't of Energy, Nat'l Energy Tech. Lab., *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States* (May 29, 2014), *available at:* http://energy.gov/fe/life-cycle-greenhouse-gas-perspective-exporting-liquefied-natural-gas-united-states; *see also* Dep't of Energy, Nat'l Energy Tech. Lab., *Life Cycle Analysis of Natural Gas Extraction and Power Generation* (May 29, 2014), *available at:* http://energy.gov/fe/LCA-GHG-Report (link to "NETL Natural Gas LCA Model and Analysis") [hereinafter NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*].

[229] Dep't of Energy, Notice of Availability of Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States and Request for Comment, 79 Fed. Reg. 32,260 (June 4, 2014). The NETL documents and all comments received were placed in the administrative record for each of the 25 non-FTA export application dockets then before DOE/FE, including this docket. *See id*.

- How do those results compare with natural gas sourced from Russia and delivered to the same European and Asian markets via pipeline?

In establishing this framework, NETL considered the following:

- In what countries will the natural gas produced in the United States and exported as LNG be used?
- How will the U.S. LNG be used in those countries, *i.e.*, for what purpose?
- What are the alternatives to using U.S. LNG for electric power generation in those countries?

Because the exact destination country (or countries) of U.S. LNG cannot be predicted for this study, NETL considered one medium-distance destination (a location in Europe) and one long-distance destination (a location in Asia). NETL chose Rotterdam, Netherlands, as the European destination and power plant location, and Shanghai, China, as the Asian location. NETL used other locations for the alternative sources of natural gas and coal, as specified in the Report. NETL also determined that one of the most likely uses of U.S. LNG is to generate electric power in the destination countries. In considering sources of fuel other than U.S. LNG, NETL assumed that producers in Europe and Asia could generate electricity in the following ways: (1) by obtaining natural gas from a local or regional pipeline, (2) by obtaining LNG from a LNG producer located closer geographically than the United States, or (3) by using regional coal supplies, foregoing natural gas altogether.

Using this framework, NETL developed four study scenarios, identified below. To compare scenarios, NETL used a common denominator as the end result for each scenario: one megawatt-hour (MWh) of electricity delivered to the consumer, representing the final consumption of electricity. Additionally, NETL considered GHG emissions from all processes in the LNG supply chains—from the "cradle" when natural gas or coal is extracted from the

ground, to the "grave" when electricity is used by the consumer. This method of accounting for cradle-to-grave emissions over a single common denominator is known as a life cycle analysis, or LCA.[230]

Using this LCA approach, NETL's objective was to model realistic LNG export scenarios, encompassing locations at both a medium and long distance from the United States, while also considering local fuel alternatives. The purpose of the medium and long distance scenarios was to establish likely results for both extremes (*i.e.*, both low and high bounds).

2. Study Scenarios

NETL identified four modeling scenarios to capture the cradle-to-grave process for both the European and Asian cases. The scenarios vary based on where the fuel (natural gas or coal) comes from and how it is transported to the power plant. For this reason, the beginning "cradle" of each scenario varies, whereas the end, or "grave," of each scenario is the same because the uniform goal is to produce 1 MWh of electricity. The first three scenarios explore different ways to transport natural gas; the fourth provides an example of how regional coal may be used to generate electricity, as summarized in Table 11 below:

[230] The data used in the LCA GHG Report were originally developed to represent U.S. energy systems. To apply the data to this study, NETL adapted its natural gas and coal LCA models. The five life cycle stages used by NETL, ranging from Raw Material Acquisition to End Use, are identified in the LCA GHG Report at 1-2.

Table 11: LCA GHG Scenarios Analyzed by NETL[231]

Scenario	Description	Key Assumptions
1	• Natural gas is extracted in the United States from the Marcellus Shale. • It is transported by pipeline to an LNG facility, where it is cooled to liquid form, loaded onto an LNG tanker, and transported to an LNG port in the receiving country (Rotterdam, Netherlands, for the European case and Shanghai, China, for the Asian case). • Upon reaching its destination, the LNG is re-gasified, then transported to a natural gas power plant.	The power plant is located near the LNG import site.
2	• Same as Scenario 1, except that the natural gas comes from a regional source closer to the destination. • In the European case, the regional source is Oran, Algeria, with a destination of Rotterdam. • In the Asian case, the regional source is Darwin, Australia, with a destination of Osaka, Japan.	Unlike Scenario 1, the regional gas is produced using conventional extraction methods, such as vertical wells that do not use hydraulic fracturing. The LNG tanker transport distance is adjusted accordingly.
3	• Natural gas is produced in the Yamal region of Siberia, Russia, using conventional extraction methods.[232] • It is transported by pipeline directly to a natural gas power plant in either Europe or Asia.	The pipeline distance was calculated based on a "great circle distance" (the shortest possible distance between two points on a sphere) between the Yamal district in Siberia and a power plant located in either Rotterdam or Shanghai.
4	• Coal is extracted in either Europe or Asia. It is transported by rail to a domestic coal-fired power plant.	This scenario models two types of coal widely used to generate steam-electric power: surface mined sub-bituminous coal and underground mined bituminous

[231] The four scenarios are set forth in the LCA GHG Report at 2.
[232] Yamal, Siberia, was chosen as the extraction site because that region accounted for 82.6% of natural gas production in Russia in 2012.

		coal. Additionally, U.S. mining data and U.S. plant operations were used as a proxy for foreign data.

In all four scenarios, the 1 MWh of electricity delivered to the end consumer is assumed to be distributed using existing transmission infrastructure.

3. GHGs Reported as Carbon Dioxide Equivalents

Recognizing that there are several types of GHGs, each having a different potential impact on the climate, NETL normalized GHGs for the study. NETL chose carbon dioxide equivalents (CO_2e), which convert GHG gases to the same basis: an equivalent mass of CO_2. CO_2e is a metric commonly used to estimate the amount of global warming that GHGs may cause, relative to the same mass of CO_2 released to the atmosphere. NETL chose CO_2e using the global warming potential (GWP) of each gas from the 2013 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2013). The LCA GHG Report applied the respective GWPs to a 100-year and a 20-year time frame.

4. Natural Gas Modeling Approach

NETL states that its natural gas model is flexible, allowing for the modeling of different methods of producing natural gas. For Scenario 1, all natural gas was modeled as unconventional gas from the Marcellus Shale, since that shale play reasonably represents new marginal gas production in the United States. For Scenarios 2 and 3, the extraction process was modeled after conventional onshore natural gas production in the United States. This includes both the regional LNG supply options that were chosen for this study (Algeria for Europe and Australia for Asia) and extraction in Yamal, Siberia, for pipeline transport to the power plants in Europe and Asia.

In the above three natural gas scenarios, the natural gas is transported through a pipeline, either to an area that processes LNG (Scenarios 1 and 2) or directly to a power plant (Scenario 3). NETL's model also includes an option for all LNG steps—from extraction to consumption—known as an LNG supply chain. After extraction and processing, natural gas is transported through a pipeline to a liquefaction facility. The LNG is loaded onto an ocean tanker, transported to an LNG terminal, re-gasified, and fed to a pipeline that transports it to a power plant. NETL assumed that the natural gas power plant in each of the import destinations already exists and is located close to the LNG port.

The amount of natural gas ultimately used to make electricity is affected by power plant efficiency. Therefore, the efficiency of the destination power plant is an important parameter required for determining the life cycle emissions for natural gas power. The less efficient a power plant, the more gas it consumes and the more GHG emissions it produces per unit of electricity generated. For this study, NETL used a range of efficiencies that is consistent with NETL's modeling of natural gas power in the United States.[233] NETL also assumed that the efficiencies used at the destination power plants (in Rotterdam and Shanghai) were the same as those used in the U.S. model.

5. Coal Modeling Approach

NETL modeled Scenario 4, the regional coal scenario, based on two types of coal: bituminous and sub-bituminous. Bituminous coal is a soft coal known for its bright bands. Sub-bituminous coal is a form of bituminous coal with a lower heating value. Both types are widely used as fuel to generate steam-electric power. NETL used its existing LCA model for the

[233] *See* LCA GHG Report at 3 (*citing* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Gener*ation).

extraction and transport of sub-bituminous and bituminous coal in the United States as a proxy for foreign extraction in Germany and China. Likewise, NETL modeled foreign coal production as having emissions characteristics equivalent to average U.S. coal production. No ocean transport of coal was included to represent the most conservative coal profile (whether regionally sourced or imported).

The heating value of coal is the amount of energy released when coal is combusted, whereas the heat rate is the rate at which coal is converted to electricity by a power plant. Both factors were used in the model to determine the feed rate of coal to the destination power plant (or the speed at which the coal would be used). For consistency, this study used the range of efficiencies that NETL modeled for coal power in the United States. The study also assumed the same range of power plant efficiencies for Europe and Asia as the U.S. model.

6. Key Modeling Parameters

NETL modeled variability among each scenario by adjusting numerous parameters, giving rise to hundreds of variables. Key modeling parameters described in the LCA GHG Report include: (1) the method of extraction for natural gas in the United States, (2) methane leakage for natural gas production,[234] (3) coal type (sub-bituminous or bituminous),[235] (4) the flaring rate for natural gas,[236] (5) transport distance (ocean tanker for LNG transport, and rail for coal transport),[237] and (6) the efficiency of the destination power plant.

[234] The key modeling parameters for the natural gas scenarios are provided in Table 5-1 (LNG) and Table 5-2 (Russian natural gas). *See* LCA GHG Report at 6. The key parameters for natural gas extraction, natural gas processing, and natural gas transmission by pipeline are set forth in Tables 5-4, 5-5, and 5-6, respectively. *See id*. at 7-8.
[235] The modeling parameters and values for the coal scenarios are provided in Table 5-3. *See* LCA GHG Report at 6.
[236] Flaring rate is a modeling parameter because the global warming potential of vented natural gas, composed mostly of methane, can be reduced if it is flared, or burned, to create CO_2. *See id*. at 7.
[237] The distances used for pipeline transport of Russian gas are provided in Table 5-2. *See id*. at 6.

For example, as shown in Table 5-1 of the LCA GHG Report, NETL used two different ranges for methane leakage rates for Scenarios 1 and 2: from 1.2 to 1.6% for natural gas extracted from the Marcellus Shale, and from 1.1 to 1.6% from gas extracted using conventional extraction methods. For Scenario 3 (the Russian cases), however, NETL used a higher range for methane leakage rates for both the European and Asian locations, in light of the greater pipeline distance from Russia.[238] As the pipeline distance increases, the total methane leakage from pipeline transmission also increases, as does the amount of natural gas that is extracted to meet the same demand for delivered natural gas. Notably, as part of the study, NETL conducted a methane leakage breakeven analysis to determine the "breakeven leakage" at which the life cycle GHG emissions for natural gas generated power would equal those for the coal reference case (Scenario 3).[239]

In sum, NETL noted that the LCA study results are sensitive to these key modeling parameters, particularly changes to natural gas and coal extraction characteristics, transport distances, and power plant performance.[240] NETL also identified several study limitations based on the modeling parameters, including: (1) NETL's LCA models are U.S.-based models adapted for foreign natural gas and coal production and power generation, and (2) the specific LNG export and import locations used in the study represent an estimate for an entire region (*e.g.*, New Orleans representing the U.S. Gulf Coast).[241]

[238] *See* LCA GHG Report at 5.
[239] The methane leakage breakeven analysis is described in the LCA GHG Report at 14 and 15.
[240] *See* LCA GHG Report at 5. To ensure that the study results were robust, NETL conducted several side analyses and sensitivity calculations, as discussed in the LCA GHG Report.
[241] The study limitations are described in the LCA GHG Report at 18.

7. Results of the LCA GHG Report

NETL states that two primary conclusions may be drawn from the LCA GHG Report.[242] First, use of U.S. LNG exports to produce electricity in European and Asian markets will *not* increase GHG emissions on a life cycle perspective, when compared to regional coal extraction and consumption for power production. As shown below in Figures 1 and 2, NETL's analysis indicates that, for most scenarios in both the European and Asian regions, the generation of power from imported natural gas has lower life cycle GHG emissions than power generation from regional coal.[243] (The use of imported coal in these countries will only increase coal's GHG profile.) Given the uncertainty in the underlying model data, however, NETL states that it is not clear if there are significant differences between the corresponding European and Asian cases other than the LNG transport distance from the United States and the pipeline distance from Russia.

[242] NETL's detailed study results, with corresponding figures, are set forth on pages 8 through 18 of the LCA GHG Report.

[243] Although these figures present an expected value for each of the four scenarios, NETL states that the figures should not be interpreted as the most likely values due to scenario variability and data uncertainty. Rather, the values allow an evaluation of trends only—specifically, how each of the major processes (*e.g.*, extraction, transport, combustion) contribute to the total life cycle GHG emissions. *See* LCA GHG Report at 8-9.

Figure 1: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[244]

[244] LCA GHG Report at 9 (Figure 6-1).

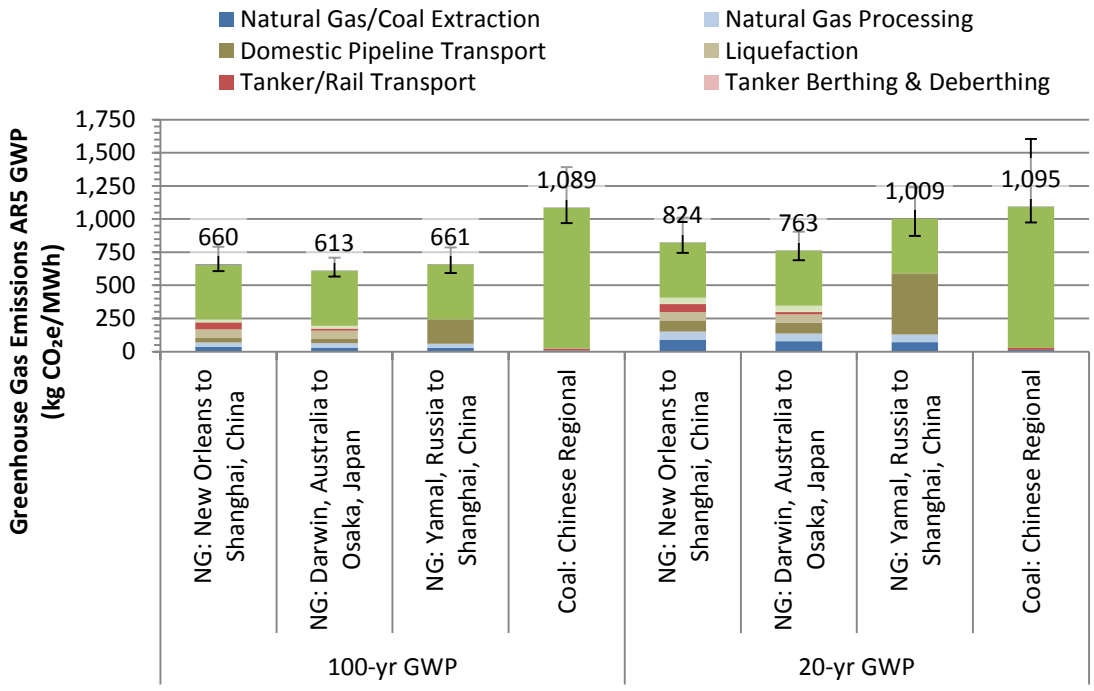

Figure 2: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[245]

Second, there is an overlap between the ranges in the life cycle GHG emissions of U.S. LNG, regional alternative sources of LNG, and natural gas from Russia delivered to the European or Asian markets. Any differences are considered indeterminate due to the underlying uncertainty in the modeling data. Therefore, the life cycle GHG emissions among these sources of natural gas are considered similar, and no significant increase or decrease in net climate impact is anticipated from any of these three scenarios.

B. Comments on the LCA GHG Report and DOE/FE Analysis

As discussed above, the LCA GHG Report compares life cycle GHG emissions from U.S. LNG exports to regional coal and other imported natural gas for electric power generation in Europe and Asia. Following the close of the public comment period on the LCA GHG

[245] LCA GHG Report at 10 (Figure 6-2).

Report, DOE/FE identified 18 unique submissions received from the general public, interest groups, industry, and academia/research institutions, which DOE/FE categorized into seven distinct comments.[246]

DOE/FE identifies below: (i) the pertinent arguments by topic, with reference to representative comments, and (ii) DOE/FE's basis for the conclusions that it drew in reviewing those comments. In so doing, DOE/FE will respond to the relevant, significant issues raised by the commenters.

1. Study Conclusions

a. Comments

Several commenters, including Citizens Against LNG and Oregon Wild, claim that the life cycle GHG emissions from natural gas are higher than those from coal.

b. DOE/FE Analysis

These comments assert that natural gas has higher GHGs than coal, but they do not cite data sources applicable to the comparison of U.S.-exported LNG to regional coal, nor do they acknowledge that the different end uses of coal and natural gas (i.e., heating, power, or transportation) affect their relative life cycle GHG performance. If the characteristics of each fuel (most critically, the carbon content per unit of the fuel's energy) and power plant efficiencies are considered, the lower per-MWh CO_2 emissions from natural gas power plants in comparison to coal power plants make natural gas lower than coal in the context of power plant operations by 61% (see Table 12 below, [(415 – 1,063)/1,063 x 100]). The life cycle of baseload

[246] In some instances, single letters were sent on behalf of a group of people. In one case, multiple copies of a form letter were received from 149 individuals, hereinafter referred to as "Concerned Citizens." Most of the individuals in the Concerned Citizens group live in New York, but other states and countries are also represented.

electricity generation is a reasonable basis for comparing natural gas and coal because both types of fuels are currently used on a large scale by baseload power plants.

Table 12 shows the life cycle GHG emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and sulfur hexafluoride (SF_6) from natural gas and coal systems and demonstrates the importance of power plant operations to total life cycle GHG emissions over 100- and 20-year GWP timeframes. This table is representative of European end-use scenarios, which consume natural gas exported from the United States and coal extracted in Europe. (This table is based on the same data as used by Figure 6-1 of the LCA GHG Report.)

Table 12: Life Cycle GHG Emissions from Natural Gas and Coal Systems (kg CO_2e/MWh)

Life Cycle Process	100-yr GWP		20-yr GWP	
	Natural Gas: New Orleans to Rotterdam, Netherlands	**Coal: European Regional**	**Natural Gas: New Orleans to Rotterdam, Netherland**	**Coal: European Regional**
Natural Gas/Coal Extraction	33.9	7.8	88.7	13.6
Natural Gas Processing	34.5	-	60.4	-
Domestic Pipeline Transport	32.3	-	81.4	-
Liquefaction	63.6	-	63.6	-
Tanker/Rail Transport	25.0	14.4	28.4	15.3
Tanker Berthing & Deberthing	1.5	-	1.6	-
LNG Regasification	20.0	-	45.3	-
Power Plant Operations	415	1,063	415	1,064
Electricity T&D	3.4	3.4	2.5	2.5
Total	**629**	**1,089**	**787**	**1,095**

2. Boundaries of the LCA GHG Report

a. Comments

Sierra Club,[247] Food & Water Watch,[248] Americans Against Fracking *et al*., Susan Sakmar, and Concerned Citizens, among others, contend that the LCA GHG Report has flawed boundaries and scenarios. In particular, these commenters contend that the LCA GHG Report assumes that LNG will displace coal power without also accounting for the displacement of renewable energy.

b. DOE/FE Analysis

The boundaries of the LCA were developed with respect to questions about two fossil fuels, coal and natural gas, and where they come from. The scenarios in the LCA do not model displacement of any kind. These two scenarios are purely attributional, meaning that they focus on independent supply chains for each scenario and do not account for supply or demand shifts caused by the use of one fuel instead of another fuel.

3. Natural Gas Transport between Regasification and Power Plants

a. Comments

Sierra Club and Concerned Citizens, among others, assert that the LCA GHG Report does not account for natural gas transport between LNG regasification facilities and power plants in the importing countries.

[247] Sierra Club submitted comments on behalf of its members and supporters as well as Cascadia Wildlands, Otsego 2000, Inc., Columbia Riverkeeper, Stewards of the Lower Susquehanna, Inc., Friends of the Earth, Chesapeake Climate Action Network, Food and Water Watch, and EarthJustice.

[248] Food & Water Watch submitted comments in the form of a letter signed by 85 individuals representing various national, state, and local public interest groups.

b. DOE/FE Analysis

The choice to exclude transportation between regasification and the power plant was a modeling simplification. The sensitivity analysis of GHG emissions with changes to pipeline transport distance, as illustrated by Figures 4-7 and 4-8 of NETL's *Life Cycle Analysis of Natural Gas Extraction and Power Generation*, shows that the *doubling* (i.e., a 100% increase) of natural gas pipeline transport distance increases the *upstream* GHG emissions from natural gas by 30%. When this upstream sensitivity is applied to the life cycle boundary of the LCA GHG Report, an additional 100 miles beyond the LNG import terminal increases the life cycle GHG emissions for the LNG export scenarios by 0.8%, and an additional 500 miles beyond the LNG import terminal increases the life cycle GHG emissions for the LNG export scenarios by 4% (using 100-year GWPs as specified by the IPCC Fifth Assessment Report). Although this parameter modification changes the results of the LCA slightly, it does not change the conclusions of the LCA GHG Report.

4. Data Quality for LNG Infrastructure, Natural Gas Extraction, and Coal Mining

a. Comments

Several commenters, including the American Petroleum Institute (API), Concerned Citizens, and Sierra Club, commented on whether the data used in the LCA GHG Report is current and fully representative of the natural gas industry. In particular, API asserts that NETL's model is representative of inefficient liquefaction technologies that overstate the GHG emissions from the LNG supply chain, coal data that understates the methane emissions from

coal mines, and natural gas extraction data that mischaracterizes "liquids unloading" practices.[249] API proposes the use of newer data for both liquefaction terminals in the United States and methane emission factors from unconventional natural gas extraction and coal mining. Concerned Citizens argue that the LCA GHG Report does not clearly identify its source of data for estimates of loss related to LNG production, shipping, and regasification, as well as the basis for estimates of pipeline losses from Russia. Sierra Club points to inaccurate referencing of EPA's Subpart W report, which was the basis for many of NETL's emission factors for natural gas extraction.

b. DOE/FE Analysis

(1) Liquefaction Data

API points to newer data for liquefaction facilities that have higher efficiencies than the liquefaction process in the LCA GHG Report. API points to the GHG intensities of the liquefaction facilities proposed by Sabine Pass, Cameron LNG, and FLEX, each of which has been granted one or more non-FTA LNG export orders by DOE/FE (*see infra* § XII.D). According to API, these proposed facilities will produce 0.26, 0.29, and 0.12 tonnes of CO_2e per tonne of LNG, respectively. The majority of a liquefaction facility's energy is generated by combusting incoming natural gas, so the GHG intensity of a liquefaction facility is directly related to its efficiency. As API correctly points out, the LCA model assumes a GHG intensity

[249] For purposes of this term, we refer to EPA's description of "liquids unloading" as follows: "In new gas wells, there is generally sufficient reservoir pressure to facilitate the flow of water and hydrocarbon liquids to the surface along with produced gas. In mature gas wells, the accumulation of liquids in the well can occur when the bottom well pressure approaches reservoir shut-in pressure. This accumulation of liquids can impede and sometimes halt gas production. When the accumulation of liquid results in the slowing or cessation of gas production (i.e., liquids loading), removal of fluids (i.e., liquids unloading) is required in order to maintain production. Emissions to the atmosphere during liquids unloading events are a potentially significant source of VOC and methane emissions." U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *Oil & Natural Gas Sector Liquids Unloading Processes,* Report for Oil & Gas Sector Liquids Unloading Processes Review Panel, at 2 (April 2014), *available at*: http://www.epa.gov/airquality/oilandgas/pdfs/20140415liquids.pdf.

of 0.44 tonnes of CO_2e per tonne of LNG; this GHG intensity is representative of a facility that consumes 12% of incoming natural gas as plant fuel.[250]

The above GHG intensities and liquefaction efficiencies are not life cycle numbers, but represent only the gate-to-gate operations of liquefaction facilities, beginning with the receipt of processed natural gas from a transmission pipeline and ending with liquefied natural gas ready for ocean transport. As illustrated by Figures 6-1 and 6-2 in the LCA GHG Report (reproduced as tables herein), liquefaction accounts for approximately 10% of the life cycle GHG emissions of U.S. LNG used for electric power generation in Europe and Asia. A doubling of liquefaction efficiency (thus achieving a GHG intensity comparable to the average of the Sabine Pass, Cameron, and Freeport facilities) would lead to a 6% reduction in the feed rate of natural gas to the liquefaction plant.[251] This feed rate reduction would also reduce natural gas extraction, processing, and transmission emissions by 6%, but would not affect the processes downstream from liquefaction (ocean tankers, power plants, and electricity transmission networks). Applying the increased liquefaction efficiency and the 6% reduction in feed rate to the results of the LCA GHG Report would reduce the life cycle GHG emissions for LNG export scenarios by only 1.5% (using 100-year GWPs as stated in the IPCC Fifth Assessment Report). Increasing liquefaction efficiency may significantly reduce the emissions from one point in the supply chain, but it does not change the conclusions of the LCA.

[250] NETL (2010). NETL Life Cycle Inventory Data – Unit Process: LNG Liquefaction, Operation. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: May 2010 (version 01); *available at*: http://www.netl.doe.gov/File Library/Research/Energy Analysis/Life Cycle Analysis/UP_Library/DS_Stage1_O_LNG_Liquefaction_2010-01.xls.
[251] *See id*.

(2) Natural Gas Methane Data

API and Concerned Citizens criticize the quality of data that DOE/NETL uses for natural gas extraction. API's concern is that NETL overstates the GHG emissions from unconventional well completion. API compares NETL's emission factor for unconventional well completions (9,000 Mcf of natural gas/episode) to the emission factor that EPA states in its 2014 GHG inventory (approximately 2,500 Mcf of natural gas/episode). EPA revised its unconventional completion emission factor between its 2013 and 2014 inventory reports,[252] after NETL's model had been finalized and during the time that NETL was completing the LCA GHG Report. These factors are referred to as "potential emission factors" because they do not represent natural gas that is directly released to the atmosphere, but they represent the volume of natural gas that can be sent to flares and other environmental control equipment. NETL uses a potential emission factor of 9,000 Mcf of natural gas per each episode of shale gas hydraulic fracturing, and a potential emission factor of 3.6 Mcf of natural gas per each episode of liquids unloading (with 31 liquids unloading episodes per well-year). NETL's model augments potential emission factors with flaring, thereby reducing the amount of methane that is released to the atmosphere. These emission factors are consistent with the findings of a survey jointly conducted by API and America's Natural Gas Alliance and released in September 2012.[253] They also match the factors used by EPA's 2013 GHG inventory.[254]

NETL's current model accounts for liquids unloading emissions from conventional wells, but does not account for liquids unloading from unconventional wells. Applying liquids

[252] U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012, *available at*: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Main-Text.pdf.
[253] *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*. Final Report (Sept. 21, 2012).
[254] U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 (Apr. 12, 2013).

unloading to the unconventional wells in this analysis increases the life cycle GHGs by 0.6% for LNG export scenarios (using 100-year GWPs as stated in the IPCC Fifth Assessment Report). This 0.6% was estimated by assigning the liquid unloading emissions from onshore conventional natural gas to the upstream results for Marcellus Shale natural gas, followed by an expansion of the boundaries to a life cycle context. Simply put, liquids unloading accounts for 11% of the upstream GHG emissions from conventional onshore natural gas.[255] When liquids unloading is added to unconventional natural gas in the LCA model, it is scaled according to the unique production rates and flaring practices of unconventional wells in addition to the subsequent flows of natural gas processing, liquefaction, ocean transport, regasification, power plant operations, and electricity transmission. Thus, while liquids unloading may account for a significant share of *upstream* GHG emissions, none of the LCA GHG Report's conclusions would change with the addition of liquids unloading to unconventional natural gas extraction.

The potential emissions from unconventional well completions are modeled as 9,000 Mcf of natural gas per episode. It is important to remember that this factor does not represent methane emissions directly released to the atmosphere, but the flow of natural gas prior to environmental controls. For unconventional natural gas, NETL's model flares 15% of these potential emissions (flaring converts methane to CO_2, thus reducing the GWP of the gas) and apportions all completion emissions to a unit of natural gas by dividing them by lifetime well production (completion emissions occur as one-time episode that must be converted to a life cycle basis by amortizing them over total lifetime production of a well). Further, the life cycle GHG contributions from well completions are diluted when scaled to the subsequent flows of

[255] *See* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.

natural gas processing, liquefaction, ocean transport, regasification, power plant operations, and electricity transmission. However, in NETL's model, life cycle completion emissions are directly affected by the estimated ultimate recovery (EUR) of a well because the total amount of natural gas produced by a well is used as a basis for apportioning completion and other one-time emissions to a unit of natural gas produced. From an engineering perspective, wells with high EURs are more likely to have a high initial reservoir pressure that increases the potential completion emissions. A reasonable uncertainty range around the potential emissions from unconventional completion emissions (9,000 Mcf/episode) is -30% to +50% (6,100 to 13,600 Mcf/episode). This uncertainty range matches the scale of uncertainty around the Marcellus Shale EUR used in the LCA GHG Report (see Table 5-4 of the LCA GHG Report). This -30% to +50% uncertainty around potential emissions from unconventional completions causes a -2% to 3% uncertainty around life cycle GHG emissions for the export scenarios of this analysis.

The recently revised New Source Performance Standards (NSPS) rules for the oil and natural gas sector, which will be in full effect by January 2015, will achieve significant methane emission reductions primarily by requiring all new or modified wells to capture and control potential emissions of VOCs during natural gas well completion. In addition to well completion emissions, the NSPS rules target other point sources of VOC emissions from new and modified sources at natural gas extraction and processing sites, but they do not address liquids unloading.[256] The LCA GHG Report does not account for the potential effects of the NSPS rules on natural gas emissions because the scope of the LCA accounts for GHG emissions from natural gas being produced today. EPA's Regulatory Impact Analysis estimated that the final

[256] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews (40 C.F.R. Part 63) (Apr. 17, 2012); *available at:* http://www.epa.gov/airquality/oilandgas/pdfs/20120417finalrule.pdf.

NSPS rule would reduce annual methane emissions in 2015 by 18 million metric tons, meaning that this rule will have the effect of reducing life cycle emissions from natural gas systems as new wells are developed and existing wells are modified. The likely effects of the NSPS rule therefore suggest that the conclusions of the LCA GHG Report are conservative with respect to the life cycle GHG emissions of natural gas produced in the United States.

Sierra Club contends that NETL's documentation, including the 200-page supporting LCA document, does not clearly cite EPA's Subpart W document. NETL's Report has three references to Subpart W, cited as EPA 2011a, 2011b, and 2011c. These three references should refer to the same document.[257] Future versions of the Report will correct these duplicate citations. Sierra Club also calls out the citation for EPA, 2012c, although this is a correct reference that points to EPA's documentation of New Source Performance Standards.

(3) Coal Methane Data

API and Concerned Citizens criticize the quality of data that DOE/NETL uses for coal extraction. In particular, API claims that coal mine methane emissions may be higher than the factors used by NETL. Concerned Citizens simply claim that NETL used a limited set of references to characterize coal mine emissions.

Methane emissions from coal mines are based on data collected by EPA's Coalbed Methane Outreach Program and have been organized by coal type and geography. Due to data limitations, the LCA GHG Report used this data as a proxy for emissions from foreign coal. This limitation is noted in the LCA GHG Report and is accounted for by uncertainty.[258] The

[257] U.S. Envtl. Prot. Agency, Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document (2011), *available at:* http://www.epa.gov/ghgreporting/documents/pdf/2010/Subpart-W_TSD.pdf.
[258] *See, e.g.*, NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation.*

bounds on coal methane uncertainty were informed by the variability in coal mine methane emissions between surface mines (subbituminous coal) and underground mines (bituminous coal) in the United States. The default parameters in NETL's model represent subbituminous coal, which has lower coal mine methane emissions than bituminous coal (these parameters are specified in Table 5-3 of the LCA GHG Report). If coal mines in Europe and Asia emit methane at rates similar to the underground, bituminous coal mines in the United States, then the life cycle GHG emissions from coal power would increase. This increase in coal mine methane emissions would increase the life cycle GHG emissions of coal power by 8 percent (from 1,089 to 1,180 kg CO_2e/MWh, using 100-year GWPs as stated in the IPCC Fifth Assessment Report). This uncertainty is illustrated by Figure 6-16 in the LCA GHG Report. Again, even though changes to coal mine methane emissions change the GHG results of the LCA, they do not change the conclusions of the LCA.

5. Methane Leakage Rate Used in the LCA GHG Report

a. Comments

A number of commenters, including Sierra Club, Food & Water Watch, Americans Against Fracking et al., and Zimmerman and Associates, claim that the methane leakage rate used by NETL is too low. They assert that it does not match top-down (or aerial) measurements recently conducted in regions with natural gas activity, nor does it match the leakage rate in a recent analysis of wellhead casings in Pennsylvania.

b. DOE/FE Analysis

Recent studies lack consensus concerning the extent and rates of leakage from the upstream natural gas supply chain, with the leakage rates reported by these studies ranging from

less than 1% to as high as 10%.[259] One reason for this broad range of leakage rates is the fact that different analysts use different boundaries (*e.g.*, extraction only, extraction through processing, extraction through transmission, and extraction through distribution). Further, top-down measurements are taken over narrow time frames and limited geographic scopes that represent only a snapshot of operations. They do not necessarily represent long-term operations over a broad area.

Another reason for this range of leakage rates is confusion between leaks and losses. Natural gas leaks include emissions from pneumatically controlled devices, valves, compressor seals, acid gas removal units, dehydrators, and flanges. These leaks are a mix of methane and other hydrocarbons, and are a subset of total natural gas losses. Another type of loss includes flaring, which converts methane to CO_2 and thus reduces methane venting to the atmosphere. Similarly, the combustion of natural gas by reboilers in a natural gas processing plant or by compressors on a pipeline represents the loss of natural gas that is used to improve the purity of the gas itself and move it along the transmission network.

NETL's expected cradle-through-transmission leakage rate is 1.2%. In other words, the extraction, processing, and transmission of 1 kg of natural gas releases 0.012 kg of CH_4 to the atmosphere. In contrast, NETL's expected loss rate from the same boundary is approximately 8%: for the delivery of 1 kg of natural gas via a transmission pipeline, 0.012 kg of CH_4 is released to the atmosphere, and 0.068 kg is flared by environmental controls or combusted for processing and transmission energy.

[259] *See* NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation* (Section 6.2.1) (identifying reports that include various leakage rates).

Sierra Club compares NETL's leakage rate to a 1.54% leakage rate derived from EPA's 2013 GHG inventory. The two types of leakage rates (the 1.2% calculated by NETL's life cycle model and the 1.54% implied by EPA's 2013 inventory) are not directly comparable. LCAs and national inventories have different temporal boundaries. NETL's leakage rate is a life cycle number based on a 30-year time frame; it levelizes the emissions from one-time well completion activities over a 30-year time frame of steady-state production. The leakage rate implied by EPA's inventory represents 2011 industry activity; it captures the spike in completion emissions due to the atypically high number of wells that were completed that year. In other words, national inventories calculate all emissions that occur in a given year, while LCAs apportion all emissions that occur during a study period (*e.g.*, 30 years) to a unit of production (*e.g.*, 1 MWh of electricity generated). Both approaches are legitimate with respect to the unique goals of each type of analysis.

Sierra Club also compares NETL's 1.2% leakage rate to the 2.01% leakage rate calculated by Burnham et al.[260] Again, a boundary difference explains why the two leakage rates are not directly comparable. Burnham et al.'s leakage rate includes natural gas distribution, which is an additional transport step beyond transmission. Natural gas distribution moves natural gas from the "city gate" to small scale end users (commercial and residential consumers). NETL's leakage rate ends after natural gas transmission, the point at which natural gas is available for large scale end users such as power plants. The natural gas distribution system is a highly-branched network that uses vent-controlled devices to regulate pressure. This boundary difference explains why Burnham et al.'s leakage rate is higher than NETL's rate. Sierra Club

[260] Burnham, Andrew, et al. Life-cycle greenhouse gas emissions of shale gas, natural gas, coal, and petroleum. *Environmental Science & Technology* 46.2 (2011): 619-627.

also compares NETL's leakage rate to a shale gas analysis conducted by Weber et al.[261] We have reviewed Weber et al.'s work and do not see any mention of leakage rate.

It is also important to note that leakage rate is not an input to NETL's life cycle model. Rather, it is calculated from the outputs of NETL's life cycle model. NETL uses an approach that assembles all activities in the natural gas supply chain into a network of interconnected processes. The emissions from each process in this model are based on engineering relationships and emission factors from the EPA and other sources. This method is known as a "bottom-up" approach. Researchers are trying to discern why "top-down" studies such as Pétron's measurements in northeast Colorado[262] do not match the bottom-up calculations by NETL and other analysts. We believe that inconsistent boundaries (*i.e.*, bottom-up models that account for long term emissions at the equipment level in comparison to top-down measurements that encompass an entire region with more than one type of industrial activity over a narrow time frame) partly explain the differences between bottom-up and top-down results. As research continues, however, we expect to learn more about the differences between bottom-up and top-down methods.

Zimmerman and Associates references a recent study by Ingraffea et al. that assessed failure rates of well casings for oil and gas wells in Pennsylvania.[263] However, Ingraffea et al. do not calculate a methane leakage rate in their analysis; rather, they calculate the rate at which wells develop leaks. The rate at which leaks develop in well casings is a different phenomenon

[261] Weber, Christopher L., and Christopher Clavin. Life cycle carbon footprint of shale gas: Review of evidence and implications. *Environmental science & technology* 46.11 (2012): 5688-5695.
[262] Pétron, G., Frost, *et al*. (2012). Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study. *Journal of Geophysical Research: Atmospheres (1984–2012)*, *117*(D4).
[263] Ingraffea, A. R., Wells, M. T., Santoro, R. L., & Shonkoff, S. B. (2014). Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000–2012. *Proceedings of the National Academy of Sciences*, *111*(30), 10955-10960.

than the rate at which methane leaks from the natural gas supply chain. The former is a measurement of failure rates (the number of wells in a group that have leaks) and the latter is a measurement of the magnitude of total leakage (the amount of methane in extracted natural gas that is released to the atmosphere).

The breakeven analysis shown in Section 6 of the LCA GHG Report models hypothetical scenarios that increase the natural gas leakage rate to the point where the life cycle emissions from natural gas power are the same as those from coal power. The breakeven points between natural gas and coal systems are illustrated in Figures 6-8 and 6-9 of the Report. These results are based on the most conservative breakeven point, which occurs between the high natural gas cases (*i.e.*, lowest power plant efficiency, longest transport distance, and highest methane leakage) with the low coal case (*i.e.*, highest power plant efficiency and shortest transport distance). These graphs show that on a 100-year GWP basis, methane leakage would have to increase by a factor of 1.7 to 3.6, depending on the scenario, before the breakeven occurs. The breakeven methane leakage is lower for the 20-year GWP basis and, for some scenarios, is lower than the modeled leakage rate.

6. The Uncertainty Bounds of the LCA GHG Report

a. Comments

Concerned Citizens claim that the LCA GHG Report has significant uncertainty, and contend that "poor modeling is not a reason to dismiss impacts."

b. DOE/FE Analysis

The results of the LCA GHG Report are based on a flexible model with parameters for natural gas extraction, processing, and transport. Uncertainty bounds are assigned to three key parameters: well production rates, flaring rates, and transport distances. These uncertainty bars

are not an indication of poor modeling. To the contrary, they are used to account for variability in natural gas systems. If the analysis did *not* account for uncertainty, the results would imply that the GHG emissions from natural gas systems are consistently a single, point value, which would be inaccurate. We therefore believe the chosen uncertainty bounds strengthen the LCA model, as opposed to indicating any weakness in modeling.

7. The LCA GHG Report and the NEPA Approval Process

a. Comments

Several commenters, including Citizens Against LNG, Dominion Cove Point LNG, Susan Sakmar, and Americans Against Fracking et al., note that the LCA GHG Report does not fulfill the requirements of an EIS as defined by NEPA. These commenters maintain that the LCA GHG Report should not be used as a basis for approving proposed LNG export terminals.

b. DOE/FE Analysis

We agree that the LCA GHG Report does not fulfill any NEPA requirements in this proceeding, nor has DOE/FE made any suggestion to that effect. The LCA GHG Report addresses foreign GHG emissions and thus goes beyond the scope of what must be reviewed under NEPA.

XII. DISCUSSION AND CONCLUSIONS

In reviewing SPL's Applications to export LNG, DOE/FE has considered both its obligations under NEPA and its obligation under NGA section 3(a) to ensure that SPL's LNG export proposals are not inconsistent with the public interest.[264] To accomplish these purposes,

[264] In its Second Supplement to the Applications (discussed *supra* § IV.B), SPL contends that the United States is obligated to grant most favored nation status for LNG exports to all WTO members, including Japan, and that GATT 1994 prohibits the United States from restricting exports by means of an application review process or the imposition of export quotas. Because DOE/FE is granting SPL's Applications, these arguments are moot.

DOE/FE has examined a wide range of information addressing environmental and non-environmental factors, including:

- SPL's First, Second, and Third Applications; SPL's First and Second Supplements to the Applications; and the submissions of intervenors, commenters, and protestors in response to the Applications;
- FERC's EA; FERC's April 6, 2015 Order, including the 65 environmental conditions adopted in that Order; and FERC's June 23, 2015 Rehearing Order;
- The 2012 LNG Export Study, including comments received in response to the Study;
- The Draft Addendum, comments received in response to the Draft Addendum, and the final Addendum; and
- The LCA GHG Report (and the supporting NETL document), including comments submitted in response to those documents.

To avoid repetition, the following discussion focuses on arguments and evidence presented by SPL and the intervenors, commenters, and protestors in the three pending proceedings, to the extent that DOE/FE has not already addressed the same or substantially similar arguments in its responses to comments on the LNG Export Study, the Addendum, or the LCA GHG Report.

A. Procedural Issues

1. Motions to Intervene

No opposition has been filed in response to the motions to intervene submitted in these proceedings by API, TGPNA, and Centrica. Consequently, those motions to intervene are deemed granted. 10 C.F.R. § 590.303(g).

SPL opposes the motions to intervene filed by AEA, IECA, and Sierra Club in FE Docket Nos. 13-30-LNG and 13-42-LNG, as well as the motions to intervene submitted by Sierra Club and APGA in FE Docket No. 13-121-LNG. SPL contends that AEA, IECA, Sierra Club, and

APGA have not articulated a sufficient interest in the outcome of these proceedings to warrant intervention.

SPL infers that this is the case for AEA and IECA because neither of these entities submitted scoping comments in response to FERC's notice of intent to prepare an EA for the Liquefaction Expansion Project. On the other hand, SPL argues that Sierra Club's intervention is duplicative and unnecessary because Sierra Club did file comments in FERC's environmental review proceeding. SPL also appears to infer that a particularized interest of AEA and IECA in the outcome of these proceedings is lacking because AEA and IECA advanced only a generalized interest in DOE's reliance on the 2012 NERA Study.

On review, we find that the motions to intervene submitted in these proceedings by AEA, IECA, Sierra Club, and APGA should be granted. These movants and their members have set forth particularized substantive and material interests in the outcome of these proceedings. We find that their intervention will not unduly prejudice SPL's interests.

SPL's contention that the interests of the movants in the outcome of these proceedings can be inferred from the fact that the movants either did or did not submit comments in FERC's environmental review proceedings are not determinative of the issue. Nor is the issue determined on the basis of SPL's characterization of the degree of specificity of the arguments made by AEA and IECA regarding the 2012 NERA Study.

The principal factor to be considered is whether a grant of the Applications is likely to affect the rights or interests of the movants. It is clear that such is the case with respect to all of

the movants for the reasons set forth in their respective motions to intervene, as summarized above.[265] Accordingly, we will grant the contested motions.

2. AEA and IECA Requests for a Rulemaking

As described above, AEA and IECA have requested that DOE institute a rulemaking to promulgate regulations defining the factors to be considered in making public interest determinations under NGA section 3. API and SPL opposed these motions.

On review, we find that the requests for a rulemaking should be denied. The record in this consolidated proceeding is both complete and adequate to support a finding that the proposed exports will not be inconsistent with the public interest, for the reasons set forth in this Order. Accordingly, a rulemaking is not necessary.[266]

3. Sierra Club's Motions to Reply

We find good cause to grant Sierra Club's motions to reply to SPL's Answers. Notwithstanding SPL's opposition, we find that the replies that accompanied Sierra Club's motions contained information material to DOE/FE's consideration of the pending Applications. SPL was afforded an opportunity to respond and did so, and thus was not unduly prejudiced by our consideration of Sierra Club's replies. Therefore, we will grant the motions.[267]

B. Non-Environmental Issues

In considering non-environmental issues in this proceeding, we have reviewed the Applications, including both the ARI Resource Report and the Second Supplement to the

[265] *See supra* § VIII.
[266] SPL also challenges AEA and IECA for raising a claim that, potentially, would involve a reassessment, modification, and/or rescission of prior authorizations in other proceedings. We agree with the Applicant that such a request is not properly raised in these proceedings where the focus is on determining whether additional proposed authorizations, not previously issued authorizations, are in the public interest.
[267] *See infra* § VX (Ordering Para. T).

Applications (containing the NERA 2014 Export Study submitted by SPL); the pleadings submitted by the intervenors; and the 2012 LNG Export Study (including both the EIA and 2012 NERA studies). We also take administrative notice of EIA's most recent authoritative supply data and projections, set forth in AEO 2015 and discussed below.

1. SPL's Applications

The Applications review natural gas supply and demand conditions in the United States and the likely impact that the proposed exports will have on natural gas prices and the domestic economy. The ARI Resource Report submitted by SPL states that the United States has significant natural gas resources available to meet both projected future domestic needs and supply gas for the proposed exports with only a modest incremental impact on domestic natural gas prices. The 2012 LNG Export Study and the more recent data in AEO 2015 provide additional support for the conclusion that the proposed exports of LNG will yield significant economic benefits.

AEA, IECA, Sierra Club, and APGA have argued that the requested export authority in these proceedings has not been shown to be consistent with the public interest. They contend, for example, that the net economic benefits projected in the 2012 NERA Study will be slight and limited to a relatively small, affluent segment of the population. They further argue that, independent of the distributional economic impacts of LNG exports, the proposed exports will likely have a negative impact on the United States economy by increasing the price of natural gas and eliminating jobs in energy intensive industries. Sierra Club asserts that, although some regions may benefit from job growth because of additional gas production activity, the benefits will be temporary and will be overtaken by a "boom-bust" cycle characteristic of economies built on extractive industries. IECA and APGA are particularly concerned over the impact of price

increases on industries that use natural gas in manufacturing. APGA additionally challenges the reliability of the studies submitted by SPL in the pending proceedings. Specifically, APGA asserts that the data used in the 2012 LNG Export Study underestimated potential price increases, as it was allegedly based on outdated projections of domestic demand for natural gas from AEO 2011 and assumes that demand for natural gas is sufficiently elastic to prevent significant price spikes. APGA submits that AEO 2013 provides more current data and that it predicts greater increases in domestic demand than the 2012 LNG Export Study with the consequence of higher gas prices.

On review, DOE/FE finds that the evidence of record showing that the proposed exports would be in the public interest outweighs the concerns expressed by the intervenors. DOE has considered and rejected each of the arguments raised by the intervenors that bear on the validity of the 2012 NERA Study in the preceding discussion in this Order. *See supra* § IX. In regards to those arguments, the intervenors have adduced no additional substantive support for their views in these proceedings. Furthermore, more recent data introduced in the record is consistent with the findings and conclusions contained in the 2012 LNG Export Study. Most significantly, EIA's most recent projections in AEO 2015 provides independent support using the most currently available data for the proposition that domestic supplies will be adequate both to meet domestic needs *and* to supply SPL's exports and other final non-FTA LNG exports previously authorized by DOE/FE. *See supra* § IX.A. We find this most recent data from AEO 2015, in conjunction with the 2012 LNG Export Study, is determinative of the question of whether the proposed exports will be in the public interest. Based on this evidence, we find that the market will be capable of sustaining the level of exports proposed in SPL's three Applications over the term of the requested authorizations without significant negative price or other impacts and, in

fact, the domestic economy is likely to experience net economic benefits. For these reasons, as further discussed below, we find that the intervenors have not overcome the statutory presumption that the requested exports are consistent with the public interest.

2. Regional Impacts

SPL asserts that the proposed exports will stimulate local, regional, and national economies through direct and indirect job creation, increased economic activity, and tax revenues. The opponents of the Applications attempt to counter these claims. APGA contends that the NERA Study concludes that price increases resulting from LNG exports will hurt consumers of natural gas and electricity. APGA and IECA are also concerned that exports of LNG will undercut manufacturing industries in the United States and, in particular, will disadvantage the industries in which natural gas is a significant cost component. APGA maintains that the United States should pursue policies that allow industry to invest in manufacturing industries rather than LNG export facilities because manufacturing provides a value-added benefit to the economy that multiplies the value of every dollar spent on natural gas.

Sierra Club makes several of the same arguments raised by APGA and IECA and challenges the sustainability of economic benefits in regions tied to resource extraction industries. In particular, Sierra Club contends that DOE/FE must consider a full range of counterfactual scenarios by evaluating whether the nation would be better off without LNG export, or with lower export volumes. Sierra Club also challenges SPL's claimed regional economic benefits by focusing principally on the durability of economic benefits in producing regions in Pennsylvania and New York where Marcellus Shale drilling is occurring. Sierra Club asserts that any "boom" in economic activity will be followed by a bust, and that the prospect of

such an event demonstrates that a grant of the requested authorization is inconsistent with the public interest.

On review, we do not agree with APGA and Sierra Club that SPL's proposed exports will not yield net economic benefits or that the proposed exports will produce deleterious economic and societal impacts. The 2012 NERA Study, bolstered by the more recent data in AEO 2015, shows that the proposed exports are likely to generate net economic benefits for the United States. The intervenors have not offered detailed analyses specific to the local and regional economic impacts of SPL's proposal to contradict this evidence.

Further, we reject the claims that exports will have a negative impact on employment. Sierra Club points to a study conducted by Weinstein and Partridge (the Weinstein study) to support its contrary position.[268] However, we have considered the analysis contained in the Weinstein study in several recent LNG export orders, and found that the Weinstein Study showed only a statistically insignificant decline in employment in the regions studied in the years before a drilling boom (2001 to 2005), compared to the years during the drilling boom (2005 to 2009).[269] This small decline could have been the result of other factors, particularly since the years of the drilling boom coincided with a national economic recession. On the other hand, comparing the same time periods, we found that the Weinstein study showed substantial gains in

[268] Sierra Club Mots., FE Docket Nos. 13-30-LNG and 13-42-LNG, at 65; Sierra Club Mot., FE Docket No. 13-121-LNG, at 65-66 (discussing Weinstein and Partridge, *The Economic Value of Shale Natural Gas in Ohio*, Ohio State University, Swank Program in Rural-Urban Policy Summary & Report (Dec. 2010)).
[269] *See, e.g., LNG Develop. Co., LLC (d/b/a Oregon LNG)*, DOE/FE Order No. 3465, FE Docket NO. 12-77-LNG, Order Conditionally Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Oregon LNG Terminal in Warrenton, Clatsop County, Oregon, to Non-Free Trade Agreement Nations, at 135-36 (July 31, 2014).

economic growth rates in counties with drilling operations as opposed to those without. For the same reasons provided in those orders, we reject Sierra Club's arguments here.[270]

Sierra Club contends more broadly that extractive industries suffer from boom-bust cycles and therefore provide little lasting benefit to local communities. To the extent Sierra Club is claiming that the exports proposed by SPL will physically exhaust existing resources, we refer to Section IX.C in which we conclude that record evidence indicates that there will be substantial supply into the foreseeable future. To the extent that the "bust" cycles Sierra Club envisions are brought on by price declines that render existing resources uneconomic to produce, we do not see compelling evidence that the exports will exacerbate this risk. If anything, it seems more likely that SPL's ability to export to non-FTA countries will deepen and diversify the market for U.S.-produced natural gas, making the potential for a precipitous price-driven downturn in production activities less likely, not more likely.

3. Price Impacts

As discussed above, the LNG Export Study projected the economic impacts of LNG exports in a range of scenarios, including scenarios that equaled and exceeded the current amount of LNG exports authorized in the final non-FTA export authorizations to date, including this Order (equivalent to a total of 9.99 Bcf/d of natural gas). *See infra* § XII.D. The LNG Export Study concluded that LNG exports at these levels (*e.g.*, 6 Bcf/d of natural gas and higher) would result in higher U.S. natural gas prices, but that these price changes would remain in a relatively narrow range across the scenarios studied. NERA's analysis in its 2012 Study indicates that, after five years of increasing LNG exports, wellhead natural gas price increases

[270] *Id*.

could range from $0.22 to $1.11 (2010$/Mcf) depending on the market-determined level of exports. However, even with these estimated price increases, NERA found that the United States would experience net economic benefits from increased LNG exports in all cases studied. *See supra* § V.B.1, 8.

APGA contends that SPL relied on outdated EIA projections from AEO 2011. This is the same set of projections used in the LNG Export Study, and was the most recent, final set of projections available at the time. We reject APGA's arguments concerning this purportedly old data, as well as its insistence that more recent data would illustrate that the proposed exports are contrary to the public interest. As discussed above, the AEO 2015 projections from EIA indicate domestic supply and demand conditions that are more favorable, not less favorable, to exports. Specifically, the most recent outlook in the AEO 2015 Reference Case for 2035 reflects LNG exports equivalent to 9.0 Bcf/d of natural gas, net natural gas pipeline exports of 5.2 Bcf/d, and market price $0.39/MMBtu below the AEO 2011 Reference Case price, in constant 2012 dollars. It should be noted that, for 2035, the AEO 2011 Reference Case forecast 0.5 Bcf/d of net imports of natural gas plus LNG. *See supra* § IX.A. Accordingly, we reject the intervenors' arguments and find that, as to the impact of these LNG exports on domestic gas prices, intervenors have not overcome the statutory presumption that the requested authorization is consistent with the public interest.

4. Significance of the LNG Export Study

For the reasons discussed above, DOE/FE commissioned the 2012 LNG Export Study and invited the submission of responsive comments. DOE/FE has analyzed this material and determined that the LNG Export Study provides substantial support for granting SPL's

Applications. The conclusion of the LNG Export Study is that the United States will experience net economic benefits from issuance of authorizations to export domestically produced LNG.

We have evaluated the initial and reply comments submitted in response to the 2012 LNG Export Study. Various commenters have criticized the data used as inputs to the LNG Export Study and numerous aspects of the models, assumptions, and design of the Study. As discussed above, however, EIA's most recent projections, set forth in AEO 2015, continue to show market conditions that will accommodate increased exports of natural gas. When compared to the AEO 2013 Reference Case, the AEO 2015 Reference Case projects increases in domestic natural gas production—well in excess of what is required to meet projected increases in domestic consumption. Accordingly, we find that the LNG Export Study is fundamentally sound and supports the proposition that the proposed authorization will not be inconsistent with the public interest.

5. Benefits of International Trade

We have not limited our review to the contents of the 2012 LNG Export Study and the current data from AEO 2015 but have considered a wide range of other information. For example, the National Export Initiative, established by Executive Order, sets an Administration goal to "improve conditions that directly affect the private sector's ability to export" and to "enhance and coordinate Federal efforts to facilitate the creation of jobs in the United States through the promotion of exports."[271]

We have also considered the international consequences of our decision. We review applications to export LNG to non-FTA nations under section 3(a) of the NGA. The United

[271] National Export Initiative, 75 Fed. Reg. 12,433 (Mar. 16, 2010).

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. Indeed, 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 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 LNG Export Study.

C. Environmental Issues

In reviewing the potential environmental impacts of SPL's proposal to export LNG, DOE/FE has considered both its obligations under NEPA and its obligation under NGA section 3(a) to ensure that the proposal is not inconsistent with the public interest.

1. Adoption of FERC's EA

As a cooperating agency in FERC's environmental review, DOE/FE is responsible for conducting an independent review of the results of FERC's efforts and determining whether the record needs to be supplemented in order for DOE/FE to meet its statutory responsibilities under section 3 of the NGA and under NEPA. DOE/FE has reviewed the administrative record compiled at FERC, including the EA and the FERC Order. Based on that review, DOE/FE has concluded that supplementation of the record is not warranted or necessary in order for DOE/FE to take final agency action herein. Accordingly, DOE/FE adopts the EA in the FONSI (*see supra*

§ I), and the findings contained in the FERC Order and Rehearing Order, and hereby incorporates FERC's reasoning and findings in this Order.

2. Scope of NEPA Review

Sierra Club intervened both in the Sabine Pass proceeding before FERC and in the present proceedings. Sierra Club asserted in the FERC proceeding that the EA failed to take the hard look required by NEPA, in that, among other things, it did not consider the indirect effects of induced natural gas production associated with the Liquefaction Expansion Project; it failed to adequately analyze direct, cumulative, and indirect impacts on climate change from GHG emissions; and it failed to consider and disclose the GHG emissions associated with the production, transport, and combustion of the natural gas. More generally, Sierra Club argued to FERC, as it argues here, that FERC should have prepared a programmatic environmental impact statement (EIS) to address the cumulative impacts of all LNG export terminals that are pending or approved by DOE/FE.

As discussed above, in its April 6, 2015 Order, FERC rejected Sierra Club's arguments that the EA should have been supplemented with additional information, and that a programmatic EIS should have been prepared. FERC concluded that a detailed environmental analysis of increased natural gas production would be too speculative for inclusion in the EA because the impact of such increased production cannot be described with sufficient specificity to make its consideration useful for reasoned decision-making. In its Order, FERC found that such increased production is not "reasonably foreseeable" for purposes of NEPA analysis.[272] We find that FERC's environmental review covered all reasonably foreseeable environmental

[272] FERC Order at 31-32.

impacts of the Liquefaction Expansion Project, and that NEPA does not require the review to include induced upstream natural gas production.

Fundamental uncertainties constrain our ability to foresee and analyze with any particularity the incremental natural gas production that may be induced by permitting exports of LNG to non-FTA countries. EIA's 2012 Study projected that incremental natural gas production in the United States would account for 63% of LNG export volumes and, of that amount, 93% would come from unconventional production.[273] For this reason, and because DOE/FE had received comments regarding the potential environmental impacts associated with unconventional production, DOE/FE produced the Addendum and made it available for public comment. The Addendum takes a broad look at unconventional natural gas production in the United States, with chapters covering water resources (including water quantity and quality), air quality, GHG emissions, induced seismicity, and land use.

The Addendum addresses unconventional natural gas production in the nation as a whole. It does not attempt to identify or characterize the incremental environmental impacts that would result from LNG exports to non-FTA nations. Such impacts are not reasonably foreseeable and cannot be analyzed with any particularity. To begin, there is uncertainty as to the aggregate quantity of natural gas that ultimately may be exported to non-FTA countries. Receiving a non-FTA authorization from DOE/FE does not guarantee that a particular facility would be financed and built; nor does it guarantee that, if built, market conditions would continue to favor export once the facility is operational. To illustrate the point, of the more than 40 applications to build

[273] *See* LNG Export Study – Related Documents, available at http://energy.gov/fe/services/natural-gas-regulation/lng-export-study (EIA 2012 Study) at 11.

new LNG import facilities that were submitted to federal agencies between 2000 and 2010, only eight new facilities were built and those facilities have seen declining use in the past decade.[274]

There is also fundamental uncertainty as to where any additional production would occur and in what quantity. As the Addendum illustrates, nearly all of the environmental issues presented by unconventional natural gas production are local in nature, affecting local water resources, local air quality, and local land use patterns, all under the auspices of state and local regulatory authority. As DOE explained in *Sabine Pass*, Order No. 2961-A, without knowing where, in what quantity, and under what circumstances additional gas production will arise, the environmental impacts resulting from production activity induced by LNG exports to non-FTA countries are not "reasonably foreseeable" within the meaning of the CEQ's NEPA regulations.[275]

3. Cumulative Environmental Impacts

As noted above, Sierra Club asserts that our environmental review must consider the cumulative environmental impacts from all proposed and previously approved export authorizations and that a programmatic EIS is legally required for these purposes. The cumulative environmental impact analysis in the EA examined cumulative impacts from other projects in the vicinity of the Liquefaction Expansion Project.[276] The types of impacts considered included potential impacts to water resources, wetlands, vegetation and wildlife, cultural resources, socioeconomics, air quality (including GHG emissions), and noise. The EA

[274] *See Freeport LNG Expansion L.P., et al., LLC*, DOE/FE Order No. 3357, FE Docket No. 11-161-LNG, Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas to Non-Free Trade Agreement Nations, at 100-01 n.161 (Nov. 15, 2013) (FLEX II Conditional Order).
[275] *Sabine Pass*, DOE/FE Order No. 2961-A, at 11 (quoting 40 C.F.R. § 1508.7).
[276] EA at 161-162.

found that most of these impacts identified were temporary and minor, such as impacts on water resources, wildlife, and vegetation. With respect to wetlands impacts, the EA found that compensatory mitigation would offset the severity of permanent cumulative impacts.[277]

We find that the environmental review conducted by FERC took into account all reasonably foreseeable cumulative environmental impacts relating to the exports of LNG proposed in this consolidated proceeding. In our view, Sierra Club is seeking a programmatic EIS when there was no "program" before FERC that met the definition under CEQ guidelines.[278] The EA properly fulfilled its purpose of disclosing the environmental impacts of the Liquefaction Expansion Project while also setting forth measures that would mitigate, minimize, or eliminate any potential impacts. We, therefore, agree with FERC's reasoning and adopt its analysis concerning cumulative environmental impacts.

4. Environmental Impacts Associated with Induced Production of Natural Gas

The current rapid development of natural gas resources in the United States likely will continue, with or without the export of natural gas to non-FTA nations.[279] Nevertheless, a decision by DOE/FE to authorize exports to non-FTA nations could accelerate that development by some increment. For this reason, DOE/FE prepared and received public comment on the Addendum and made the Addendum and the comments part of the record in this proceeding. As discussed above, the Addendum reviewed the academic and technical literature covering the most significant issues associated with unconventional gas production, including impacts to water resources, air quality, greenhouse gas emissions, induced seismicity, and land use.

[277] *Id.* at 171.
[278] 40 C.F.R. §§ 1508.7, 1508.8.
[279] Addendum at 2.

The Addendum shows that there are potential environmental issues associated with unconventional natural gas production that need to be carefully managed, especially with respect to emissions of VOCs and methane, and the potential for groundwater contamination. These environmental concerns do not lead us to conclude, however, that exports of natural gas to non-FTA nations should be prohibited. Rather, we believe the public interest is better served by addressing these environmental concerns directly—through federal, state, or local regulation, or through self-imposed industry guidelines where appropriate—rather than by prohibiting exports of natural gas. Unlike DOE, environmental regulators have the legal authority to impose requirements on natural gas production that appropriately balance benefits and burdens, and to update these regulations from time to time as technological practices and scientific understanding evolve. For example, in 2012, using its authority under the Clean Air Act, EPA promulgated regulations for hydraulically fractured wells that are expected to yield significant emissions reductions.[280] In 2013, EPA updated those regulations to include storage tanks,[281] and in 2014 EPA issued a series of technical white papers exploring the potential need for additional measures to address methane emissions from the oil and gas sector.[282] More recently, in January 2015, EPA announced a strategy for "address[ing] methane and smog-forming VOC emissions from the oil and gas industry in order to ensure continued, safe and responsible growth in U.S. oil and natural gas production."[283] Specifically, as part of the Administration's efforts to address

[280] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews; Final Rule, 77 Fed. Reg. 49,490 (Aug. 16, 2012).
[281] U.S. Envtl. Prot. Agency, Oil and Natural Gas Sector: Reconsideration of Certain Provisions of New Source Performance Standards; Final Rule, 77 Fed. Reg. 58,416 (Sept. 23, 2013).
[282] U.S. Envtl. Prot. Agency, Office of Air Quality Planning & Standards, *White Papers on Methane and VOC Emissions*, *available at* http://www.epa.gov/airquality/oilandgas/whitepapers.html) (released April 15, 2014), discussed *supra* § X.C.
[283] U.S. Envtl. Prot. Agency, Fact Sheet: EPA's Strategy for Reducing Methane and Ozone-Forming Pollution From the Oil and Natural Gas Industry (Jan. 14, 2015), *available at*

climate change, EPA will initiate a rulemaking to set standards for methane and VOC emissions from new and modified oil and gas production sources, and natural gas processing and transmission sources.[284] EPA states that it will issue a proposed rule in the summer of 2015, with a final rule to follow in 2016.[285]

Section 3(a) of the NGA is too blunt an instrument to address these environmental concerns efficiently. A decision to prohibit exports of natural gas would cause the United States to forego entirely the economic and international benefits discussed herein, but would have little more than a modest, incremental impact on the environmental issues identified by intervenors. For these reasons, we conclude that the environmental concerns associated with natural gas production do not establish that exports of natural gas to non-FTA nations are inconsistent with the public interest.

5. Greenhouse Gas Impacts Associated with U.S. LNG Exports

Sierra Club and other commenters on the LCA GHG Report and the Addendum have expressed concern that exports of domestic natural gas to non-FTA nations may impact the balance of global GHG emissions through their impact domestically on the price and availability of natural gas for electric generation and other uses. They also have objected that exports of natural gas could have a negative effect on the GHG intensity and total amount of energy consumed in foreign nations.

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http://www.epa.gov/airquality/oilandgas/pdfs/20150114fs.pdf.

[284] The White House, Office of the Press Secretary, Fact Sheet: Administration Takes Steps Forward on Climate Action Plan by Announcing Actions to Cut Methane Emissions (Jan. 14, 2015), *available at* https://www.whitehouse.gov/the-press-office/2015/01/14/fact-sheet-administration-takes-steps-forward-climateaction-plan-anno-1.

[285] *See id*. (stating that, in developing the proposed and final standards, EPA "will focus on in-use technologies, current industry practices, [and] emerging innovations, … to ensure that emissions reductions can be achieved as oil and gas production and operations continue to grow.").

a. Domestic Impacts Associated with Increased Natural Gas Prices

To the extent exports of natural gas to non-FTA nations increase domestic natural gas prices, those higher prices would be expected, all else equal, to reduce the use of natural gas in the United States as compared to a future case in which exports to non-FTA exports were prohibited. Within the U.S. electric generation sector, reduced demand for natural gas caused by higher prices would be balanced by some combination of reduced electric generation overall (aided by conservation and efficiency measures), increased generation from other resources (such as coal, renewables, and nuclear), and more efficient use of natural gas (*i.e.*, shifting of generation to natural gas-fired generators with superior heat rates).

Although EIA's 2012 Study found that additional natural gas production would supply most of the natural gas needed to support added LNG exports, EIA modeled the effects of higher natural gas prices on energy consumption in the United States in the years 2015 through 2035, and found several additional results. In particular, EIA found that "under Reference case conditions, decreased natural gas consumption as a result of added exports are countered proportionately by increased coal consumption (72 percent), increased liquid fuel consumption (8 percent), other increased consumption, such as from renewable generation sources (9 percent), and decreases in total consumption (11 percent)."[286] Further, EIA determined that, in the earlier years of the 2015 to 2035 period, "the amount of natural gas to coal switching is greater," with "coal play[ing] a more dominant role in replacing the decreased levels of natural gas consumption, which also tend to be greater in the earlier years."[287] Likewise, "[s]witching from natural gas to coal is less significant in later years, partially as a result of a greater proportion of

[286] 2012 EIA Study at 18.
[287] *Id*.

switching into renewable generation."[288] EIA ultimately projected that, for LNG export levels from 6 to 12 Bcf/d of natural gas and under Reference Case conditions, aggregate carbon dioxide emissions would increase above a base case with no exports by between 643 and 1,227 million metric tons (0.5 to 1.0%) over the period from 2015 to 2035.[289] It is worth noting, however, that a substantial portion of these projected emissions came from consumption of natural gas in the liquefaction process, rather than from increased use of coal. The liquefaction of natural gas is captured in the LCA GHG Report's estimate of the life cycle GHG emissions of U.S.-exported LNG, discussed above.

We further note that EIA's 2012 Study assumed the continuation of regulations in effect at the time the AEO 2011 was prepared.[290] Therefore, EIA's analysis did not include the impacts that EPA's Mercury and Air Toxics Standard[291] and its Transport Rule[292] may have on the extent to which the U.S. coal fleet would compensate for reduced use of natural gas. Nor did EIA's analysis capture the potential for broad regulation of carbon dioxide emissions from the electric power sector. After publication of the EIA Study in early 2012, EPA proposed two rules that, if finalized, would likely reduce the extent to which increased use of coal would compensate for reduced use of natural gas. In September 2013, EPA proposed a rule that would limit carbon

[288] *Id*.
[289] *Id*.
[290] 2012 EIA Study at 12 n.7 ("The degree to which coal might be used in lieu of natural gas depends on what regulations are in-place that might restrict coal use. These scenarios reflect current laws and regulations in place at the time [AEO 2011] was produced.").
[291] U.S. Envtl. Prot. Agency, National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial- Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units; Final Rule, 77 Fed. Reg. 9,304 (Feb. 16, 2012).
[292] U.S. Envtl. Prot. Agency, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals; Final Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011).

dioxide emissions from new coal-fired electric-generating units.[293] In June 2014, EPA proposed a rule that would limit carbon dioxide emissions from existing coal-fired electric generating units.[294] Additionally, on January 7, 2015, EPA announced plans to issue the final carbon pollution rules for new, reconstructed, and existing coal-fired electric-generating units by the summer of 2015.[295]

If and when finalized, these proposed rules have the potential to mitigate significantly any increased emissions from the U.S. electric power sector that would otherwise result from increased use of coal, and perhaps to negate those increased emissions entirely. Therefore, on the record before us, we cannot conclude that exports of natural gas would be likely to cause a significant increase in U.S. GHG emissions through their effect on natural gas prices and the use of coal for electric generation.

b. International Impacts Associated with Energy Consumption in Foreign Nations

The LCA GHG Report estimated the life cycle GHG emissions of U.S. LNG exports to Europe and Asia, compared with certain other fuels used to produce electric power in those importing countries. The key findings for U.S. LNG exports to Europe and Asia are summarized in Figures 3 and 4 below, which are also presented above in Section XI.A (Figures 1 and 2):

[293] U.S. Envtl. Prot. Agency, Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed. Reg. 1,430 (Jan. 8, 2014).
[294] U.S. Envtl. Prot. Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed. Reg. 34,830 (June 18, 2014).
[295] U.S. Envtl. Prot. Agency, Fact Sheet: Clean Power Plan and Carbon Pollution Standards Key Dates, *available at* http://www2.epa.gov/carbon-pollution-standards/fact-sheet-clean-power-plan-carbon-pollution-standards-key-dates; *see also id.*, Announcements (Jan. 7, 2015), http://www2.epa.gov/carbon-pollution-standards.

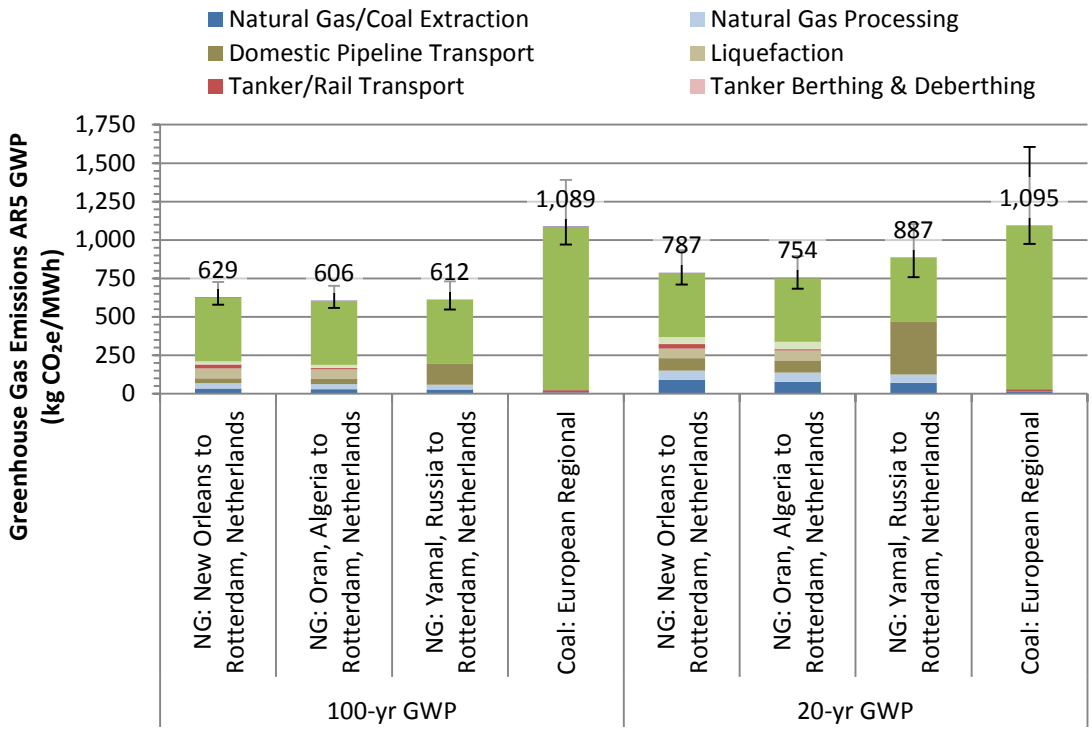

Figure 3: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe[296]

[296] LCA GHG Report at 9 (Figure 6-1).

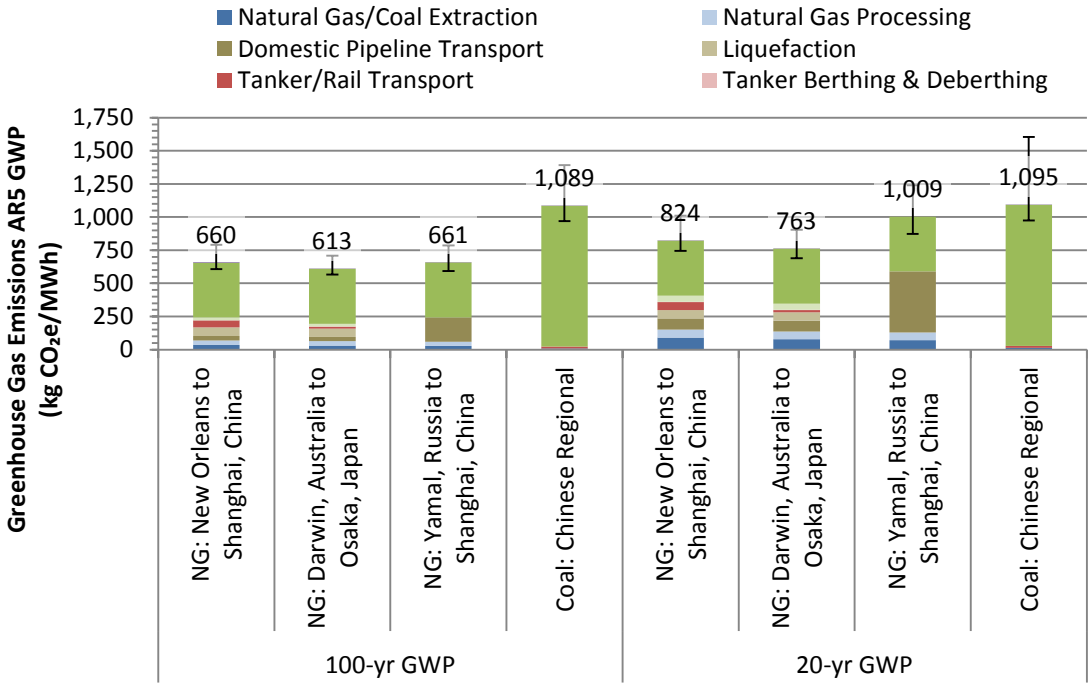

Figure 4: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia[297]

While acknowledging substantial uncertainty, the LCA GHG Report shows that to the extent U.S. LNG exports are preferred over coal in LNG-importing nations, U.S. LNG exports are likely to reduce global GHG emissions. Further, to the extent U.S. LNG exports are preferred over other forms of imported natural gas, they are likely to have only a small impact on global GHG emissions.[298]

The LCA GHG Report does not answer the ultimate question whether authorizing exports of natural gas to non-FTA nations will increase or decrease global GHG emissions, because regional coal and imported natural gas are not the *only* fuels with which U.S.-exported LNG would compete. U.S. LNG exports may also compete with renewable energy, nuclear energy, petroleum-based liquid fuels, coal imported from outside East Asia or Western Europe,

[297] LCA GHG Report at 10 (Figure 6-2).
[298] *Id*. at 9, 18.

indigenous natural gas, synthetic natural gas derived from coal, and other resources, as well as efficiency and conservation measures. To model the effect that U.S. LNG exports would have on net global GHG emissions would require projections of how each of these fuel sources would be affected in each LNG-importing nation. Such an analysis would not only have to consider market dynamics in each of these countries over the coming decades, but also the interventions of numerous foreign governments in those markets.[299]

The uncertainty associated with estimating each of these factors would likely render such an analysis too speculative to inform the public interest determination in this or other non-FTA LNG export proceedings. Accordingly, DOE/FE elected to focus on the discrete question of how U.S. LNG compares on a life cycle basis to regional coal and other sources of imported natural gas in key LNG-importing countries. This is a useful comparison because coal and imported natural gas are prevalent fuel sources for electric generation in non-FTA LNG-importing nations. For example, EIA notes that installed electric generation capacity in China was 66% coal and 3% natural gas in 2012.[300] For India, installed electric generation capacity in 2014 is 59% coal and 9% natural gas.[301] In both China and India, electric generation capacity is expected to increase substantially in coming years. For Japan, the largest importer of LNG in the world, electric

[299] Sierra Club observes in its protest in FE Docket No. 13-121-LNG that renewable energy has experienced significant growth in key LNG-importing countries such as India and China. Sierra Club does not, however, place the growth of renewable energy in the context of the aggregate use of fossil energy projects in those countries. Nor does Sierra Club explain the extent to which growth in renewable energy has been driven by public policies in those countries and how the availability of U.S. LNG exports would or would not impact the continuation of those policies.

[300] U.S. Energy Information Administration, China Analysis Brief (last updated Feb. 4, 2014), *available at:* http://www.eia.gov/countries/cab.cfm?fips=CH.

[301] U.S. Energy Information Administration, Japan Analysis Brief (last updated Jan. 30, 2015), *available at* http://www.eia.gov/countries/cab.cfm?fips=JA. In this updated Brief, EIA observed that, "[o]nce Japan removed its nuclear generation capacity from operation starting in 2011, other fuels such as LNG, oil, and coal displaced it. This shift has markedly altered the generation portfolio," with reports that "LNG, oil, and coal shares rose to 43%, 14%, and 30%, respectively, in 2013." *Id.*

generation from fossil fuels was 74% of total generation in 2011 and 89% in 2012 after the Fukushima disaster.[302] In Europe, use of fossil fuels is slightly less than in the Asian nations noted above but still significant, comprising 68% and 49% of electric generation in the United Kingdom and Spain for 2012, respectively.[303]

The conclusions of the LCA GHG Report, combined with the observation that many LNG-importing nations rely heavily on fossil fuels for electric generation, suggests that exports of U.S. LNG may decrease global GHG emissions, although there is substantial uncertainty on this point as indicated above. In any event, the record does not support the conclusion that U.S. LNG exports will increase global GHG emissions in a material or predictable way. Therefore, while we share the commenters' strong concern about GHG emissions as a general matter, based on the current record evidence, we do not see a reason to conclude that U.S. LNG exports will significantly exacerbate global GHG emissions.

6. Other Considerations

Our decision is not premised on an uncritical acceptance of the general conclusion of the LNG Export Study of net economic benefits from LNG exports. Both the LNG Export Study and many public comments identify significant uncertainties and even potential negative impacts from LNG exports. The economic impacts of higher natural gas prices and potential increases in natural gas price volatility are two of the factors that we view most seriously. Yet we also have

[302] U.S. Energy Information Administration, Japan Analysis Brief (last updated July 31, 2014), *available at:* http://www.eia.gov/countries/cab.cfm?fips=JA.

[303] EIA, International Energy Statistics, *available at:* http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=alltypes&aid=12&cid=SP,UK,&syid=2008&eyid=2012&unit=BKWH. To evaluate the effect that U.S. LNG exports may have on the mix of fuels used for electric generation in Western Europe also requires consideration of the role of the European Trading System (ETS). The ETS places a cap on GHG emissions. Therefore, where the cap is a binding constraint, the ETS ultimately may ensure that the availability of U.S.-exported LNG will not affect aggregate emissions.

taken into account factors that could mitigate such impacts, such as the current oversupply situation and data indicating that the natural gas industry would increase natural gas supply in response to increasing exports. Further, we note that it is far from certain that all or even most of the proposed LNG export projects will ever be realized because of the time, difficulty, and expense of commercializing, financing, and constructing LNG export terminals, as well as the uncertainties inherent in the global market demand for LNG. On balance, we find that the potential negative impacts of SPL's proposed exports are outweighed by the likely net economic benefits and by other non-economic or indirect benefits.

More generally, DOE/FE continues to subscribe to the principle set forth in our 1984 Policy Guidelines[304] that, under most circumstances, the market is the most efficient means of allocating natural gas supplies. However, agency intervention may be necessary to protect the public in the event there is insufficient domestic natural gas for domestic use. There may be other circumstances as well that cannot be foreseen that would require agency action.[305] Given these possibilities, DOE/FE recognizes the need to monitor market developments closely as the impact of successive authorizations of LNG exports unfolds.

[304] 49 Fed. Reg. at 6684.

[305] Some commenters on the LNG Export Study asked DOE to clarify the circumstances under which the agency would exercise its authority to revoke (in whole or in part) previously issued LNG export authorizations. We cannot precisely identify all the circumstances under which such action would be taken. We reiterate our observation in *Sabine Pass* that: "In the event of any unforeseen developments of such significant consequence as to put the public interest at risk, DOE/FE is fully authorized to take action as necessary to protect the public interest. Specifically, DOE/FE is authorized by section 3(a) of the Natural Gas Act … to make a supplemental order as necessary or appropriate to protect the public interest. Additionally, DOE is authorized by section 16 of the Natural Gas Act 'to perform any and all acts and to prescribe, issue, make, amend, and rescind such orders, rules, and regulations as it may find necessary or appropriate' to carry out its responsibilities." *Sabine Pass*, DOE/FE Order No. 2961, at 33 n.45 (quoting 15 U.S.C. § 717o).

D. Conclusion

We have reviewed the evidence in the record and have not found an adequate basis to conclude that SPL's proposed export of LNG to non-FTA countries will be inconsistent with the public interest. We find that the intervenors, commenters, and protestors in this proceeding have failed to overcome the statutory presumption that the proposed export authorization is consistent with the public interest. For that reason, we are authorizing SPL's proposed exports to non-FTA countries subject to the limitations and conditions described in this Order.

In deciding whether to grant a final non-FTA export authorization, we consider in our decision-making the cumulative impacts of the total volume of all final non-FTA export authorizations. With the issuance of this Order, DOE/FE has now issued final non-FTA authorizations in a cumulative volume of exports totaling 9.99 Bcf/d of natural gas, or 3.646 Tcf/yr, for the eight final authorizations issued to date—Sabine Pass (Trains 1-4) (2.2 Bcf/d); Carib Energy (USA) LLC (0.04 Bcf/d);[306] Cameron LNG, LLC (1.7 Bcf/d);[307] FLEX I (1.4 Bcf/d);[308] FLEX II (0.4 Bcf/d);[309] Dominion Cove Point LNG, LP (0.77 Bcf/d);[310] Cheniere

[306] *Carib Energy (USA) LLC*, DOE/FE Order No. 3487, FE Docket No. 11-141-LNG, Final Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers by Vessel to Non-Free Trade Agreement Nations in Central America, South America, or the Caribbean (Sept. 10, 2014).
[307] *Cameron LNG, LLC*, DOE/FE Order No. 3391-A, FE Docket No. 11-162-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cameron LNG Terminal in Cameron Parish, Louisiana, to Non-Free Trade Agreement Nations (Sept. 10, 2014).
[308] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3282-C, FE Docket No. 10-161-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Nov. 14, 2014) (FLEX I Final Order).
[309] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357-B, FE Docket No. 11-161-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Nov. 14, 2014) (FLEX II Final Order).
[310] *Dominion Cove Point LNG, LP*, DOE/FE Order No. 3331-A, FE Docket No. 11-128-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas from the Cove Point LNG Terminal in Calvert County, Maryland, to Non-Free Trade Agreement Nations (May 7, 2015).

Marketing, LLC and Corpus Christi Liquefaction, LLC (2.1 Bcf/d);[311] and this Order (1.38 Bcf/d). This total export volume is within the range of scenarios analyzed in the 2012 EIA and NERA studies. NERA found that in all such scenarios—assuming either 6 Bcf/d or 12 Bcf/d of export volumes—the United States would experience net economic benefits. As discussed above, the submissions of the intervenors do not undermine the reasonableness of the findings in the LNG Export Study.

DOE/FE will continue taking a measured approach in reviewing the other pending applications to export domestically produced LNG. Specifically, DOE/FE will continue to assess the cumulative impacts of each succeeding request for export authorization on the public interest with due regard to the effect on domestic natural gas supply and demand fundamentals. In keeping with the performance of its statutory responsibilities, DOE/FE will attach appropriate and necessary terms and conditions to authorizations to ensure that the authorizations are utilized in a timely manner and that authorizations are not issued except where the applicant can show that there are or will be facilities capable of handling the proposed export volumes and existing and forecast supplies that support that action. Other conditions will be applied as necessary.

The reasons in support of proceeding cautiously are several: (1) the LNG Export Study, like any study based on assumptions and economic projections, is inherently limited in its predictive accuracy; (2) applications to export significant quantities of domestically produced LNG are a new phenomena with uncertain impacts; and (3) the market for natural gas has experienced rapid reversals in the past and is again changing rapidly due to economic,

[311] *Cheniere Marketing, LLC, and Corpus Christi, LLC*, DOE/FE Order No. 3638, FE Docket No. 12-97-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Proposed Corpus Christi Liquefaction Project to be Located in Corpus Christi, Texas, to Non-Free Trade Agreement Nations (May 12, 2015).

technological, and regulatory developments. The market of the future very likely will not resemble the market of today. In recognition of these factors, DOE/FE intends to monitor developments that could tend to undermine the public interest in grants of successive applications for exports of domestically produced LNG and, as previously stated, to attach terms and conditions to the authorization in this proceeding and to succeeding LNG export authorizations as are necessary for protection of the public interest.

XIII. TERMS AND CONDITIONS

To ensure that the authorization issued by this Order is not inconsistent with the public interest, DOE/FE has attached the following Terms and Conditions to the authorization. The reasons for each term or condition are explained below. SPL must abide by each Term and Condition or may face rescission of the authorization or other appropriate sanction.

A. Term of the Authorization

In each of the three Applications, SPL requests a 20-year term for the authorization commencing from the date export operations begin.[312] This term is consistent with our practice in the final and conditional non-FTA export authorizations issued to date.[313] In imposing this condition, we are mindful that LNG export facilities are capital intensive and that, to obtain financing for such projects, there must be a reasonable expectation that the authorization will continue for a term sufficient to support repayment. We find that a 20-year term is likely sufficient to achieve this result. Accordingly, the 20-year term will begin on the date when SPL

[312] SPL explains that, although it is seeking an export term commencing from the date of first export or eight years from the date of issuance of this authorization, both the TGPNA and the Centrica SPAs require SPL to deliver LNG for a primary 20-year term commencing on the date of first commercial delivery from Train 5 of the Terminal. SPL App. 1 at 2-3; SPL App. 2 at 2-3.

[313] *See, e.g., Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357-B, at 100-01.

commences commercial export of domestically sourced LNG from Train 5 of the Sabine Pass LNG Terminal, but not before.

B. Commencement of Operations Within Seven Years

In each of the three Applications, SPL requests that this authorization commence on the earlier of the date of first export or eight years from the date of the issuance of this Order. Consistent with the final and conditional non-FTA authorizations issued to date,[314] DOE/FE will add as a condition of the authorization that SPL must commence commercial LNG export operations no later than seven years from the date of issuance of this Order. The purpose of this condition is to ensure that other entities that may seek similar authorizations are not frustrated in their efforts to obtain those authorizations by authorization holders that are not engaged in actual export operations.

C. Commissioning Volumes

SPL will be permitted to apply for short-term export authorizations to export Commissioning Volumes prior to the commencement of the first commercial exports of domestically sourced LNG from Trains 5 and 6 of the Sabine Pass LNG Terminal. "Commissioning Volumes" are defined as the volume of LNG produced and exported under a short-term authorization during the initial start-up of each LNG train, before each LNG train has reached its full steady-state capacity and begun its commercial exports pursuant to Sabine Pass's long-term contracts.[315] The Commissioning Volumes will not be counted against the maximum

[314] *See, e.g., Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357-B, at 100-01.
[315] For additional discussion of Commissioning Volumes and the Make-Up Period referenced below, see *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order Nos. 3282-B & 3357-A, Order Amending DOE/FE Order Nos. 3282 and 3357, FE Docket Nos. 10-161-LNG & 11-161-LNG, at 4-9 (June 6, 2014).

level of volumes previously authorized in any of SPL's FTA and non-FTA orders, including this Order.

D. Make-Up Period

SPL will be permitted to continue exporting for a total of three years following the end of the 20-year term established in this Order, solely to export any Make-Up Volume that it was unable to export during the original export period. The three-year term during which the Make-Up Volume may be exported shall be known as the "Make-Up Period."

The Make-Up Period does not affect or modify the total volume of LNG previously authorized in any of SPL's FTA and non-FTA orders, including this Order. Insofar as SPL may seek to export additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

E. Transfer, Assignment, or Change in Control

DOE/FE's natural gas import/export regulations prohibit authorization holders from transferring or assigning authorizations to import or export natural gas without specific authorization by the Assistant Secretary for Fossil Energy.[316] As a condition of the similar authorization issued to SPL in Order No. 2961, DOE/FE found that the requirement for prior approval by the Assistant Secretary under its regulations applies to any change of effective control of the authorization holder either through asset sale or stock transfer or by other means. This condition was deemed necessary to ensure that, prior to any transfer or change in control, DOE/FE will be given an adequate opportunity to assess the public interest impacts of such a transfer or change.

[316] 10 C.F.R. § 590.405.

DOE/FE construes a change in control to mean a change, directly or indirectly, of the power to direct the management or policies of an entity whether such power is exercised through one or more intermediary companies or pursuant to an agreement, written or oral, and whether such power is established through ownership or voting of securities, or common directors, officers, or stockholders, or voting trusts, holding trusts, or debt holdings, or contract, or any other direct or indirect means. A rebuttable presumption that control exists will arise from the ownership or the power to vote, directly or indirectly, 10 percent or more of the voting securities of such entity.[317]

F. Agency Rights

Third Application (FE Docket No. 13-121-LNG). As noted above, in the Third Application, SPL requests authorization to export LNG in a volume equivalent to 314 Bcf/yr of natural gas from Trains 5 and 6 of the Sabine Pass LNG Terminal. SPL expressly requests this authorization both on its own behalf and as agent for other entities that hold title to the LNG at the time of export.[318]

DOE/FE previously addressed the issue of Agency Rights in Order No. 2913,[319] which granted FLEX authority to export LNG to FTA countries. In that order, DOE/FE approved a proposal by FLEX to register each LNG title holder for whom FLEX sought to export LNG as agent. DOE/FE found that this proposal was an acceptable alternative to the non-binding policy adopted by DOE/FE in *Dow Chemical,* which established that the title for all LNG authorized for

[317] For information on DOE/FE's procedures governing a change in control, see U.S. Dep't of Energy, Procedures for Changes in Control Affecting Applications and Authorizations to Import or Export Natural Gas, 79 Fed. Reg. 65,641 (Nov. 5, 2014).
[318] App. 3 at 4.
[319] *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 2913, FE Docket No. 10-160-LNG, Order Granting Long-Term Authorization to Export Liquefied Natural Gas from Freeport LNG Terminal to Free Trade Nations (Feb. 10, 2011) [hereinafter *Freeport LNG*].

export must be held by the authorization holder at the point of export.[320] We find that the same policy considerations that supported DOE/FE's acceptance of the alternative registration proposal in Order No. 2913 apply here as well. DOE/FE reiterated its policy on Agency Rights procedures in *Gulf Coast LNG Export, LLC*.[321] In *Gulf Coast*, DOE/FE confirmed that, in LNG export orders in which Agency Rights have been granted, DOE/FE shall require registration materials filed for, or by, an LNG title-holder (Registrant) to include the same company identification information and long-term contract information of the Registrant as if the Registrant had filed an application to export LNG on its own behalf.[322]

To ensure that the public interest is served, this authorization shall be conditioned to require that where SPL proposes to export this volume of LNG from Trains 5 and 6 (equivalent to 314 Bcf/yr of natural gas) as agent for other entities that hold title to the LNG (Registrants), it must register with DOE/FE those entities on whose behalf it will export LNG in accordance with the procedures and requirements described herein.

First and Second Applications (FE Docket Nos. 13-30-LNG and 13-42-LNG). In the First and Second Applications, SPL does not seek Agency Rights. Rather, SPL asks DOE/FE to grant it long-term authorization to engage in the requested exports of LNG pursuant to the TGPNA and Centrica SPAs (101 and 88.3 Bcf/yr of natural gas, respectively).[323] SPL states that these two SPAs call for title of the LNG to transfer from SPL to TGPNA and Centrica,

[320] *Dow Chem. Co.*, DOE/FE Order No. 2859, FE Docket No. 10-57-LNG, Order Granting Blanket Authorization to Export Liquefied Natural Gas, at 7-8 (Oct. 5, 2010), *discussed in Freeport LNG*, DOE/FE Order No. 2913, at 7-8.
[321] *Gulf Coast LNG Export, LLC*, DOE/FE Order No. 3163, FE Docket No. 12-05-LNG, Order Granting Long-Term Multi-Contract Authority to Export LNG by Vessel from the Proposed Brownsville Terminal to Free Trade Agreement Nations (Oct. 16, 2012).
[322] *See id*. at 7-8.
[323] SPL App. 1 at 2; SPL App. 2 at 2.

respectively, at the "flange coupling of the LNG intake manifold of the relevant LNG tanker."[324] DOE/FE has previously stated that the flange of the LNG vessel is the point of export.[325] As such, SPL states that it will be the exporter of the LNG under these agreements.[326] In light of this arrangement, we find that SPL will be exporting the LNG solely on its own behalf under the First and Second Applications, and therefore does not need Agency Rights.

G. Contract Provisions for the Sale or Transfer of LNG to be Exported

DOE/FE's regulations require applicants to supply transaction-specific factual information "to the extent practicable."[327] Additionally, DOE/FE regulations allow confidential treatment of the information supplied in support of or in opposition to an application if the submitting party requests such treatment, shows why the information should be exempted from public disclosure, and DOE/FE determines it will be afforded confidential treatment in accordance with 10 C.F.R. § 1004.11.[328]

DOE/FE will require that SPL file or cause to be filed with DOE/FE any relevant long-term commercial agreements, including liquefaction tolling agreements, pursuant to which SPL exports LNG as agent for a Registrant. *See supra* § IV.D.

DOE/FE finds that the submission of all such agreements or contracts within 30 days of their execution using the procedures described below will be consistent with the "to the extent practicable" requirement of section 590.202(b). By way of example and without limitation, a "relevant long-term commercial agreement" would include an agreement with a minimum term

[324] *See* TGPNA SPA at 31 (Appendix A to SPL App. 1); Centrica SPA at 29-30 (Appendix A to SPL App. 2).
[325] *See Dow Chem. Co.*, DOE/FE Order No. 2859, FE Docket No. 10-57-LNG, Order Granting Blanket Authorization to Export Liquefied Natural Gas (Oct. 5, 2010).
[326] *See also* FTA Order No. 3306; FTA Order No. 3307.
[327] 10 C.F.R. § 590.202(b).
[328] *Id*. § 590.202(e).

of two years, an agreement to provide gas processing or liquefaction services at the Sabine Pass LNG Terminal, a long-term sales contract involving natural gas or LNG stored or liquefied at the Terminal, or an agreement to provide export services from the Terminal.

In addition, DOE/FE finds that section 590.202(c) of DOE/FE's regulations[329] requires that SPL file, or cause to be filed, all long-term contracts associated with the long-term supply of natural gas to the Sabine Pass LNG Terminal, whether signed by SPL or the Registrant, within 30 days of their execution.

DOE/FE recognizes that some information in SPL's or a Registrant's long-term commercial agreements associated with the export of LNG, and/or long-term contracts associated with the long-term supply of natural gas to the Sabine Pass LNG Terminal, may be commercially sensitive. DOE/FE therefore will provide SPL the option to file or cause to be filed either unredacted contracts, or in the alternative (A) SPL may file, or cause to be filed, long-term contracts under seal, but it also will file either: i) a copy of each long-term contract with commercially sensitive information redacted, or ii) a summary of all major provisions of the contract(s) including, but not limited to, the parties to each contract, contract term, quantity, any take or pay or equivalent provisions/conditions, destinations, re-sale provisions, and other relevant provisions; and (B) the filing must demonstrate why the redacted information should be exempted from public disclosure.

To ensure that DOE/FE destination and reporting requirements included in this Order are conveyed to subsequent title holders, DOE/FE will include as a condition of this authorization

[329] *Id*. § 590.202(c).

that future contracts for the sale or transfer of LNG exported pursuant to this Order shall include an acknowledgement of these requirements.

H. Export Quantity and Operational Flexibility

In the three Applications subject to this Order, SPL has sought export authorization in a total combined volume of LNG equivalent to 503.3 Bcf/yr of natural gas. This Order authorizes the export of LNG in the full amount requested, up to the equivalent of 503.3 Bcf/yr of natural gas, pursuant to the allocations specified by SPL and set forth in Ordering Paragraph A below.

We note that both the TGPNA and Centrica SPAs require SPL to deliver LNG for a term of 20 years commencing on the date of first commercial delivery from Train 5 of the Terminal. Nonetheless, as noted above (*supra* § I), SPL states in each Application that "[it] retains the flexibility to satisfy its delivery obligations [under the SPAs] with LNG from ***any train at its facility***."[330] Insofar as SPL is requesting authority through these statements to satisfy some or all of its delivery obligations from Trains 1-4 of the Terminal (instead of from Trains 5-6), we find that it is reasonable to allow this operational flexibility, subject to any applicable DOE/FE export limitations in previously issued orders bearing on exports using Trains 1-4 (including *Sabine Pass*, DOE/FE Order No. 2961-A) and the terms of those individual SPAs. Therefore, SPL may export the volume of LNG authorized for export by this Order from any of the Terminal's Trains 1-6, but may not utilize this authority to exceed the volume limits set forth in prior authorizations regarding Trains 1-4, including in DOE/FE Order No. 2961-A (803 Bcf/yr of natural gas).[331] It follows that use of Trains 1-4 to meet SPL's contractual obligations under the TGPNA or the

[330] *Id*. (emphasis added).
[331] *Sabine Pass*, DOE/FE Order No. 2961-A, at 29.

Centrica SPAs will reduce the volumes of LNG that may be exported using Trains 1-4 for other customers under DOE/FE Order No. 2961-A.

I. Combined FTA and Non-FTA Export Authorization Volumes

Currently, the volumes of LNG authorized for export in SPL's three FTA orders for Trains 5-6 (DOE/FE Order Nos. 3306, 3307, or 3384), and this Order reflect the planned liquefaction capacity of those two liquefaction trains and are not additive to one another. By contrast, the volume of LNG authorized for export in this Order is distinct from, and therefore additive to, the volumes of LNG authorized for export in SPL's FTA and non-FTA orders for Trains 1-4 (DOE/FE Order Nos. 2961, 2833, and 3595). If, however, SPL ultimately chooses to satisfy its delivery obligations under the TGPNA and Centrica SPAs from Trains 1-4 of the Terminal, instead of from Trains 5-6, it will be subject to the maximum LNG export volume approved for Trains1-4 currently set forth in its non-FTA export authorization for those trains, DOE/FE Order No. 2961 (803 Bcf/yr of natural gas), as well as in any other applicable DOE/FE authorizations.

XIV. FINDINGS

On the basis of the findings and conclusions set forth above, we find that it has not been shown that a grant of the requested authorization will be inconsistent with the public interest, and we further find that SPL's three Applications should be granted subject to the Terms and Conditions set forth herein. The following Ordering Paragraphs reflect current DOE/FE practice.

XV. ORDER

Pursuant to section 3 of the Natural Gas Act, it is ordered that:

A. Sabine Pass Liquefaction, LLC is authorized to export domestically produced LNG by vessel from the Sabine Pass LNG Terminal located in Cameron Parish, Louisiana, using

Trains 5 and/or 6, up to the combined total volume of 503.3 Bcf/yr of natural gas for a term of 20 years to commence on the earlier of the date of first commercial export from Train 5 or seven years from the date that this Order is issued (June 26, 2022). SPL is authorized to export this volume of LNG in the following allocation pursuant to one or more long-term contracts (a contract greater than two years): (i) up to 101 Bcf/yr of natural gas pursuant to its Sale and Purchase Agreement with Total Gas & Power North American, Inc.; (ii) up to 88.3 Bcf/yr of natural gas pursuant to its Sale and Purchase Agreement with Centrica plc; and (iii) up to 314 Bcf/yr of natural gas from Trains 5 and 6, which it is authorized to export on its own behalf and as agent for other entities who hold title to the natural gas. SPL may export the volumes of LNG under the two Sale and Purchase Agreements from any of the Terminal's Trains 1-6, subject to any applicable DOE/FE authorization and the terms of those Agreements.

B. The 20-year authorization period will commence when SPL commences commercial export of domestically sourced LNG from Train 5 of the Sabine Pass LNG Terminal, but not before. SPL may export Commissioning Volumes prior to the commencement of the terms of this Order, pursuant to a separate short-term export authorization. The Commissioning Volumes will not be counted against the maximum level of volumes previously authorized in any of SPL's FTA and non-FTA orders, including this Order.

C. SPL may continue exporting for a total of three years following the end of the 20-year export term, solely to export any Make-Up Volume that it was unable to export during the original export period. The three-year Make-Up Period allowing the export of Make-Up Volumes does not affect or modify the total volume of LNG previously authorized for export in any of SPL's FTA and non-FTA orders, including this Order. Insofar as SPL may seek to export

additional volumes not previously authorized for export, it will be required to obtain appropriate authorization from DOE/FE.

D. SPL must commence export operations using the planned liquefaction facilities no later than seven years from the date of issuance of this Order.

E. The LNG export quantity authorized in this Order is equivalent to 503.3 Bcf/yr of natural gas.

F. This LNG may be exported to any country with which the United States does not have a FTA requiring the national treatment for trade in natural gas, which currently has or in the future develops the capacity to import LNG, and with which trade is not prohibited by United States law or policy.

G. SPL shall ensure that all transactions authorized by this Order are permitted and lawful under United States laws and policies, including the rules, regulations, orders, policies, and other determinations of the Office of Foreign Assets Control of the United States Department of the Treasury and FERC. Failure to comply with this requirement could result in rescission of this authorization and/or other civil or criminal remedies.

H. SPL shall ensure compliance with all terms and conditions established by FERC in the EA, including the 65 environmental conditions adopted in the FERC Order. Additionally, this authorization is conditioned on SPL's on-going compliance with any other preventative and mitigative measures at the Sabine Pass LNG Terminal imposed by federal or state agencies.

I. (i) SPL shall file, or cause others to file, with the Office of Oil and Gas Global Security and Supply a non-redacted copy of all executed long-term contracts associated with the long-term export of LNG as agent for other entities from Trains 5 and 6 of the Sabine Pass LNG Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of

their execution. Additionally, if SPL has filed the contracts described in the preceding sentence under seal or subject to a claim of confidentiality or privilege, within 30 days of their execution, SPL shall also file, or cause others to file, for public posting either: i) a redacted version of the contracts described in the preceding sentence, or ii) major provisions of the contracts. In these filings, SPL shall state why the redacted or non-disclosed information should be exempted from public disclosure.

(ii) SPL shall file, or cause others to file, with the Office of Oil and Gas Global Security and Supply a non-redacted copy of all executed long-term contracts associated with the long-term supply of natural gas to the Sabine Pass LNG Terminal. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if SPL has filed the contracts described in the preceding sentence under seal or subject to a claim of confidentiality or privilege, within 30 days of their execution, SPL shall also file, or cause others to file, for public posting either: i) a redacted version of the contracts described in the preceding sentence, or ii) major provisions of the contracts. In these filings, SPL shall state why the redacted or non-disclosed information should be exempted from public disclosure.

J. SPL, or others for whom SPL acts as agent, shall include the following provision in any agreement or other contract for the sale or transfer of LNG exported pursuant to this Order and any other applicable DOE/FE authorization:

> Customer or purchaser acknowledges and agrees that it will resell or transfer LNG purchased hereunder for delivery only to countries identified in Ordering Paragraph F of DOE/FE Order No. 3669, issued June 26, 2015, in FE Docket Nos. 13-30-LNG, 13-42-LNG, and 13-121-LNG, and/or to purchasers that have agreed in writing to limit their direct or indirect resale or transfer of such LNG to such countries. Customer or purchaser further commits to cause a report to be provided to Sabine Pass Liquefaction, LLC that identifies the country of destination, upon delivery, into which the exported LNG was actually delivered, and to include in any resale contract for such LNG the necessary conditions to

insure that Sabine Pass Liquefaction, LLC is made aware of all such actual destination countries.

K. SPL is permitted to use its authorization in order to export LNG as agent for other entities, after registering the other parties with DOE/FE. Registration materials shall include an acknowledgement and agreement by the Registrant to supply SPL with all information necessary to permit SPL to register that person or entity with DOE/FE, including: (1) the Registrant's agreement to comply with this Order and all applicable requirements of DOE/FE's regulations at 10 C.F.R. Part 590, including but not limited to destination restrictions; (2) the exact legal name of the Registrant, state/location of incorporation/registration, primary place of doing business, and the Registrant's ownership structure, including the ultimate parent entity if the Registrant is a subsidiary or affiliate of another entity; (3) the name, title, mailing address, e-mail address, and telephone number of a corporate officer or employee of the registrant to whom inquiries may be directed; and (4) within 30 days of execution, a copy of any long-term contracts not previously filed with DOE/FE, described in Ordering Paragraph I of this Order.

L. Each registration submitted pursuant to this Order shall have current information on file with DOE/FE. Any changes in company name, contact information, change in term of the long-term contract, termination of the long-term contract, or other relevant modification, shall be filed with DOE/FE within 30 days of such change(s).

M. As a condition of this authorization, SPL shall ensure that all persons required by this Order to register with DOE/FE have done so. Any failure by SPL to ensure that all such persons or entities are registered with DOE/FE shall be grounds for rescinding in whole or in part the authorization.

N. Within two weeks after the first export of domestically produced LNG occurs from Train 5 of the Sabine Pass LNG Terminal, SPL shall provide written notification of the date that the first export of LNG authorized in Ordering Paragraph A above occurred.

O. SPL shall file with the Office of Oil and Gas Global Security and Supply, on a semi-annual basis, written reports describing the progress of Trains 5 and 6 of the Sabine Pass LNG Terminal. The reports shall be filed on or by April 1 and October 1 of each year, and shall include information on the progress of Trains 5 and 6, the date these two LNG trains are expected to be operational, and the status of the long-term contracts associated with the long-term export of LNG and any long-term supply contracts.

P. Prior to any change in control of the authorization holder, SPL must obtain the approval of the Assistant Secretary for Fossil Energy. For purposes of this Ordering Paragraph, a "change in control" shall include any change, directly or indirectly, of the power to direct the management or policies of SPL, whether such power is exercised through one or more intermediary companies or pursuant to an agreement, written or oral, and whether such power is established through ownership or voting of securities, or common directors, officers, or stockholders, or voting trusts, holding trusts, or debt holdings, or contract, or any other direct or indirect means.[332]

Q. Monthly Reports: With respect to the LNG exports authorized by this Order, SPL shall file with the Office of Oil and Gas Global Security and Supply, within 30 days following the last day of each calendar month, a report indicating whether exports of LNG have been made. The first monthly report required by this Order is due not later than the 30th day of the month

[332] *See* U.S. Dep't of Energy, Procedures for Changes in Control Affecting Applications and Authorizations to Import or Export Natural Gas, 79 Fed. Reg. 65,641 (Nov. 5, 2014).

following the month of first export. In subsequent months, if exports have not occurred, a report of "no activity" for that month must be filed. If exports of LNG have occurred, the report must give the following details of each LNG cargo: (1) the name(s) of the authorized exporter registered with DOE/FE; (2) the name of the U.S. export terminal; (3) the name of the LNG tanker; (4) the date of departure from the U.S. export terminal; (5) the country (or countries) of destination into which the exported LNG was actually delivered; (6) the name of the supplier/seller; (7) the volume in Mcf; (8) the price at point of export per million British thermal units (MMBtu); (9) the duration of the supply agreement; and (10) the name(s) of the purchaser(s).

(Approved by the Office of Management and Budget under OMB Control No. 1901-0294)

R. All monthly report filings shall be made to U.S. Department of Energy (FE-34), Office of Fossil Energy, Office of Oil and Gas Global Security and Supply, P.O. Box 44375, Washington, D.C. 20026-4375, Attention: Natural Gas Reports. Alternatively, reports may be e-mailed to ngreports@hq.doe.gov or may be faxed to Natural Gas Reports at (202) 586-6050.

S. The motions to intervene submitted by Sierra Club, TGPNA, Centrica, AEA, API, and IECA in FE Docket Nos. 13-30-LNG and 13-42-LNG, and by Sierra Club, APGA, and API in FE Docket No. 13-121-LNG, are granted.

T. The motion to reply filed by Sierra Club on October 23, 2013, in FE Docket Nos. 13-30-LNG and 13-42-LNG is granted.

Issued in Washington, D.C., on June 26, 2015.

Christopher A. Smith
Assistant Secretary
Office of Fossil Energy