

UNITED STATES OF AMERICA  
DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY

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BEAR HEAD LNG CORPORATION and )  
BEAR HEAD LNG (USA), LLC ) FE DOCKET NO. 15-33-LNG

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OPINION AND ORDER GRANTING LONG-TERM, MULTI-CONTRACT  
AUTHORIZATION TO EXPORT U.S.-SOURCED NATURAL GAS BY PIPELINE TO  
CANADA FOR LIQUEFACTION AND RE-EXPORT IN THE FORM OF LIQUEFIED  
NATURAL GAS TO NON-FREE TRADE AGREEMENT COUNTRIES

DOE/FE ORDER NO. 3770

FEBRUARY 5, 2016

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## **FREQUENTLY USED ACRONYMS**

AEO	Annual Energy Outlook
API	American Petroleum Institute
Bcf/d	Billion Cubic Feet per Day
Bcf/yr	Billion Cubic Feet per Year
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon Dioxide
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
EITE	Energy Intensive, Trade Exposed
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
FLEX	Freeport LNG Expansion, L.P., <i>et al.</i>
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNGM	Global Natural Gas Model
GWP	Global Warming Potential
IECA	Industrial Energy Consumers of America
kWh	Kilowatt-Hour
LNG	Liquefied Natural Gas
Mcf	Thousand Cubic Feet
MMBtu	Million British Thermal Units
mtpa	Million Metric Tons per Annum
NED	Proposed Northeast Energy Direct Pipeline
NEES	Northeast Energy Solutions, Inc.
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NERA	NERA Economic Consulting
NGA	Natural Gas Act
NGL	Natural Gas Liquid
NO <sub>x</sub>	Nitrogen Oxides
TRR	Technically Recoverable Resources
VOC	Volatile Organic Compound

## I. INTRODUCTION

On February 25, 2015, Bear Head LNG Corporation and Bear Head LNG (USA), LLC (collectively, Bear Head LNG)<sup>1</sup> filed an application (Application)<sup>2</sup> with the Office of Fossil Energy (FE) of the Department of Energy (DOE) under section 3 of the Natural Gas Act (NGA).<sup>3</sup> The Application requests long-term, multi-contract authorization to export natural gas from the United States to Canada and, after liquefaction in Canada, to re-export<sup>4</sup> the U.S.-sourced natural gas in the form of liquefied natural gas (LNG) to other countries as described below, in a combined total volume equivalent to 440 billion cubic feet per year (Bcf/yr) of natural gas, or 1.2 Bcf per day (Bcf/d). Bear Head LNG states that the natural gas will be exported to Canada at the United States-Canada border near Calais, Maine, and St. Stephen, New Brunswick, respectively, on the Maritimes & Northeast (M&N) Pipeline).<sup>5</sup>

Bear Head LNG seeks to export this volume of natural gas for the following purposes:

- (i) To use approximately 42.4 Bcf/yr as feedstock in a proposed Canadian natural gas liquefaction facility called the Bear Head LNG export terminal (Bear Head Project or the Project), currently being developed by Bear Head LNG within the

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<sup>1</sup> Bear Head LNG Corporation is a Canadian company incorporated pursuant to the laws of Nova Scotia. Bear Head (USA) is a Delaware limited liability company. Both are wholly-owned indirect subsidiaries of Liquefied Natural Gas Limited, a publicly listed Australian company. *See infra* § IV(A).

<sup>2</sup> Bear Head LNG Corporation and Bear Head LNG (USA), LLC, Application for Long-Term Authorizations to Export Natural Gas to Canada and to Export Liquefied Natural Gas from Canada to Free Trade Agreement and Non-Free Trade Agreement Nations, FE Docket No. 15-33-LNG (Feb. 25, 2015) [hereinafter Bear Head LNG App.]. Bear Head LNG also filed three Project Update Letters, as described *infra* § IV(C). The information contained in those supplements is reflected in the description of the Application herein.

<sup>3</sup> 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. 00-006.02 issued on November 17, 2014.

<sup>4</sup> For purposes of this Order, “re-export” means to ship or transmit U.S.-sourced natural gas in its various forms (gas, compressed, or liquefied) subject to DOE/FE’s jurisdiction under the Natural Gas Act, 15 U.S.C. § 717b, from one foreign country (*i.e.*, a country other than the United States) to another foreign country.

<sup>5</sup> According to Bear Head LNG, the M&N US Pipeline system is a 690-mile long cross-border pipeline owned and operated by Maritimes & Northeast Pipeline, L.L.C., a Delaware limited liability company (Maritimes) in the United States, and by Maritimes’s Canadian pipeline affiliate, Maritimes & Northeast Pipeline Limited Partnership, in Canada.

Point Tupper/Bear Head Industrial Park near the town of Port Hawkesbury, on the Strait of Canso, in Richmond County, Cape Breton, Nova Scotia, Canada;<sup>6</sup>

- (ii) To use approximately 397.6 Bcf/yr of natural gas (1.1 Bcf/d)—the equivalent of eight million metric tons per annum (mtpa) of LNG—as feedstock in the Bear Head Project, where the U.S.-sourced natural gas will be liquefied, then re-exported in the form of LNG by vessel from Nova Scotia, Canada, to:
  - (a) Any country with which the United States has, or in the future enters into, a free trade agreement (FTA) requiring national treatment for trade in natural gas (FTA countries),<sup>7</sup> and
  - (b) Any other country with which trade is not prohibited by U.S. law or policy (non-FTA countries).<sup>8</sup>

The Bear Head Project will have four LNG trains, each with a nominal LNG production capacity of two mtpa of LNG, providing an initial total LNG production capacity of 8 mtpa of LNG.<sup>9</sup>

On July 16, 2015, in DOE/FE Order No. 3681, DOE/FE granted the portion of Bear Head LNG’s Application requesting long-term authority to export U.S.-sourced natural gas to Canada

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<sup>6</sup> See Bear Head LNG App. at 1 n.3 (“[A]pproximately 42.4 Bcf/y of the natural gas volume ... will be consumed in Canada and not exported as LNG.”).

<sup>7</sup> The United States currently has FTAs requiring national treatment for trade in natural gas with Australia, Bahrain, Canada, Chile, Colombia, Dominican Republic, El Salvador, Guatemala, Honduras, Jordan, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, Republic of Korea, and Singapore. FTAs with Israel and Costa Rica do not require national treatment for trade in natural gas.

<sup>8</sup> See Bear Head LNG App. at 2, 11.

<sup>9</sup> On January 23, 2015, Bear Head LNG filed a separate application with DOE/FE in FE Docket No. 15-14-NG requesting authorization to access certain Canadian natural gas supplies, in a volume up to 250 Bcf/yr, which it states must flow through the United States due to the configuration of existing North American pipeline infrastructure. Bear Head LNG App. at 2-3 n.7. Concurrently with this Order, DOE/FE is issuing an order dismissing that application because Bear Head LNG’s proposed “in-transit” shipments of Canadian-sourced natural gas solely between Canadian points are outside of DOE’s jurisdiction under NGA section 3. See *Bear Head LNG Corporation & Bear Head LNG (USA), LLC*, DOE/FE Order No. 3769, FE Docket No. 15-14-NG, Opinion and Order Dismissing Application for In-Transit Shipments of Canadian-Sourced Natural Gas and Directing Submission of Information Concerning In-Transit Shipments Returning to the Country of Origin (Feb. 5, 2016).

and to other FTA countries, pursuant to NGA section 3(c), 15 U.S.C. § 717b(c).<sup>10</sup> Under the terms of that FTA order, Bear Head LNG is authorized to export natural gas to Canada by pipeline for end use<sup>11</sup> in Canada, and to re-export the U.S. sourced natural gas, after liquefaction in Canada, to other FTA countries for end use in FTA countries, in a total combined volume of 440 Bcf/yr of natural gas (the same volume requested in the non-FTA portion of the Application).<sup>12</sup>

In this Order, we review the portion of the Application requesting long-term authorization to export U.S.-sourced natural gas by pipeline to Canada for liquefaction and re-export in the form of LNG from Canada to non-FTA countries, pursuant to NGA section 3(a), 15 U.S.C. § 717b(a). Bear Head LNG requests this export authorization for a 25-year term to commence on the earlier of the date of first export or 10 years from the date the authorization is granted (February 5, 2026). Bear Head LNG also requests this authorization on its own behalf and as agent for other entities that will hold title to the LNG at the time of export (or re-export).<sup>13</sup>

For the reasons discussed below, this Opinion and Order grants Bear Head LNG's Application in a modified volume up to the equivalent of 296 Bcf/yr of natural gas (0.81 Bcf/d)—the existing capacity of the M&N US Pipeline at the cross-border facilities. This volume is less than the total export volume requested by Bear Head LNG (440 Bcf/yr, or 1.2 Bcf/d), but there is no basis for DOE/FE to authorize exports of natural gas (or re-exports of U.S.-sourced gas in the form of LNG) in a volume greater than the M&N US Pipeline's existing

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<sup>10</sup> *Bear Head LNG Corp. & Bear Head LNG (USA), LLC*, DOE/FE Order No. 3681, FE Docket No. 15-33-LNG, Order Granting Long-Term, Multi-Contract Authorization to Export Natural Gas to Canada and to Other Free Trade Agreement Nations (July 16, 2015) [hereinafter *Bear Head LNG FTA Order*], *discussed infra* § IV.C (Procedural History).

<sup>11</sup> For purposes of DOE/FE Order No. 3681 and this Order, “end use” is defined as combustion or other chemical reaction conversion process (*e.g.*, conversion to methanol). *See* *Bear Head LNG FTA Order* at 3 n.9.

<sup>12</sup> *See id.* at 3, 12.

<sup>13</sup> *Bear Head LNG App.* at 11.

capacity,<sup>14</sup> nor have the environmental impacts of expanding the M&N US Pipeline been studied as would be required by NEPA. We note that this proceeding presents the unusual circumstance of an applicant proposing to export volumes that exceed the capacity of the single pipeline essential to completing the transportation central to the re-export proposal.

Accordingly, we emphasize that this authorization is limited to volumes that can be exported using the existing capacity of the M&N US Pipeline at the cross-border facilities.

As discussed in Section XI.C.1, we find that the current capacity of the cross-border facilities of the M&N US Pipeline is 833,317 dekatherms per day (Dth/d), as set forth in two orders issued to Maritimes & Northeast Pipeline, L.L.C. (Maritimes) by the Federal Energy Regulatory Commission (FERC) in 2007 and 2009, respectively.<sup>15</sup> The 2007 and 2009 FERC Orders do not clearly establish the capacity of the other segments of the M&N US Pipeline that would be used to transport natural gas in a northerly direction from Dracut, Massachusetts, to the cross-border facilities. The Application states that the capacity of M&N Pipeline's capacity is 833,317 Dth/d,<sup>16</sup> but this assertion is not supported by evidence demonstrating the capacity of the Pipeline to transport natural gas north from Dracut. It may be, as one intervenor has alleged, that Maritimes will be incentivized to make capacity additions partly or wholly in response to the demand enabled by this and similar export authorizations. Those facts cannot be ascertained on the record before us. Insofar, however, as DOE/FE export authorizations are likely to lead to the expansion of the capacity of the M&N US Pipeline or the construction or expansion of other

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<sup>14</sup> See *id.* at 1 n.4 (“Bear Head LNG anticipates that the natural gas will be exported at the U.S.-Canada border ... on the Maritimes Northeast Pipeline ...”).

<sup>15</sup> See Maritimes & Northeast Pipeline, L.L.C., Order Amending Presidential Permit and Authorization Under Section 3 of the Natural Gas Act, 128 FERC ¶ 61,070 (July 21, 2009) [hereinafter FERC 2009 Order]; Maritimes & Northeast Pipeline, L.L.C., Order Issuing Certificate and Amending Presidential Permit, 118 FERC ¶ 61,137 (Feb. 21, 2007) [hereinafter FERC 2007 Order].

<sup>16</sup> Bear Head LNG App. at 5 n.18 (“Existing capacity on the U.S. portion of the M&NP system is 833,317 MMBtu/d, including at the existing cross-border facilities previously authorized by FERC to be used for the additional purpose of exporting gas to Canada.”).

cross-border pipelines for purposes of non-FTA exports, DOE/FE is responsible for assessing the impacts of such expansions as part of its public interest review under NGA section 3(a) and NEPA.

Therefore, to ensure that DOE/FE has an opportunity to review the public interest and environmental impacts of any such capacity additions or the use of other existing pipelines, this authorization requires Bear Head LNG to submit a new export application with DOE/FE should it propose to export natural gas using new capacity not presently in existence on the M&N US Pipeline, or if it proposes to use capacity on newly constructed or upgraded cross-border pipelines.<sup>17</sup> Pipeline capacity will be considered “new” or “upgraded” for purposes of this limitation if it is the result of physical changes that increase the northbound capacity of such a pipeline and any such changes require an amendment to the pipeline’s certificate issued by FERC under NGA section 7, 15 U.S.C. §717f. In the event that such a certificate proceeding is required and a new application is filed, DOE may participate in the FERC-led NEPA review, as it typically does in proceedings involving LNG export facilities pursuant to NGA section 15, 15 U.S.C. §717n.

**DOE/FE Proceeding.** On April 16, 2015, DOE/FE published a Notice of Bear Head LNG’s Application in the Federal Register.<sup>18</sup> The Notice of Application called on interested

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<sup>17</sup> Concurrently with this Order, we are issuing an order to Pieridae Energy (USA), Ltd. (Pieridae US) granting it similar long-term authority to export U.S.-sourced natural gas through Canada to non-FTA countries (and/or to FTA countries for end use in non-FTA countries) after liquefaction in Canada. *See Pieridae Energy (USA), Ltd.*, DOE/FE Order No. 3768, FE Docket No. 14-179-LNG, Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export U.S.-Sourced Natural Gas by Pipeline to Canada for Liquefaction and Re-Export in the Form of Liquefied Natural Gas to Non-Free Trade Agreement Countries (Jan. 29, 2015). Because both Pieridae US and Bear Head LNG propose to use the M&N US Pipeline to transport U.S.-sourced natural gas to Canada, we are limiting the combined authorized export volume in this Order and the Pieridae order (DOE/FE No. 3768) to a total of 0.81 Bcf/d of natural gas—the capacity of the cross-border facilities and the existing Presidential Permit. We are attaching a similar condition to the Pieridae US authorization requiring the submission of a new export application should the M&N US Pipeline seek to increase its capacity in the future due in whole or in part to export operations. Therefore, the non-FTA export volumes in this Order and the Bear Head LNG order are not additive to one another.

<sup>18</sup> Bear Head LNG Corporation and Bear Head LNG (USA), LLC; Application for Long-Term, Multi-Contract Authorization To Export Domestically Produced Natural Gas Through Canada to Non-Free Trade Agreement

persons to submit protests, motions to intervene, notices of intervention, and comments no later than 4:30 p.m., Eastern time, on June 15, 2015. In response to the Notice of Application, DOE/FE did not receive any comments. DOE/FE received two timely-filed motions for leave to intervene: one filed by Northeast Energy Solutions, Inc. (NEES), which opposed the Application, requested suspension of consideration of Bear Head LNG's Application (and all other pending LNG export applications); and asked DOE/FE to direct additional procedures concerning the Application; and one filed by Saint John Gas Marketing Company (Saint John Gas), which took no position on the Application. Additional procedural history is set forth below. *See infra* § IV.D.

Previously, on May 20, 2011, DOE/FE issued *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 2961 (*Sabine Pass*), the Department's first order conditionally granting a long-term authorization to export LNG produced in the lower-48 states to non-FTA countries.<sup>19</sup> In that order, DOE/FE conditionally authorized Sabine Pass to export a volume of LNG equivalent to 2.2 Bcf/d of natural gas.

By August 2011, with 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.<sup>20</sup> Accordingly, DOE/FE

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Countries After Liquefaction for a 25-Year Term, 80 Fed. Reg. 20,482 (Apr. 16, 2015) [hereinafter Bear Head LNG Notice of Application].

<sup>19</sup> *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) [hereinafter *Sabine Pass*]. In August 2012, DOE/FE granted final authorization. *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 Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (Aug. 7, 2012).

<sup>20</sup> 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.<sup>21</sup>

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.<sup>22</sup> 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* (EIA Study), in January 2012.<sup>23</sup> 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.<sup>24</sup> Among its key findings, NERA projected that the United States would gain net economic benefits from

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<sup>21</sup> 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](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).

<sup>22</sup> 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* §§ V.A.1, VIII.A.

<sup>23</sup> See 2012 LNG Export Study – Related Documents, available at <http://energy.gov/fe/downloads/lng-export-study-related-documents> (EIA Analysis (Study - Part 1)).

<sup>24</sup> See *id.* (NERA Economic Consulting Analysis (Study - Part 2)).

allowing LNG exports. For every market scenario examined, net economic benefits increased as the level of LNG exports increased.<sup>25</sup>

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).<sup>26</sup> DOE/FE invited public comment on the LNG Export 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.<sup>27</sup> The NOA required initial comments by January 24, 2013, and reply comments between January 25 and February 25, 2013.<sup>28</sup> DOE/FE received over 188,000 initial comments and over 2,700 reply comments, of which approximately 800 were unique.<sup>29</sup> 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 2012 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 records of several then-pending non-FTA LNG export proceedings.<sup>30</sup> As discussed below,

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<sup>25</sup> See *infra* § V.B.

<sup>26</sup> 77 Fed. Reg. at 73,627.

<sup>27</sup> *Id.* at 73,628.

<sup>28</sup> *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.

<sup>29</sup> 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](http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_initial_comments.html) (Initial Comments – 2012 LNG Export Study) & [http://www.fossil.energy.gov/programs/gasregulation/authorizations/export\\_study/export\\_study\\_reply\\_comments.html](http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_reply_comments.html) (Reply Comments – 2012 LNG Export Study).

<sup>30</sup> See 77 Fed. Reg. at 73,629 & n.4.

DOE/FE has carefully examined the comments and has considered them in its review of Bear Head LNG's Application.

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 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).<sup>31</sup> 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.

On June 4, 2014, DOE/FE issued a notice in the *Federal Register* proposing to evaluate different environmental aspects of the LNG production chain. Specifically, 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*

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<sup>31</sup> 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.

(Draft Addendum).<sup>32</sup> 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.<sup>33</sup> *See infra* § IX.

DOE/FE has taken all public comments on the Addendum and the LCA GHG Report into consideration in this decision and has made those comments, as well as the underlying studies, part of the record in this proceeding.<sup>34</sup> 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 they will inform its review of the public interest under NGA section 3(a), and are responsive to concerns previously raised in connection with non-FTA LNG export proceedings.

**DOE/FE's Categorical Exclusion Under NEPA.** On January 28, 2016, DOE/FE issued a categorical exclusion from the preparation of an environmental impact statement or environmental assessment under NEPA for the exports proposed in the Application. (Categorical Exclusion).<sup>35</sup> Specifically, DOE/FE applied categorical exclusion B5.7 of DOE/FE's regulations (10 C.F.R. Part 1021, Subpart D, Appendix B5). This exclusion applies to natural gas import or export activities requiring minor operational changes to existing projects, but no new construction. As discussed below, this Order grants Bear Head LNG's Application, in part, on the basis of this Categorical Exclusion, but does not apply to any future construction or operational changes to expand the capacity of the M&N US Pipeline or other facilities located within the United States caused either in whole or in part by Bear Head LNG's export operations.

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<sup>32</sup> 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.

<sup>33</sup> 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) [hereinafter Addendum].

<sup>34</sup> *See* Bear Head LNG Notice of Application, 80 Fed. Reg. at 20,483.

<sup>35</sup> U.S. Dep't of Energy, Categorical Exclusion Determination, *Bear Head LNG Corporation and Bear Head LNG (USA), LLC*, FE Docket No. 15-33-LNG (Jan. 28, 2016) [hereinafter Categorical Exclusion].

## **II. SUMMARY OF FINDINGS AND CONCLUSIONS**

This Order presents DOE/FE's findings and conclusions on all issues associated with Bear Head LNG's proposed exports under NGA section 3(a), both environmental and non-environmental.<sup>36</sup> As the basis for this Order, DOE/FE has reviewed a substantial administrative record that includes (but is not limited to) Bear Head LNG's Application and Appendices A through F, and three project letter updates; the single protest to the Application filed by NEES; Saint John Gas's motion to intervene taking no position on the Application; the 2012 LNG Export Study, the Addendum, the LCA GHG Report, and public comments received on DOE/FE's various analyses. Based on that record and the reasons set forth below, DOE/FE has determined that NEES has not demonstrated that the proposed exports will be inconsistent with the public interest, as would be required to deny the Application in full under NGA section 3(a).

On this basis, DOE/FE authorizes Bear Head LNG to export U.S.-sourced natural gas for the purpose of liquefying the gas in Canada and re-exporting that natural gas in the form of LNG from the proposed Bear Head Project to non-FTA countries (or for end use in non-FTA countries) in a volume equivalent to 0.81 Bcf/d of natural gas, reflecting the existing capacity of the M&N US Pipeline. Because the authorization issued by this Order falls within the scope of a categorical exclusion under NEPA, it is subject to the Terms and Conditions and Ordering Paragraphs set forth herein, but is not conditioned on additional environmental analysis or review. *See infra* §§ XII-XIV.

## **III. PUBLIC INTEREST STANDARD**

Section 3(a) of the NGA sets forth the standard for review of Bear Head LNG's Application:

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<sup>36</sup> As discussed below, the non-environmental issues primarily include economic and international impacts associated with the proposed exports, as well as security of the natural gas supply in the United States. *See infra* § III (public interest standard).

[N]o person shall export any natural gas from the United States to a foreign country or import any natural gas from a foreign country without first having secured an order of the [Secretary of Energy<sup>37</sup>] 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 the presumption is rebutted by an affirmative showing of inconsistency with the public interest.<sup>38</sup>

Although 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,<sup>39</sup> among others. To conduct this review, DOE/FE looks to record evidence developed in the application proceeding.<sup>40</sup>

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<sup>37</sup> 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.

<sup>38</sup> See, e.g., *Sabine Pass*, Order No. 2961, at 28; *Phillips Alaska Natural Gas Corp. & Marathon Oil Co.*, DOE/FE Order No. 1473, Order Extending Authorization to Export Liquefied Natural Gas from Alaska, at 13 (April 2, 1999), citing *Panhandle Producers & Royalty Owners Ass'n v. ERA*, 822 F.2d 1105, 1111 (D.C. Cir. 1987)).

<sup>39</sup> Insofar as environmental impacts are concerned, we note that the rebuttable presumption in section 3(a) may affect DOE/FE's ultimate judgment whether to grant or deny an application, but it does not affect DOE's obligations under NEPA. NEPA places an independent obligation on DOE to obtain information relating to the environmental impacts that may result from its decisions and to take a “hard look” at those impacts pursuant to 42 U.S.C. § 4332. The rebuttable presumption has no bearing on these NEPA obligations and consequently does not affect DOE's performance of those obligations in individual proceedings.

<sup>40</sup> See, e.g., *Sabine Pass*, DOE/FE Order No. 2961, at 27-42 (reviewing record evidence in issuing conditional authorization).

DOE/FE's prior decisions have also looked to certain principles established in its 1984 Policy Guidelines.<sup>41</sup> 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] gas . . . . The federal government's primary responsibility in authorizing imports [or exports] should 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.<sup>42</sup>

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.<sup>43</sup>

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 section 3 of the NGA, 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."<sup>44</sup> In February 1989, the Assistant Secretary for Fossil Energy assumed the delegated responsibilities of the Administrator of ERA.<sup>45</sup>

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 proposed to be exported, (ii) whether the proposed exports pose a threat to the security of

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<sup>41</sup> New Policy Guidelines and Delegations Order Relating to Regulation of Imported Natural Gas, 49 Fed. Reg. 6684 (Feb. 22, 1984) [hereinafter 1984 Policy Guidelines].

<sup>42</sup> *Id.* at 6685.

<sup>43</sup> *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, 71,128 (1989)).

<sup>44</sup> DOE Delegation Order No. 0204-111, at 1; *see also* 49 Fed. Reg. at 6690.

<sup>45</sup> *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)).

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**

In the portion of the Application subject to this Order, Bear Head LNG requests long-term, multi-contract authorization to export up to 440 Bcf/yr of U.S.-sourced natural gas by pipeline to Canada, where Bear Head LNG intends to: (i) consume approximately 42.4 Bcf/yr of the U.S.-sourced natural gas in Canada; and (ii) liquefy the remaining portion of U.S.-sourced natural gas—approximately 397.6 Bcf/yr—at the proposed Bear Head Project, then re-export the U.S.-sourced natural gas in the form of LNG by vessel to non-FTA countries. Bear Head LNG requests this authority, on its own behalf and as agent for other entities that will hold title to the natural gas and/or LNG, for a 25-year term to commence on the earlier of the date of first export or 10 years from the date of this Order.<sup>46</sup>

##### **A. Description of Applicants**

Bear Head LNG Corporation is a Canadian company incorporated pursuant to the laws of Nova Scotia. Bear Head LNG (USA), LLC is a Delaware limited liability company. Both have their principal place of business in Houston, Texas, and both are wholly-owned indirect subsidiaries of Liquefied Natural Gas Limited (LNGL).

LNGL is a publicly listed Australian company based in Perth, Australia. According to Bear Head LNG, LNGL's objective is to develop LNG projects in both Australia and international markets, focusing on mid-scale LNG projects that use its Optimised Single Mixed Refrigerant (OSMR<sup>®</sup>) process.<sup>47</sup> In addition to the Bear Head Project, LNGL's portfolio

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<sup>46</sup> Bear Head LNG App. at 1-2 & n.3.

<sup>47</sup> See Bear Head LNG App. at 6.

includes 100 percent ownership of both the proposed Magnolia LNG Project to be located in Louisiana, and the Fisherman's Landing LNG Project to be located in Australia.

### **B. Liquefaction Project**

Bear Head LNG states that it is proposing the Bear Head Project for the purpose of liquefying surplus North American natural gas for export as LNG to foreign markets. According to Bear Head LNG, the proposed exports of U.S.-sourced natural gas would be made from a point at the United States/Canada border located near Calais, Maine/St. Stephen, New Brunswick on the M&N US Pipeline. Bear Head LNG anticipates that the M&N Pipeline system will interconnect with a proposed pipeline header near Goldsboro, Nova Scotia, for the delivery of natural gas feedstock to the Bear Head Project.<sup>48</sup>

According to Bear Head LNG, the Project is situated at the 255-acre site owned by Bear Head Corp. and located within the Point Tupper/Bear Head Industrial Park, near the town of Hawkesbury, on the Strait of Canso in Richmond County, Cape Breton, Nova Scotia. Bear Head LNG states that the Project site previously was permitted for Bear Head Corp.'s proposed LNG import facility, but due to changed market conditions, construction was halted. Bear Head LNG states that, due to this project history, the site requires only minor modifications of certain existing initial permits and regulatory approvals issued by Canadian Federal, Nova Scotia Provincial, and Richmond County administrative bodies.<sup>49</sup>

Bear Head LNG states that the Project will include the following major components: four LNG liquefaction trains with OSMR<sup>®</sup> technology, LNG ship berthing marine facilities, and two LNG storage tanks, each with a volume of approximately 180,000 cubic meters. Each of the

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<sup>48</sup> *See id.* at 5.

<sup>49</sup> In the Application, Bear Head LNG states that it holds eight of the 10 initial Canadian project approvals. As discussed herein, however, Bear Head LNG subsequently informed DOE/FE that it has since received the two remaining Canadian project approvals.

four liquefaction trains will have a nominal production capacity of two mtpa, for a total LNG production capacity of eight mtpa of natural gas.<sup>50</sup>

Bear Head LNG states that the Project, once constructed, will be capable of receiving, processing, and liquefying North American natural gas, storing LNG, and loading LNG onto ocean-going vessels for delivery to foreign markets. Bear Head LNG further states that the construction work previously completed at the brownfield site has allowed Bear Head LNG to expedite the Project's development timeframe, and that engineering and design work for the Project is in advanced stages.<sup>51</sup> Bear Head LNG expects to commence exporting LNG from the Project to foreign markets in 2019.

### **C. M&N Pipeline**

Bear Head LNG intends to export the U.S.-sourced natural gas subject to the requested authorization from the United States to Canada via the M&N Pipeline. According to Bear Head LNG, the M&N Pipeline is a 690-mile long, cross-border pipeline, with 338 miles located in the United States and 352 miles located in Canada. The Pipeline traverses from a point near Goldboro, Nova Scotia, to the United States-Canada border, and through the states of Maine and New Hampshire. It has one terminus in Dracut, Massachusetts, and another terminus in Beverly, Massachusetts.<sup>52</sup>

Bear Head LNG states that the M&N Pipeline's current operations involve moving natural gas from Canada to the United States (*i.e.*, north to south), such that an "operational reversal" of the Pipeline would be required to enable the proposed exports of U.S.-sourced natural gas to flow on a firm basis from south to north (*i.e.*, from the Dracut, Massachusetts

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<sup>50</sup> Bear Head LNG states that it anticipates expanding the Project through the addition of two LNG trains, to increase total LNG production capacity from 8 to 12 mtpa. However, it anticipates that the natural gas supply to support this expansion would be derived strictly from Canadian sources. Bear Head LNG App. at 12 n.33.

<sup>51</sup> *See id.* at 13.

<sup>52</sup> *See supra* n.5; Bear Head LNG App. at 1 n.4.

delivery point to the Project pipeline header in Nova Scotia). Bear Head LNG further asserts that “[e]xisting capacity on the U.S. portion of the M&NP system is 833,317 MMBtu/d, including at the existing cross-border facilities previously authorized by FERC [in FERC’s 2009 Order] to be used for the additional purpose of exporting gas to Canada.”<sup>53</sup>

In support of its statements regarding the M&N Pipeline, Bear Head LNG filed, as Appendix G to the Application, a report by engineering and construction group SNC-Lavalin entitled, *Anticipated Maritimes & Northeast Pipeline System Modification/Expansion Requirements*, dated February 2015 (MN&P Requirements Report). Bear Head LNG states that it filed this report under seal as privileged and confidential information to protect its competitive advantage and business interests.<sup>54</sup> Citing the M&NP Requirements Report, Bear Head LNG states that, “with minor modification of the existing facilities, incremental reverse capacity would be available on the M&NP to transport significant gas volumes from Dracut, MA to the U.S.-Canada border.”<sup>55</sup> Bear Head LNG further asserts that, “[w]ith the addition of compression and looping of the system, incremental reverse capacity would be available to accommodate the full volume of Bear Head LNG’s proposed natural gas exports to the U.S.-Canada border.”<sup>56</sup>

Bear Head LNG “acknowledges that modification and even expansion of the M&NP system is likely required to enable feedstock gas deliveries to the Project,” but contends that “the precise nature of those changes is unknown.”<sup>57</sup> According to Bear Head LNG, “the precise nature and location of the required changes to accommodate the volume increase of bi-directional gas flow cannot be determined until Bear Head LNG finalizes commercial

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<sup>53</sup> See *id.* at 18; *supra* at n.15.

<sup>54</sup> Bear Head LNG App. at 5 n.17.

<sup>55</sup> *Id.* at 5 n.18.

<sup>56</sup> *Id.*

<sup>57</sup> *Id.* at 10.

arrangements with customers of the Project.”<sup>58</sup> Bear Head LNG states that, at this time, it has not entered into any agreements with Maritimes relating to the modification or expansion of the M&N Pipeline system, nor is it aware of a pending proposal by Maritimes for such modification or expansion.<sup>59</sup>

Bear Head LNG also states that it “is aware that several major pipeline companies further upstream are actively contemplated or seeking FERC authorizations as necessary to expand their pipeline capacity to deliver gas to the Northeast,” but asserts that “none of those plans are proposed in connection with the Bear Head Project.”<sup>60</sup>

#### **D. Procedural History**

Pertinent procedural history concerning Bear Head LNG’s Application is summarized below.

**First Project Update Letter.** On April 7, 2015, Bear Head LNG supplemented its Application with its first Project Update Letter. Bear Head LNG informed DOE/FE (in relevant part) that, in March 2015, the Nova Scotia Utility and Review Board issued Bear Head LNG Corporation an updated and amended “Permit to Construct.” According to Bear Head LNG, the Permit to Construct is the ninth, and next to last, initial regulatory approval necessary to commence construction of the Bear Head Project.<sup>61</sup>

**Second Project Update Letter.** On May 29, 2015, Bear Head LNG filed its second Project Update Letter. Bear Head LNG informed DOE/FE that, on May 15, 2015, Nova Scotia Environment approved an updated provincial Environmental Assessment for the development of

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<sup>58</sup> *Id.* at 50.

<sup>59</sup> *Id.* at 50-51 n.229.

<sup>60</sup> Bear Head LNG App. at 10.

<sup>61</sup> Bear Head LNG Corporation & Bear Head LNG (USA), LLC, Project Update Letter, FE Docket No. 15-33-LNG, at 1 (Apr. 7, 2015).

the Bear Head Project.<sup>62</sup> Bear Head LNG states that this approval marks the tenth and final initial regulatory approval necessary to commence construction of the Project.

Bear Head LNG further states that, similar to the FERC environmental review process in the United States, the collective environmental review performed in awarding the 10 Canadian initial regulatory approvals involves, among other things, a review of Project impacts on the environment, wildlife, wetlands, air quality, and safety. Bear Head LNG thus asserts that its Application now “stands in *pari passu* with those applications for LNG exports from U.S. projects that have obtained an order from FERC pursuant to Section 3 of the Natural Gas Act ....”<sup>63</sup>

**FTA Order (DOE/FE Order No. 3681).** On July 17, 2015, in DOE/FE Order No. 3681, DOE/FE authorized Bear Head LNG to “export U.S.-sourced natural gas by pipeline from the United States to Canada for end use in Canada and/or, after liquefaction in Canada, by vessel from the proposed Bear Head Project ... to FTA countries for end use in FTA countries.”<sup>64</sup> Under the terms of that Order, Bear Head LNG is authorized to act on its own behalf and as agent for other entities who hold title to the natural gas. The total combined volume authorized in the FTA order is up to the equivalent of 440 Bcf/yr of natural gas for a 25-year term, beginning on the earlier of the date of first export or 10 years from the date the authorization was issued (July 16, 2025). As set forth below, the volumes authorized for export (or re-export) in the FTA order and this Order are not additive to one another. *See infra* § XII.G.

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<sup>62</sup> Bear Head LNG Corporation & Bear Head LNG (USA), LLC, Project Update Letter, FE Docket No. 15-33-LNG, at 1 (May 29, 2015).

<sup>63</sup> *Id.* at 2.

<sup>64</sup> *Bear Head LNG*, DOE/FE Order No. 3681, *supra* n.10, at 12 (Ordering Para. A); *see also Bear Head LNG Corporation & Bear Head LNG (USA), LLC*, Errata to DOE/FE Order No. 3681, FE Docket No. 15-33-LNG (July 21, 2015).

**Third Project Update Letter.** In the third update letter, submitted on August 18, 2015, Bear Head LNG states that, on August 13, 2015, the Canadian National Energy Board approved its application for a license to import natural gas to, and export LNG from, Canada. Bear Head LNG asks DOE/FE to grant the requested non-FTA export authorization no later than September 17, 2015, so that it may proceed with the development of the Bear Head Project.

**E. Source of Natural Gas**

Bear Head LNG states that natural gas can be sourced from basins throughout North America, including Eastern and Western Canada, and the Appalachian, Gulf of Mexico, and Rocky Mountain regions of the United States, thus providing the Bear Head Project with “tremendous supply diversity and optionality.”<sup>65</sup> Citing its interconnection with the M&N Pipeline, Bear Head LNG further states that the Project will have access to competitively-priced natural gas supplies from “almost any point” on the North American natural gas pipeline grid through direct physical delivery or by displacement.<sup>66</sup>

Bear Head LNG states that the Appalachian basin, which encompasses both the Marcellus and Utica supply regions, is well situated to provide a large portion of the natural gas requirements of eastern Canada through 2050, including the natural gas needed for the requested export volumes. According to Bear Head LNG, U.S. supply of natural gas from both the Rockies and Gulf regions are also potential sources of natural gas feedstock for the Project through the expansive North American pipeline grid. In support of these statements, Bear Head LNG cites a report prepared in November 2014 for Bear Head LNG by Ziff Energy, and attached to the Application as Appendix D. This report, entitled *Long-Term Natural Gas Supply and*

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<sup>65</sup> Bear Head LNG App. at 14-15.

<sup>66</sup> *Id.* at 15.

*Demand Forecast to 2050 for Bear Head LNG*, analyzes North American supply and demand dynamics through the year 2050.<sup>67</sup>

#### **F. Business Model**

Bear Head LNG requests authorization to export natural gas and LNG on its own behalf and as agent for other entities that will hold title to the LNG at the time of export. Bear Head LNG states that it will comply with all DOE/FE requirements for exporters and agents, as set forth in DOE/FE precedent and described in the Application.<sup>68</sup>

Bear Head LNG anticipates that it will utilize a tolling commercial structure for the Bear Head Project. According to Bear Head LNG, customers of the Project will be responsible under the relevant liquefaction tolling agreements to procure natural gas supply, as well as natural gas pipeline transportation capacity for the delivery of natural gas to the Project.

Bear Head LNG states that it has not yet entered into long-term natural gas supply or long-term export contracts in connection with the requested authorization, but will submit to DOE/FE any such contracts, once executed, in accordance with DOE/FE's filing requirements.

#### **G. Environmental Review**

Bear Head LNG asserts that, because the proposed Bear Head Project does not involve the construction of any facilities in the United States, the Project will not give rise to cognizable environmental effects under the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321, *et seq.* Specifically, Bear Head LNG urges DOE/FE to apply categorical exclusion B5.7, *Import or export natural gas, with operational changes*, which applies to “[a]pprovals ... of new authorizations ... to ... export natural gas under section 3 of the Natural Gas Act that involve

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<sup>67</sup> *Id.* at 15-16, 3 n.12 (citing Appendix D, Ziff Energy, *Long-Term Natural Gas Supply & Demand Forecast to 2050 for Bear Head LNG* (Nov. 2014) [hereinafter Ziff Report]).

<sup>68</sup> *See* Bear Head LNG App. at 11.

minor operational changes (such as changes in natural gas throughput, transportation, and storage) but not new construction.”<sup>69</sup>

Bear Head LNG contends that this categorical exclusion applies to its requested authorization because the “precise nature” of any modifications or expansions to the M&N Pipeline system are currently unknown—and may remain unknown until such time as Bear Head LNG’s customers enter into commercial arrangements for natural gas supply and firm pipeline transportation—and therefore the Application does not involve the construction or operation of any pipeline facilities in the United States. Additionally, the proposed liquefaction facility—the Bear Head Project—is located in Canada, and therefore the Application does not involve the construction or operation of any LNG export facilities in the United States. For these reasons, Bear Head LNG asserts that it is appropriate for DOE/FE to categorically exclude the proposed action from the preparation of an environmental assessment or an environmental impact statement under NEPA.<sup>70</sup>

In support of its position, Bear Head LNG argues, among other things, that: (i) there are no extraordinary circumstances related to the Application indicating that further environmental review is warranted, (ii) DOE/FE has applied categorical exclusion B5.7 in the context of other proposed LNG exports from the United States, (iii) DOE’s precedent indicates that NEPA’s reach does not extend beyond the territorial boundaries of the United States, and (iv) Bear Head LNG’s proposal has not been “segmented” to meet the definition of a categorical exclusion.<sup>71</sup>

## **V. 2012 LNG EXPORT STUDY**

As noted above, in August 2011, with several non-FTA applications pending before it, DOE/FE determined that study of the cumulative economic impact of LNG exports was

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<sup>69</sup> See *id.* at 43 n.204 (quoting 10 C.F.R. § Part 1021, Subpart D, Appendix B, Categorical Exclusion B5.7).

<sup>70</sup> See Bear Head LNG App. at 43.

<sup>71</sup> See *id.* at 43-53.

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, listed in Table 1.

**Table 1: Case Scenarios Considered By EIA in Analyzing Impacts of LNG Exports**

	<b>AEO 2011 Cases</b>	<b>Export Scenarios</b>
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, in the cases where cumulative export volumes are 6 Bcf/d, liquefaction would consume 0.6 Bcf/d with 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.<sup>72</sup> Additionally, EIA assumed 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 the EIA Study, EIA identifies several limiting factors governing use of the Study results:

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<sup>72</sup> 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.

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.<sup>73</sup>

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.

### **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.

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<sup>73</sup> EIA Study at ii (emphasis in original).

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 carbon dioxide (CO<sub>2</sub>) 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<sub>2</sub> 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<sub>2</sub> emissions, EIA projected that the increased use of coal in the electric sector would generally result in a net increase in domestic CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>ew</sub>ERA” energy-economy model, NERA drew conclusions regarding the domestic macroeconomic impacts of LNG exports. The impacts measured using the N<sub>ew</sub>ERA macroeconomic model included price, welfare,<sup>74</sup> gross domestic product (GDP), aggregate consumption, aggregate investment, natural gas export revenues, sectoral output,<sup>75</sup> and wages and

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<sup>74</sup> 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.

<sup>75</sup> 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.

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 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 per million cubic feet (Mcf) (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. As shown in Table 2 below, the 13 scenarios included:

**Table 2: NewERA Scenarios Analyzed by NERA**

	<b>U.S. Scenarios</b>	<b>International Demand and Supply Scenarios</b>	<b>Export Scenarios</b>
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 NewERA 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.<sup>76</sup> 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.

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.<sup>77</sup> 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;

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<sup>76</sup> 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](http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf).

<sup>77</sup> 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](http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf).

- 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.

#### **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.<sup>78</sup> 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

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<sup>78</sup> 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](http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf).

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 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<sub>ew</sub>ERA Macroeconomic Model**

NERA developed the N<sub>ew</sub>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.<sup>79</sup> Like other general equilibrium models, N<sub>ew</sub>ERA is designed to analyze long-term economic trends. NERA explained that, in any given year, actual prices, employment,

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<sup>79</sup> For a full discussion of the N<sub>ew</sub>ERA macroeconomic model, see pages 20 to 22 of the NERA Study, [http://fossil.energy.gov/programs/gasregulation/reports/nera\\_lng\\_report.pdf](http://fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf).

or economic activity may differ from the projected levels.

The version of N<sub>ew</sub>ERA used in NERA's analysis considered all sectors of the U.S. 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<sub>ew</sub>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<sub>ew</sub>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<sub>ew</sub>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.<sup>80</sup> First, the GNGM model produced information regarding the conditions that will support exports of natural gas from the United States. Second, the N<sub>ew</sub>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.<sup>81</sup> NERA estimated economic impacts for these three cases with no constraint on exports, and found that even with exports reaching levels greater than 12 Bcf/d and associated higher prices than in the constrained cases, there were net economic benefits from allowing unlimited exports in all cases.

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<sup>80</sup> 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.

<sup>81</sup> 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.

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 Table 5 of the NERA Study, as modified from trillion cubic feet per year (Tcf/yr) to Bcf/d in Table 3 below.

**Table 3: NERA Export Volumes in Bcf/d,  
Adapted from Table 5 of the NERA Report**

<b>NERA Export Volumes (in Bcf/d)</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>
U.S. Reference Case with International Demand Shock and lower than Low/Slow export levels	<b>1.02</b>	2.69	3.92	3.27	<b>6.00</b>
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	<b>1.02</b>	6.00	10.77	<b>12.00</b>	<b>12.00</b>
U.S. Reference Case with International Supply/Demand Shock and lower than High/Rapid export levels	<b>3.02</b>	<b>8.00</b>	10.77	<b>12.00</b>	<b>12.00</b>
U.S. High Shale EUR with International Supply/Demand Shock at Low/Slowest export levels	<b>0.50</b>	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**

Bear Head LNG states that its requested authorization is not inconsistent with the public interest, and therefore meets the statutory standard under NGA section 3(a). Bear Head LNG notes that DOE/FE applies its 1984 Policy Guidelines (discussed *supra* § III) in considering LNG export applications, including DOE's stated intention to minimize federal control and involvement in energy markets. Bear Head LNG states that, although the Policy Guidelines focus on imports of natural gas, DOE/FE has found that the same principles apply to exports.<sup>82</sup>

Bear Head LNG addresses numerous factors that it asserts are consistent with the public interest. Under "Analysis of Domestic Need for Gas to be Exported," Bear Head LNG discusses: (i) the supply of natural gas in the United States, (ii) U.S. demand for natural gas, (iii) price impacts on natural gas in the United States, (iv) regional supply of natural gas, (v) regional demand for natural gas, (vi) regional price impacts, and (vii) the supply-demand balance. Discussing "Other Public Interest Considerations," Bear Head LNG addresses: (i) benefits to the U.S. economy and (ii) international considerations. These factors are summarized below.

### **A. Domestic U.S. Need for the Natural Gas to be Exported**

Citing DOE precedent, Bear Head LNG states that domestic need for the natural gas to be exported is the only explicit criterion that DOE/FE must consider in determining the public interest. Bear Head LNG asserts that, given the increases in recoverable resources in the United States, the national and regional supply/demand balance, and the limited price impacts to consumers discussed herein, there is a lack of need for domestically produced natural gas in the

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<sup>82</sup> Bear Head LNG App. at 16 n.51.

United States, and exports of LNG from the Bear Head Project would yield net economic benefits to the United States.<sup>83</sup>

### **1. Supply of Natural Gas the United States**

Citing data from the U.S. Energy Information Administration (EIA), Bear Head LNG states that, since 2005, U.S. marketed production of natural gas has grown 35.7 percent (to 25.7 Tcf in 2013), representing the highest production levels in U.S. history. Noting the application of new technologies that increase the production of large unconventional resources, Bear Head LNG states that shale gas production accounted for 40 percent of the Lower-48 natural gas production in 2013, in contrast to approximately 5 percent in 2006.

According to Bear Head LNG, actual U.S. natural gas production increased from approximately 6 Bcf/d in January 2008 to 40 Bcf/d in 2014—representing an increase of more than five times during this period. In support of this statement, Bear Head LNG cites a report that it commissioned by Black & Veatch, entitled *U.S. Market Impact Assessment for LNG Exports at the Bear Head Export Project* (U.S. Market Impact Report), and appended to the Application as Appendix B.<sup>84</sup> This report, published in February 2015, analyzes the price impacts of LNG exports from the Bear Head Project on the U.S. natural gas market as a whole.

Turning to the future outlook for the U.S. natural gas supply, Bear Head LNG states that the domestic natural gas supply is expected to remain robust, with natural gas production from the Marcellus shale play and from the Haynesville shale play remaining “steady and accessible” to the Bear Head Project.<sup>85</sup> Citing the Ziff Report, Bear Head LNG claims that the Appalachian region has produced only five percent (37 Tcf) of its ultimate potential, and that the Rockies

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<sup>83</sup> See *id.* 16-17.

<sup>84</sup> See *id.* at 3 n.10, 17 n.56.

<sup>85</sup> *Id.* at 17 (citing U.S. Market Impact Report at 18).

region has only produced one third of its ultimate potential, with approximately 396 Tcf in remaining resources.<sup>86</sup>

Additionally, Bear Head LNG points out that EIA's *Annual Energy Outlook 2014* (AEO 2014) Reference Case projects a 56 percent increase in total natural gas production between 2012 and 2040, with shale gas production accounting for 53 percent of total production by 2040. Total U.S. dry gas production is projected to be 37.54 Tcf by 2040 in the Reference Case, with a 1.6 percent annual growth rate between 2012 and 2040. Based on these projections by EIA, Bear Head LNG states that the United States will transition from a net importer to a net exporter of natural gas, exporting up to 5.8 Tcf in 2040.<sup>87</sup>

## **2. U.S. Natural Gas Demand**

Bear Head LNG argues that domestic natural gas supply will continue to outpace domestic demand during the proposed 25-year term of its requested authorization. Bear Head LNG states that the United States is expected to become a net exporter of natural gas before 2020, with the AEO 2014 Reference Case projecting that domestic long-term annual demand for natural gas will grow by only 0.8 percent from 2012 to 2040, while domestic dry gas production is projected to double during the same time period, with a 1.6 percent growth rate.

According to Bear Head LNG, the average energy use per person from 2012 to 2040 is also projected to decline to 279 million Btu per person in 2040—a level not seen since 1965—according to the AEO 2014 Reference Case. This projected decline is due to a combination of factors, including more efficient appliances and vehicles. Bear Head LNG claims that the industrial sector of the U.S. economy is projected to have moderate growth over the long term,

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<sup>86</sup> *Id.* at 17-18 (citing Ziff Report at 7 & fig. 3).

<sup>87</sup> *Id.* at 18 (citing *AEO 2014*).

while residential and commercial demand is expected to remain flat as population and economic growth are offset by improved energy efficiency.<sup>88</sup>

### 3. U.S. Price Impacts

Bear Head LNG discusses three studies—the 2012 EIA Study and the NERA Report discussed herein, and EIA’s 2014 Increased Export Study<sup>89</sup>—to argue that exports of U.S.-sourced natural gas in the form of LNG would not result in adverse economic impacts to U.S. consumers. To the contrary, according to Bear Head LNG, these studies demonstrate that the U.S. economy as a whole would benefit from exports of U.S.-sourced natural gas.

Bear Head LNG states that, most recently, EIA conducted the 2014 Increased Export Study to evaluate the effects on U.S. energy markets of increased LNG exports (ranging from 12 Bcf/d to 20 Bcf/d) from the contiguous United States in light of AEO 2014. Bear Head LNG contends that this EIA study bolsters the conclusions of the 2012 NERA Report—that increased exports of U.S.-sourced natural gas in the form of LNG will result in higher levels of economic output, and thus will more than offset the adverse impact of somewhat higher energy prices when the export scenarios are applied.<sup>90</sup>

Next, Bear Head LNG discusses its own study, the U.S. Market Impact Report, which Bear Head Corp. commissioned from Black and Veatch. This Report analyzed the market pricing impacts of the Bear Head Project throughout the lower-48 states under four scenarios from 2019 to 2049, using prices at Henry Hub as a barometer for the national price impact. The first scenario, the Base Case, was developed from Black and Veatch’s 2015 Energy Market

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<sup>88</sup> See *id.* at 19 (citing U.S. Market Impact Report at 22); see *id.* at 20-21 (discussing demand for natural gas across sectors of the U.S. economy).

<sup>89</sup> U.S. Energy Information Administration, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets* (Oct. 29, 2014) [hereinafter EIA 2014 Increased Export Study], cited in Bear Head LNG App. at 24 n.106.

<sup>90</sup> Bear Head LNG App. at 24 (quotation and citation omitted).

Perspective, which incorporates its assessment of EPA’s proposed Clean Power Plan, and natural gas liquid uplifts to shale production costs and their impact on North American unconventional production. The other three scenarios involve different export cases that factor into the model natural gas demand associated with exports of U.S.-sourced natural gas in the form of LNG from the Bear Head project. The third and fourth scenarios reflect higher natural gas demand, as well as exports from additional LNG export terminals that either are likely to be or may be permitted in the future.<sup>91</sup>

According to Bear Head LNG, the U.S. Market Impact Report found that “the export volumes proposed in [Bear Head LNG’s] Application have a limited impact on natural gas prices across the United States.”<sup>92</sup> Specifically, “the estimated domestic price impact from the Bear Head Project [is] minimal, and ... impacts are projected to decrease over the life of the Project.”<sup>93</sup> Bear Head LNG asserts that the Report, in fact, found that domestic natural gas prices would decrease over the proposed Project term.

#### **4. Regional Supply**

Bear Head LNG emphasizes that production from the Marcellus shale region has increased dramatically over the past four years—from 2 Bcf/d in 2010 to over 15 Bcf/d through July 2014—and is projected by EIA to reach a peak production volume of approximately 5 Tcf per year between 2022 and 2025. According to Bear Head LNG, the New England natural gas market lacks local gas production, which historically has necessitated an influx of natural gas supply basis throughout the United States and Canada. Bear Head LNG contends, however, that recent market shifts due to the overabundance of supply in the Appalachian region have decreased the Northeast’s need to import LNG from two import terminals (the Everett LNG and

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<sup>91</sup> See *id.* at 25-26.

<sup>92</sup> *Id.* at 25 (citing the U.S. Market Impact Report at 7).

<sup>93</sup> *Id.* at 26.

Canaport LNG terminals), enabling the Northeast region to source increasing quantities from the Marcellus and Utica shale regions.

## **5. Regional Demand**

Citing the AEO 2014 Reference Case, Bear Head LNG asserts that natural gas supply from the Marcellus region is projected to exceed 100 percent of the demand projected for the New England and Mid-Atlantic regions from 2016 through 2040, including by more than 1.0 Tcf during the peak production period of 2022 and 2025.<sup>94</sup> Relying on data from EIA, Bear Head LN states that, since Summer 2012, the increase in Marcellus natural gas production has outpaced growth in the region's available pipeline takeaway capacity. Further, according to Bear Head LNG, EIA recently observed that production in the Marcellus Region has surpassed winter demand for natural gas in Pennsylvania and West Virginia, and is now on track to equal demand in those two states plus New York, New Jersey, Delaware, Maryland, and Virginia combined.<sup>95</sup>

Bear Head LNG acknowledges that the New England natural gas market has seen steady demand growth from the power generation sector, and that price spikes have occurred due to seasonal peaking demand, leading to basis blowouts. Bear Head LNG counters, however, that significant pipeline infrastructure development in the region is projected, and that new proposed capacity may help ameliorate these issues in the near future. Citing the U.S. Market Impact Report, Bear Head LNG states that, compared to the nation as a whole, the New England region is projected to experience demand growth across all sectors of the economy (industrial, electricity, commercial, and residential), with moderate growth in the residential and commercial sectors.

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<sup>94</sup> See *id.* at 27 (citing AEO 2014, at MT-25).

<sup>95</sup> See *id.* at 28 (citation omitted).

## **6. Regional Price Impacts**

Bear Head LNG explains that it commissioned Black & Veatch to prepare a report analyzing the price impacts of LNG exports from the Bear Head Project on the Northeast natural gas market, with a particular emphasis on the New England market. This report, entitled *New England Market Impact Assessment for LNG Exports at the Bear Head Export Project* (New England Market Impact Report), was published in February 2015 and is appended to the Application as Appendix C.<sup>96</sup>

According to Bear Head LNG, the New England Market Impact Report analyzed the pricing impacts for the same four scenarios considered in the U.S. Market Impact Report. Specifically, it examined prices at two New England market price points and several upstream northeastern market price points under each scenario to gauge impacts of increased LNG exports in the United States and Canada from 2019 to 2049. Bear Head LNG states that the New England Market Impact Report concluded that the proposed export volumes proposed by the Bear Head Project are “expected to have a limited price impact in New England and an even lesser impact on upstream northeastern price points during the 2019-2049 period.”<sup>97</sup>

## **7. Supply/Demand Balance**

Bear Head LNG contends that its Application is consistent with the public interest because “natural gas resources in the United States are prolific and are projected to outpace consumer energy demands at fair market prices during the proposed 25-year term.”<sup>98</sup> This supply/demand balance, Bear Head LNG argues, demonstrates the lack of U.S. or regional need for the proposed exports.

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<sup>96</sup> Bear Head LNG App. at 3 n.11.

<sup>97</sup> *Id.* at 30.

<sup>98</sup> *Id.* at 32.

First, citing a 2014 report by EIA, Bear Head LNG states that the U.S. natural gas markets balance in response to increase LNG exports—mainly through increased natural gas production which is feasible due to the magnitude of domestic natural gas resources and the ability of producers to apply new technologies to tap unconventional shale gas resources.

Second, Bear Head LNG argues that the Northeast region of the United States has access to the Appalachian region—consisting of both the Marcellus and Utica shale plays—and is therefore one of the most extensive potential sources of natural gas supply available in the United States. Bear Head LNG cites AEO 2014 in stating that the overabundance of supply in the Appalachian region requires some Marcellus gas to be transported out of the region to other markets. As a result, Bear Head LNG contends, the Northeast becomes less dependent on natural gas from Canada and the Gulf Coast due to the growing shale gas supply in the Appalachian region and the region’s proximity to major markets on the East Coast of the United States.<sup>99</sup>

Bear Head LNG further contends that the market dynamics of the existing pipeline infrastructure in the Northeast are “rapidly changing” for several reasons: price spikes and increased demand in New England, a declining need to import natural gas from Canada, and increased production in and access to natural gas from unconventional resources (in particular, the Marcellus and Utica shale plays).<sup>100</sup> Bear Head LNG calls attention to studies by the New England States Committee on Electricity and the Massachusetts Department of Natural Resources, which it claims indicate that the best solution for combatting natural gas shortages is additional pipeline capacity flowing to the region.<sup>101</sup> Bear Head LNG states that, in response, major natural gas pipeline companies have announced plans to expand capacity to bring

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<sup>99</sup> See *id.* at 32 n.149 (citing Brattle Report at 6).

<sup>100</sup> *Id.* at 33 (citing U.S. Market Impact Report at 12; New England Market Impact Report at 8).

<sup>101</sup> See *id.* at 33 (citing New England Market Impact Report at 11).

additional natural gas to the region and reverse flows of natural gas that historically transited from eastern Canada into the United States.

According to Bear Head LNG, new Canadian demand for U.S.-sourced natural gas originating in the Marcellus and Utica shale plays will lead producers to move natural gas out of “fulsome shale basins into the market,” bolstering the need for additional New England pipeline expansion projects.<sup>102</sup> Bear Head LNG further contends that the Bear Head Project will create an additional demand source that may contribute to the infrastructure expansion needed in the Northeast.

Third, Bear Head LNG claims that New England’s supply/demand balance will be stabilized by the availability of natural gas storage in Eastern Canada. These storage facilities can help to alleviate winter price spikes on peaking day and to prevent basis blowouts. According to Bear Head LNG, this storage capacity may allow the Bear Head Project to structure seasonal feed gas purchases in a manner that increases New England’s access to additional supply when demand peaks, thus minimizing the Project’s impact on market prices and helping to restore regional supply/demand balance.

Last, Bear Head LNG claims that the interconnectivity of the U.S. and Canadian natural gas markets supports the proposition that natural gas supply is (and will remain) sufficient to meet demand. Bear Head LNG states that the Project’s ability to access Canadian supply, coupled with the expansive pipeline infrastructure in North America, will allow the Project to access natural gas from “potentially anywhere on the North American grid.”<sup>103</sup>

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<sup>102</sup> *Id.* at 34.

<sup>103</sup> Bear Head LNG App. at 35.

## **B. Other Public Interest Considerations**

### **1. Benefits to the U.S. Economy**

In support of its requested authorization, Bear Head LNG commissioned a report by the Perryman Group entitled, *Economic and Fiscal Benefits of the Proposed Bear Head LNG Project in Nova Scotia: An Analysis with Emphasis on the Effects on the United States* (Perryman Report).<sup>104</sup> The Report, published in January 2015, is appended to the Application as Appendix E. According to Bear Head LNG, the Perryman Report quantifies the economic and fiscal benefits of the Bear Head Project to the North American economy, with an emphasis on benefits to the U.S. economy. Bear Head LNG states that, according to the Perryman Report, the Bear Head Project “will lead to substantial economic benefits in the United States economy during both the construction and operation phases of the Project, through increased economic activity, tax revenues, and job creation.”<sup>105</sup>

Addressing the construction and pre-operational impacts of the Bear Head Project, Bear Head LNG states that the Louisiana economy will experience growth because a significant portion of the necessary equipment for the Project is likely to be manufactured there. Bear Head LNG asserts that the national U.S. economy also will be stimulated by the effects of the Project on the exploration and production chain for natural gas extraction. This national economic stimulus, Bear Head LNG argues, will have a “multiplier effect,” resulting in further economic growth due to additional wages, taxes, and expenditures involved in the supply chain. Specifically, the Perryman Report found that expenditures during the life of the Project are projected to be approximately \$3.68 billion for the United States as a whole, with \$0.93 billion

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<sup>104</sup> See *id.* at 4 n.13 (citing the Perryman Report).

<sup>105</sup> *Id.* at 35-36.

occurring in Louisiana. This is estimated to result in economic gains of over \$1.1 billion in gross product for the United States and \$0.4 billion for Louisiana.<sup>106</sup>

Bear Head LNG contends that the Project will produce significant job creation in the United States. Citing the Perryman Report, Bear Head LNG states that construction and pre-operational spending is anticipated to result in the creation of 16,969 person-years of employment in the United States, with 4,445 person-years of employment in Louisiana alone. Bear Head LNG also states that the Project will create increases in tax revenues at the federal, state, and local levels.

Turning to operational impacts, Bear Head LNG emphasizes that it intends to use U.S.-sourced natural gas as feedstock for the Project, which it contends will provide significant benefits to the U.S. economy. According to Bear Head LNG, the Project will stimulate natural gas production across the United States (as the feedstock could derive from any natural gas-producing region in the United States) and introduce more natural gas into the interstate market. Bear Head LNG asserts that, by promoting increased drilling and production activities, the Bear Head Project will foster additional investments in domestic natural gas basins, further stimulating the U.S. economy.

Citing the Perryman Report, Bear Head LNG projects that, over the first 25 years of the Project's operations, the cumulative economic benefits in the United States from enhanced production are expected to include an approximate increase in gross product of \$93.8 billion, and 988,553 person-years of employment. The fiscal benefits accrued during this time are projected to include approximately \$6.8 billion to the federal government, \$4.5 billion to state governments, and \$2.3 billion to local governments.<sup>107</sup>

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<sup>106</sup> See *id.* at 36 (citing the Perryman Report at 8-9).

<sup>107</sup> See *id.* at 37 (citing Perryman Report at 11).

Bear Head LNG projects that, on an annual basis, the average gross product stemming from natural gas production is estimated to be \$3.45 billion in the Marcellus Shale region (the expected source for the natural gas), and \$3.75 billion nationwide. Bear Head LNG also points to significant annual economic benefits based on employment in both the Marcellus Shale region and nationwide, as well as fiscal benefits accrued annually to the benefit of the federal, state, and local governments—projected to be \$0.3 billion, \$0.2 billion, and \$0.1 billion, respectively.<sup>108</sup>

## **2. International Considerations**

In addressing international considerations accruing from the Bear Head Project, Bear Head LNG focuses on benefits to both the United-States Canada trade relationship and geopolitics.

Citing an assessment of the U.S. Department of State, Bear Head LNG emphasizes that the United States and Canada share the world’s largest, most comprehensive trading relationship. Bear Head LNG points out that two “crucial agreements” were designed to eliminate trade barriers between the two countries—the Free Trade Agreement (FTA) signed in 1989, and the North American Free Trade Agreement (NAFTA) signed in 1992.<sup>109</sup> Bear Head LNG thus asserts that DOE/FE’s grant of its Application would promote national economic policy by reducing barriers to foreign trade and stimulating the flow of goods and services between the United States and Canada, consistent with those agreements.

Bear Head LNG next asserts that a grant of its Application will bring significant geopolitical benefits to the United States—namely, by increasing the nation’s energy independence and security. This, in turn, will bolster the United States’ political position internationally and result in better leverage and reinforced alliances with global trading partners.

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<sup>108</sup> See *id.* at 38 (citing Perryman Report at 12-13).

<sup>109</sup> Bear Head LNG App. at 39.

Additionally, Bear Head LNG contends that increased production of natural gas serves to bolster the position of the United States in global climate change discussions. According to Bear Head LNG, the export of LNG to countries where natural gas can displace coal consumption supports the United States' climate goals of encouraging countries to reduce their carbon emissions.

## **VII. CURRENT PROCEEDING BEFORE DOE/FE**

In response to the Notice of Application, DOE/FE received two timely-filed motions to intervene in this proceeding—one submitted by Northeast Energy Solutions (NEES) that opposes the Application, and one from Saint John Gas Marketing Company (Saint John Gas) that takes no position on the Application. Bear Head LNG did not file a response to either motion. DOE/FE did not receive any comments in response to the Notice of Application.

### **A. Motion to Intervene of Northeast Energy Solutions, Inc.**

NEES filed a Motion to Intervene on June 15, 2015.<sup>110</sup> NEES states that it is a nonprofit corporation comprised of energy, land, environmental, end-user, and related economic interests. NEES serves as an educational resource and advocacy group to ensure that economically viable and environmentally responsible energy projects account for its members' interests. NEES states that it is currently a formal intervenor before FERC, among other agencies, in proceedings involving capacity and infrastructure proposals in the Northeast United States.

**Motion to Intervene.** NEES states that it has a direct and substantial interest in this proceeding. In support of this argument, NEES quotes the Application, in which Bear Head LNG states that the “‘proposed natural gas and LNG exports do not involve the construction of any U.S. facilities giving rise to cognizable effects under NEPA.’”<sup>111</sup> NEES argues that Bear Head LNG contradicts itself by stating later in the Application that it intends to interconnect with

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<sup>110</sup> Motion to Intervene of Northeast Energy Solutions, FE Docket No. 15-33-LNG (June 15, 2015) [hereinafter NEES Mot.].

<sup>111</sup> NEES Mot. at 2 (quoting Bear Head LNG App. at 4).

the Bear Head Project’s proposed pipeline ““by the potential modification and expansion of the M&NP system.””<sup>112</sup> NEES contends that Bear Head continues to contradict itself in the Application by discussing proposed natural gas pipeline facility expansion plans in the Northeast that potentially will support its Application. On this basis, NEES asserts that its interests will be directly affected by the outcome of this proceeding and requests leave to intervene in opposition to the Application.

**Request to Suspend Non-FTA Approvals.** NEES asks DOE/FE to suspend any further LNG export approvals to non-FTA countries. In support of this request, NEES states that EIA issued an updated LNG export report in 2014, entitled *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets*, but—allegedly by EIA’s own admission—the NEMS model used by EIA “is not a system that uses a world energy model and does not address the interaction between the potential for additional U.S. natural gas exports and developments in world natural gas markets.”<sup>113</sup> NEES asserts that DOE/FE should suspend its approval of this Application and other pending LNG export applications to non-FTA countries until EIA is able to provide more accurate information that allows DOE/FE to determine whether additional LNG exports are in the public interest.

**Request for Additional Procedures.** Pursuant to DOE/FE’s regulations (10 C.F.R. § 590.206), NEES asks DOE/FE to direct additional procedures concerning Bear Head LNG’s Application. NEES suggests that these procedures should include “the filing of supplemental written comments, written interrogatories, and/or other discovery procedures, a conference,

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<sup>112</sup> *Id.* (quoting Bear Head LNG App. at 5).

<sup>113</sup> *Id.* at 2.

verbal presentation, and/or adjudication.”<sup>114</sup> Alternatively, under 10 C.F.R. § 590.310, NEES requests an opportunity to submit written interrogatories to Bear Head LNG.

NEES asserts there are numerous unanswered questions in Bear Head LNG’s Application, including the alleged vagueness of the underlying purpose of the Application, the full extent of Bear Head LNG’s relationship with the Project and other pipeline expansion projects (including the M&N Pipeline and the Algonquin Pipeline), and its inclusion of unspecified foreign markets in its project scope. In NEES’s view, this lack of information hinders a thorough, deliberative review of the Application. NEES believes that DOE/FE will be “better enabled” to make a determination on the Application if NEES is afforded the opportunity for additional procedures, including interrogatories directed at Bear Head LNG.

#### **B. Motion to Intervene of Saint John Gas Marketing Company**

Saint John Gas filed a Motion to Intervene on June 15, 2015.<sup>115</sup> Saint John Gas states that it is a Delaware corporation with its principal place of business in The Woodlands, Texas, and a wholly-owned subsidiary of Repsol St. John LNG, S.L., a Spanish corporation. Saint John Gas states that its affiliates are considering whether to construct a natural gas liquefaction and LNG export project to be located at an existing Canaport LNG terminal in Saint John, New Brunswick, Canada, and that Saint John Gas may act as the U.S. marketing agent for procuring U.S.-sourced natural gas. According to Saint John Gas, this potential project—like Bear Head LNG’s Project—may export natural gas by pipeline to Canada for subsequent export as LNG.

Saint John Gas asserts that “DOE’s regulatory approach to adjudicating applications to export natural gas by pipeline to an adjacent FTA country for subsequent export as LNG is an

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<sup>114</sup> *Id.* at 3.

<sup>115</sup> Motion to Intervene of Saint John Gas Marketing Co., FE Docket No. 15-33-LNG (June 15, 2015) [hereinafter Saint John Gas Mot.].

issue of first impression.”<sup>116</sup> Accordingly, Saint John Gas believes that it has a direct interest in proceeding that it wishes to protect. Saint John Gas seeks to intervene as a party to this proceeding, but does not express support or opposition to the Application.

### **VIII. COMMENTS ON THE 2012 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. 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.”<sup>117</sup> 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.”<sup>118</sup>

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.<sup>119</sup>

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<sup>116</sup> *Id.* at 4.

<sup>117</sup> 77 Fed. Reg. at 73,629.

<sup>118</sup> *Id.*

<sup>119</sup> *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,<sup>120</sup> Dow Chemical Company (Dow), along with U.S. Representative Edward Markey, U.S. Senator Ron Wyden, Alcoa, Save Our Supplies, IECA, and Jannette Barth, challenge the data used as inputs to the 2012 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 AEO 2013 Early Release Overview projects a substantial increase in demand for natural gas in

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<sup>120</sup> For purposes of this discussion, Sierra Club filed comments on the 2012 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].

the industrial manufacturing sector.<sup>121</sup> 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 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

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<sup>121</sup> During the time of the comment period on the 2012 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](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.

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 2012 LNG Export Study used that data, and DOE/FE sought to ensure consistency across both parts of the 2012 LNG Export Study. Further, a number of commenters, including API, America's Natural Gas Alliance, Exxon Mobil Corporation (ExxonMobil), Golden Pass Products LLC, 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 2012 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 2012 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 2012 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 2012 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.”<sup>122</sup> Requiring DOE to start over with new data “would lead to significant costs and potentially endless delays.”<sup>123</sup> Moreover, under the commenters’ rationale,

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<sup>122</sup> *Theodore Roosevelt Conserv. P’ship v. Salazar*, 616 F.3d 497, 511 (D.C. Cir. 2010) (quotations and citations omitted) (alteration in original).

<sup>123</sup> *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).

DOE's 2012 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."<sup>124</sup>

**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 2012 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 2012 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 market impacts that come from LNG exports.<sup>125</sup>

Using the later-published final AEO 2013 Reference Case (see Table 4 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

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<sup>124</sup> *Vermont Yankee Nuclear Power Corp. v. Natural Res. Def. Council*, 435 U.S. 519, 554-55 (1978).

<sup>125</sup> Comments of Navigant Consulting, Inc., at 6 (attached to Initial Comments of Jordan Cove Energy Project, L.P.).

(from 72.1 Bcf/d to 85.9 Bcf/d). In addition, the projected 2035 Henry Hub price declined from \$7.07 per million British thermal units (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 4 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.<sup>126</sup> As depicted in Table 4, 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.<sup>127</sup> 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).

Table 4 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,

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<sup>126</sup> U.S. Energy Information Administration, *Annual Energy Outlook 2015* (April 14, 2015), available at <http://www.eia.gov/forecasts/aeo/> [hereinafter AEO 2015].

<sup>127</sup> See AEO 2015 at A-27, Table A13.

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 4: Comparison of AEO Cases**

<b>Projections for 2035</b>	<b>AEO 2011 Reference Case</b>	<b>AEO 2012 Reference Case</b>	<b>AEO 2013 Reference Case</b>	<b>AEO 2015 Reference Case</b>	<b>AEO 2011 High Shale EUR Case</b>
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 Table 4 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.<sup>128</sup> 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 2012 LNG Export Study.

Further, as reflected in the comments submitted by Lake Charles Exports<sup>129</sup> and Secretary Abraham,<sup>130</sup> 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 2012 LNG Export Study underestimated future demand for natural gas.<sup>131</sup> 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.<sup>132</sup> Indeed, while many of the FTA authorizations

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<sup>128</sup> NERA Study at 6.

<sup>129</sup> Reply Comments of Lake Charles Exports, LLC at 12-13.

<sup>130</sup> Reply Comments of Secretary Spencer Abraham at 8.

<sup>131</sup> As of July 1, 2015, DOE has granted 43 long-term authorizations totaling 40.61 Bcf/d to export lower-48 states domestically-produced LNG to FTA countries.

<sup>132</sup> 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

have 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 2012 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.

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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 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.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 API, Paul Eikelboom, Gary Lambert, and Helen Rice, assert that LNG exports will create jobs and boost the economy. For example, API 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.<sup>133</sup> 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.<sup>134</sup> 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.”<sup>135</sup> 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 LNG exports will be short-lived and potentially of lower value to the U.S. economy. In this

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<sup>133</sup> NERA Study at 6.

<sup>134</sup> *Id.*

<sup>135</sup> *Id.* at 56.

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 ....<sup>136</sup>

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 [energy intensive sector] is not appropriate for studying the impact of LNG exports on the economy.”<sup>137</sup>

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 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

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<sup>136</sup> Initial Comments of Dow Chem. Co. at 27.

<sup>137</sup> *Id.* at 28.

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.<sup>138</sup>

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.<sup>139</sup> 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.

On the other hand, a number of commenters, including API, ExxonMobil, 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.

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<sup>138</sup> *Id.* at 16-17.

<sup>139</sup> *Id.* at 28 (Dow table citing figures from the U.S. Bureau of Economic Analysis, *Gross Domestic Product by Industry Data*).

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 natural gas liquids (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 API, 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, API, 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,<sup>140</sup> 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. 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<sub>ew</sub>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

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<sup>140</sup> 110 members of the U.S. House of Representatives filed a single set of comments in support of LNG exports.

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.<sup>141</sup>

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.

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<sup>141</sup> NERA Study at 2.

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.<sup>142</sup>

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 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.

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<sup>142</sup> *Id.* at 69.

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 2012 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 2012 LNG Export Study that exports will benefit the economy as a whole, and absent stronger record evidence on the distributional consequences of authorizing Bear Head LNG'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, the American Public Gas Association (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<sup>143</sup>—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 2012 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 export application.

### **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

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<sup>143</sup> U.S. Senators James Inhofe, Lisa Murkowski, David Vitter, Mary Landrieu, Heidi Heitkamp, and John Cornyn submitted comments generally supporting LNG exports.

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.<sup>144</sup>

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 API 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 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.<sup>145</sup>

Other commenters take a somewhat longer view of the potential indirect impacts of LNG

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<sup>144</sup> 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 result in LNG exports totaling 9 Bcf/d of natural gas. DOE/FE notes that Canada has approved the third LNG export project mentioned by Senator Wyden—the Royal Dutch Shell Plc project.

<sup>145</sup> Initial Comments of Dow Chem. Co. at 16.

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 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 American LNG'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 4 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 5 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 5: U.S. Dry Natural Gas Proved Reserves<sup>146</sup>**

Year	Proved Reserves (R)		U.S. Dry Natural Gas Estimated Production (P)		R/P Ratio - Years
	(Bcf)	Percent change versus year 2000	(Bcf)	Percent change versus year 2000	
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.<sup>147</sup>

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.<sup>148</sup> 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

<sup>146</sup> 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](http://www.eia.gov/dnav/ng/ng_enr_dry_dcu_nus_a.htm) (additional calculations conducted to produce percentage change and R/P ratios).

<sup>147</sup> Unproved resources are generally less well known and therefore less precisely quantifiable than proved reserves, and their eventual recovery is less assured.

<sup>148</sup> 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](http://www.eia.gov/forecasts/aeo/assumptions/pdf/0554(2014).pdf).

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 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 2012 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.<sup>149</sup> 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.<sup>150</sup>

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 analyses. They reasonably evaluated alternative scenarios that would capture possible changes that would affect natural gas supplies.

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<sup>149</sup> NERA Study at 110.

<sup>150</sup> *Id.* at 25.

## **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 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.<sup>151</sup> 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 was also exacerbated by its failure to account for the construction of natural gas infrastructure on a global basis. These commenters assert that NERA appears to underestimate both the supply cost of international LNG projects and the magnitude and trajectory of global LNG demand. They further claim that NERA 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

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<sup>151</sup> Initial Comments of Save Our Supplies at 34, 41.

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 also DOE/FE's view 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.<sup>152</sup> 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. Because there is neither a throughput obligation nor a fixed commodity price in the commercial arrangements assumed by NERA, 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.

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<sup>152</sup> Natural Gas Policy Act of 1978, 15 U.S.C. § 3301, *et seq.* (establishing a policy for phasing out the regulation of wellhead prices).

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.<sup>153</sup>

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:

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.

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<sup>153</sup> NERA Study at 6-7.

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.<sup>154</sup>

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 foreign sources and thus understates the impact of such investment on US GDP.<sup>155</sup>

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

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<sup>154</sup> *Id.* at 211.

<sup>155</sup> Reply Comments of Lake Charles Exports at 31 (citations omitted).

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 2012 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 capacity."<sup>156</sup> 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."<sup>157</sup> We find this to be a reasonable simplifying

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<sup>156</sup> NERA Study at 34.

<sup>157</sup> *Id.* at 34-35.

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 2012 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.<sup>158</sup>

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

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<sup>158</sup> *Id.* at 84-90.

travel shorter distances,<sup>159</sup> 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.<sup>160</sup> 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.

## **E. Cost of Environmental Externalities**

### **1. Comments**

Sierra Club, along with Delaware Riverkeeper Network,<sup>161</sup> 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:

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<sup>159</sup> 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/>.

<sup>160</sup> NERA Study at 87.

<sup>161</sup> Delaware Riverkeeper Network filed comments on behalf of itself and more than 80 other organizations.

- 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* § 0.

### **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 2012 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. API contends that the NERA and Brookings studies project natural gas prices to remain in a narrow, low range through 2030 in all scenarios. Further, API 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. API 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 API, 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. API 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, the NERA 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, API 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 2012 LNG Export Study**

### **1. Comments**

Several commenters, such as Clean Ocean Action and Sierra Club, argue that DOE/FE cannot rely on the NERA Study 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 NERA Study because NERA has not disclosed all technical details of its proprietary *N<sub>ew</sub>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."<sup>162</sup> 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.

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<sup>162</sup> Reply Comments of Sierra Club at 20.

## **2. DOE/FE Analysis**

DOE has evaluated all submissions in this proceeding on their own merits, including the 2012 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 V.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.

### **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).<sup>163</sup> 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

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<sup>163</sup> Final Information Quality Bulletin for Peer Review, 70 Fed. Reg. 2664 (Jan. 14, 2005).

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 2012 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 assessments based on the behavioral and social sciences, public health and medical sciences, life and earth sciences, engineering, or physical sciences.”<sup>164</sup> “Scientific information” does not include opinions where the presentation makes it clear the information is “opinion rather than fact or the agency’s views.”<sup>165</sup> 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 ....”<sup>166</sup>

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 2012 LNG Export Study are in the nature of expert opinion, not scientific fact, and also because the principal purpose of peer review of

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<sup>164</sup> *Id.* at 2675.

<sup>165</sup> *Id.*

<sup>166</sup> *Id.* at 2677.

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.”<sup>167</sup> Similarly, the NERA Study was developed around assumptions of future scenarios and repeatedly acknowledges the uncertainties that could shift the results within the range of likely outcomes.<sup>168</sup>

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 2012 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.<sup>169</sup> 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.<sup>170</sup>

DOE/FE has carefully weighed these competing analyses and viewpoints, and has conducted its own internal review of the 2012 LNG Export Study. In so doing, DOE/FE has recognized that its ultimate decision on the pending export applications would benefit from a

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<sup>167</sup> EIA Study at ii.

<sup>168</sup> See, e.g., NERA Study at 25-26.

<sup>169</sup> Synapse Energy Economics, Inc., *Will LNG Exports Benefit the United States Economy?* (Jan. 23, 2013), at 1, submitted with Initial Comments of Sierra Club.

<sup>170</sup> 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.

public exchange of judgments and expert opinions.<sup>171</sup> 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.

## **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

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<sup>171</sup> 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.”)

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 2012 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 2012 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 Notice of Application contained a detailed description of the Application, and invited the public to submit protests, motions to intervene, notices of intervention, and comments.<sup>172</sup> 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 for the EIA and NERA Studies in the Federal Register.<sup>173</sup> 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.<sup>174</sup> 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

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<sup>172</sup> See Bear Head LNG Notice of Application, *supra* 6, n.18.

<sup>173</sup> 77 Fed. Reg. at 73,627.

<sup>174</sup> *Id.* at 73,628.

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 discretion to decide what procedures to use in fulfilling its statutory responsibilities under the NGA,<sup>175</sup> 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.

**IX. 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.<sup>176</sup> DOE provided a summary of the comments received and responses to substantive comments in Appendix B of the Addendum.<sup>177</sup> 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

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<sup>175</sup> See, e.g., *Process Gas Consumers v. FERC*, 930 F.2d 926, 929 (D.C. Cir. 1991).

<sup>176</sup> Addendum at 3.

<sup>177</sup> *Id.* at 79-151.

production because such production is considered more likely than other forms of production to increase in response to LNG export demand. EIA's Study, published as part of the 2012 LNG Export Study, projected that more than 90% of the incremental natural gas produced to supply LNG exports would come from these unconventional sources.<sup>178</sup>

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.<sup>179</sup> 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

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<sup>178</sup> See 2012 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).

<sup>179</sup> Addendum at 10.

well has been put into production. As shown in the Addendum, the Table 6 captures differences in water intensity across energy sources.

**Table 6: Water Intensity**<sup>180</sup>

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 ( <i>in situ</i> )	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.”<sup>181</sup> Table 7 shows the variation in the proportion of water usage by activity in shale gas regions:

<sup>180</sup> *Id.* at 11 (Table 2).

<sup>181</sup> *Id.* at 12.

**Table 7: Water Usage in Shale Gas Regions<sup>182</sup>**

Play	Public Supply (%)	Industry & Mining (%)	Power Generation (%)	Irrigation (%)	Livestock (%)	Shale Gas (%)	Total Water Use (Bgal/yr)*
Barnett 1	82.7	4.5	3.7	6.3	2.3	0.4	133.8
Eagle Ford <sup>2</sup>	17	4	5	66	4	3 – 6	64.8
Fayetteville <sup>1</sup>	2.3	1.1	33.3	62.9	0.3	0.1	378
Haynesville <sup>1</sup>	45.9	27.2	13.5	8.5	4.0	0.8	90.3
Marcellus <sup>1</sup>	12.0	16.1	71.7	0.1	0.01	0.06	3,570
Niobrara <sup>3</sup>	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.”<sup>183</sup>

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 protect fresh water aquifers.<sup>184</sup> The Addendum acknowledges, however, that while unconventional natural gas formations are thousands of feet below aquifers associated with public

<sup>182</sup> *Id.* at 12 (Table 3) (citations omitted).

<sup>183</sup> *Id.* at 13.

<sup>184</sup> 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](http://www.netl.doe.gov/File%20Library/Research/Oil-Gas/Shale_Gas_Primer_2009.pdf)).

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.<sup>185</sup>

The fluid used for hydraulic fracturing consists of over 98 percent water, but also may include several different chemical compounds.<sup>186</sup> 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.<sup>187</sup> Further, chemical additives may contaminate groundwater should the integrity of the casing or cement seal of the well be compromised.<sup>188</sup>

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 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,

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<sup>185</sup> *Id.* at 14.

<sup>186</sup> *Id.* at 14-15.

<sup>187</sup> *Id.* at 18.

<sup>188</sup> *Id.*

implementing best management practices, and administering pollution prevention concepts, may have temporary, minor impacts to water resources.”<sup>189</sup> 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.”<sup>190</sup>

## 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 8 below:

**Table 8: Source Categories of Airborne Emissions from Upstream Natural Gas Activities (EPA, 2013)**<sup>191</sup>

Category	Type of Emissions	Sources of Emissions
<b>Combustion Emissions</b>	Nitrogen oxide (NO <sub>x</sub> ) and carbon monoxide (CO) resulting from the burning of hydrocarbon (fossil) fuels. Air toxics, particulate matter, uncombusted volatile organic compounds (VOCs), and methane (CH <sub>4</sub> ) are also emitted.	Engines, heaters, flares, incinerators, and turbines.
<b>Vented Emissions</b>	VOCs, air toxics, and CH <sub>4</sub> resulting from direct releases to the atmosphere.	Pneumatic devices, dehydration processes, gas sweetening processes, chemical injection pumps, compressors, tanks, well testing, completions, and workovers.
<b>Fugitive Emissions</b>	VOCs, air toxics, and CH <sub>4</sub> 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.

<sup>189</sup> Addendum at 19.

<sup>190</sup> *Id.* at 19.

<sup>191</sup> *Id.* at 23 (Table 6).

The Addendum describes the existing regulatory framework relating to such emissions, as well as the EPA's 2012 New Sources Performances Standards for hydraulically fractured natural gas wells<sup>192</sup> and EPA's 2013 update to those standards covering storage tanks.<sup>193</sup> 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 hazardous air pollutants. According to the Addendum, the intermittent nature of air 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.<sup>194</sup>

### **C. Greenhouse Gas Emissions**

The Addendum includes a discussion of greenhouse gas (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

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<sup>192</sup> *Id.* at 20-22.

<sup>193</sup> *Id.* at 22.

<sup>194</sup> *Id.* at 32.

oil and gas sector, including completions and ongoing production of hydraulically fractured oil wells, compressors, pneumatic valves, liquids unloading, and leaks.<sup>195</sup> 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.<sup>196</sup>

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.”<sup>197</sup>

#### **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.”<sup>198</sup> 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

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<sup>195</sup> Addendum at 22 (citing U.S. Env'tl. 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).

<sup>196</sup> *Id.* at 44.

<sup>197</sup> *Id.* at 40.

<sup>198</sup> *Id.* at 51.

result that fluid pressures can be increased within a large area surrounding the injection well.”<sup>199</sup>

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 principally one of alarm to the public and minor property damage, as opposed to significant disruption.<sup>200</sup>

### **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.”<sup>201</sup> 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.”<sup>202</sup> 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.

## **X. DOE/FE LIFE CYCLE GREENHOUSE GAS PERSPECTIVE ON EXPORTING**

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<sup>199</sup> *Id.* at 52.

<sup>200</sup> *Id.* at 55-56 (citing *Induced Seismicity Potential in Energy Technologies*. National Research Council. The National Academies Press, Washington, D.C. (2013) at 5).

<sup>201</sup> Addendum at 62.

<sup>202</sup> *Id.*

## ***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<sub>2</sub>) and methane (CH<sub>4</sub>), associated with natural gas produced in the United States and exported as LNG to other countries 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*.<sup>203</sup> On June 4, 2014, DOE/FE provided notice of the documents in the *Federal Register* and invited public comment.<sup>204</sup> 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.

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<sup>203</sup> 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*].

<sup>204</sup> 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.*

## 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?
- 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.<sup>205</sup>

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:

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<sup>205</sup> 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 9: LCA GHG Scenarios Analyzed by NETL<sup>206</sup>**

Scenario	Description	Key Assumptions
1	<ul style="list-style-type: none"> <li>• Natural gas is extracted in the United States from the Marcellus Shale.</li> <li>• 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).</li> <li>• Upon reaching its destination, the LNG is re-gasified, then transported to a natural gas power plant.</li> </ul>	The power plant is located near the LNG import site.
2	<ul style="list-style-type: none"> <li>• Same as Scenario 1, except that the natural gas comes from a regional source closer to the destination.</li> <li>• In the European case, the regional source is Oran, Algeria, with a destination of Rotterdam.</li> <li>• In the Asian case, the regional source is Darwin, Australia, with a destination of Osaka, Japan.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Natural gas is produced in the Yamal region of Siberia, Russia, using conventional extraction methods.<sup>207</sup></li> <li>• It is transported by pipeline directly to a natural gas power plant in either Europe or Asia.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Coal is extracted in either Europe or Asia. It is transported by rail to a domestic coal-fired power plant.</li> </ul>	This scenario models two types of coal widely used to generate steam-electric power: surface mined sub-bituminous coal and underground mined bituminous coal. Additionally, U.S. mining data and U.S. plant operations were used as a proxy for foreign data.

<sup>206</sup> The four scenarios are set forth in the LCA GHG Report at 2.

<sup>207</sup> Yamal, Siberia, was chosen as the extraction site because that region accounted for 82.6% of natural gas production in Russia in 2012.

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<sub>2</sub>e), which convert GHG gases to the same basis: an equivalent mass of CO<sub>2</sub>. CO<sub>2</sub>e is a metric commonly used to estimate the amount of global warming that GHGs may cause, relative to the same mass of CO<sub>2</sub> released to the atmosphere. NETL chose CO<sub>2</sub>e using the Global Warming Potential (GWP) of each gas from the 2013 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2013).<sup>208</sup> The LCA GHG Report applied the respective GWPs to a 100-year and a 20-year time frame.

At the time that NETL selected the GWP values and other parameters for its LCA GHG Report, the working group papers for the IPCC's Fifth Assessment Report<sup>209</sup> were available in draft form. For the first time, those analyses produced two sets of GWP values for methane: GWP values based solely on the radiative forcing of methane and GWP values that also included an adder for climate-carbon feedbacks. Based on a perception of uncertainty underlying the climate carbon feedback adders, as well as their novelty and a lack of clear guidance from the IPCC at that time, NETL elected to use the GWP values without the climate carbon feedback

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<sup>208</sup> GWP is a measure of how much energy the emissions of one ton of a gas will absorb over a given period of time, relative to the emissions of one ton of carbon dioxide. The larger the GWP, the more that a given gas warms the Earth compared to carbon dioxide over that time period. The time period usually used for GWPs is 100 years. GWPs provide a common unit of measure, which allows analysts to add up emissions estimates of different gases (e.g., to compile a national greenhouse gas inventory), and allows policy-makers to compare emissions-reductions opportunities across sectors and gases. See U.S. Eenvtl. Protection Agency, *Understanding Global Warming Potentials*, <http://www.epa.gov/climatechange/ghgemissions/gwps.html> (last updated Sept. 11, 2015).

<sup>209</sup> IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

adders as it had done in the past. Specifically, the LCA GHG Report uses 20- and 100-year methane GWPs of 85 and 30, respectively—as compared to the GWPs of 87 and 36 when climate carbon effects are included.

#### **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.<sup>210</sup> 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 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,

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<sup>210</sup> See LCA GHG Report at 3 (citing NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*).

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,<sup>211</sup> (3) coal type (sub-bituminous or bituminous),<sup>212</sup> (4) the flaring rate for natural gas,<sup>213</sup> (5) transport distance (ocean tanker for LNG transport, and rail for coal transport),<sup>214</sup> and (6) the efficiency of the destination power plant.

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.<sup>215</sup> 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).<sup>216</sup>

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

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<sup>211</sup> 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.

<sup>212</sup> The modeling parameters and values for the coal scenarios are provided in Table 5-3. *See* LCA GHG Report at 6.

<sup>213</sup> 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<sub>2</sub>. *See id.* at 7.

<sup>214</sup> The distances used for pipeline transport of Russian gas are provided in Table 5-2. *See id.* at 6.

<sup>215</sup> *See* LCA GHG Report at 5.

<sup>216</sup> The methane leakage breakeven analysis is described in the LCA GHG Report at 14 and 15.

distances, and power plant performance.<sup>217</sup> 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).<sup>218</sup>

## **7. Results of the LCA GHG Report**

NETL states that two primary conclusions may be drawn from the LCA GHG Report.<sup>219</sup> 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.<sup>220</sup> (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.

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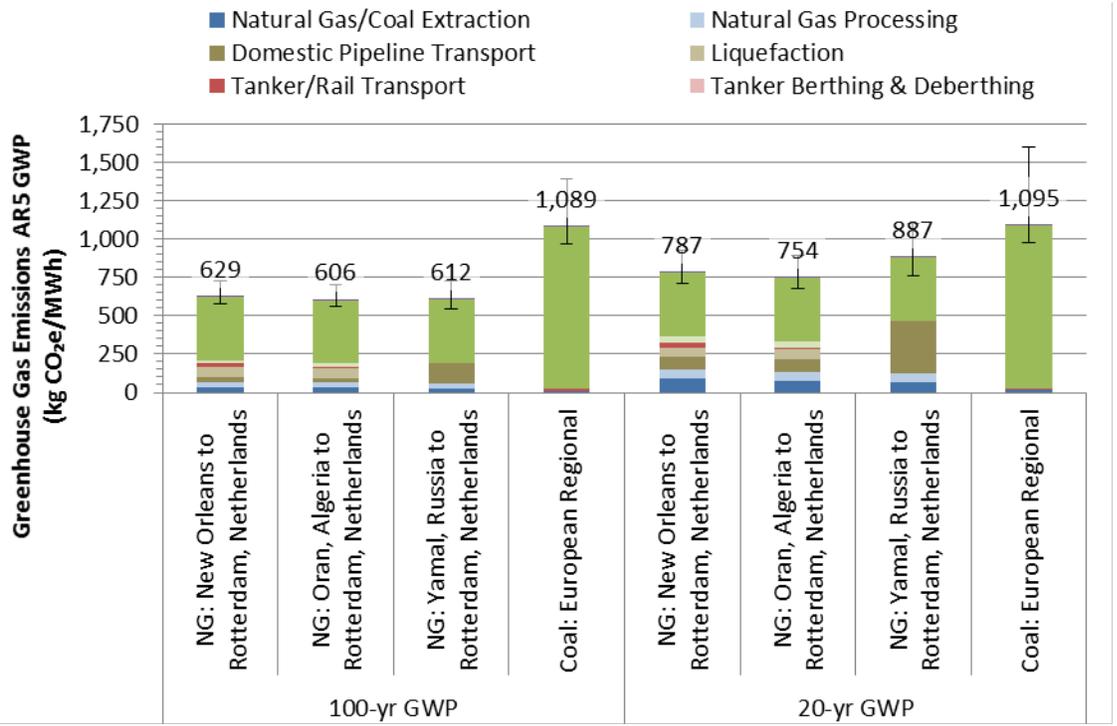
<sup>217</sup> See LCA GHG Report at 5. To ensure that the study results were robust, NETL conducted several side analyses and sensitivity calculations, as discussed in the LCA GHG Report.

<sup>218</sup> The study limitations are described in the LCA GHG Report at 18.

<sup>219</sup> NETL’s detailed study results, with corresponding figures, are set forth on pages 8 through 18 of the LCA GHG Report.

<sup>220</sup> 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.

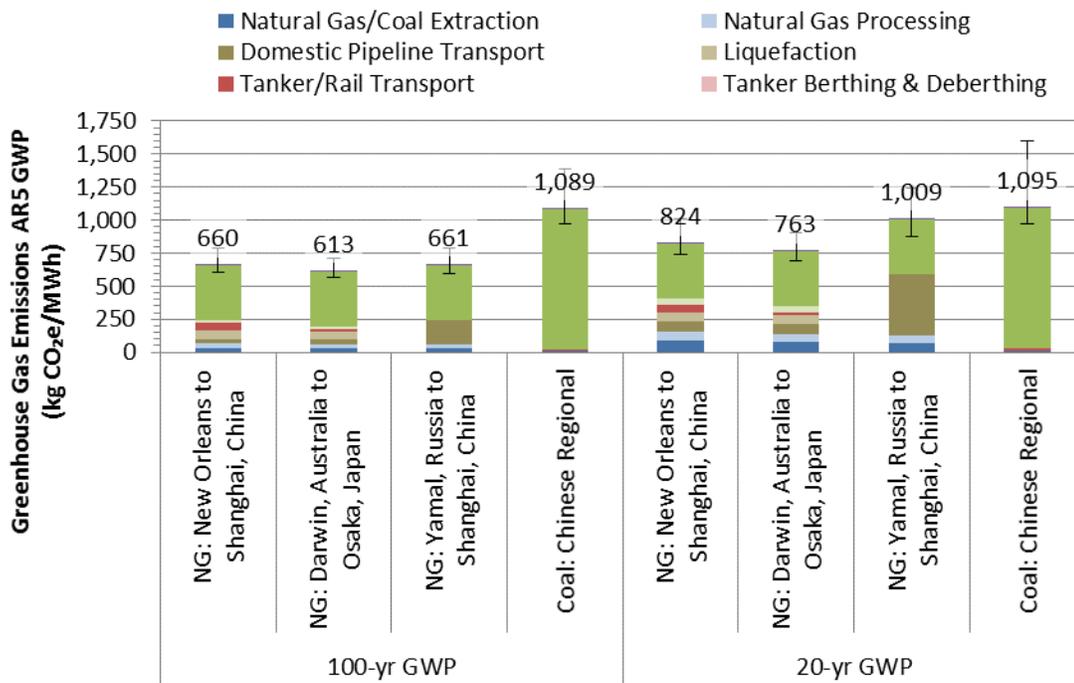
c.



d.

**Figure 1: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe<sup>221</sup>**

<sup>221</sup> LCA GHG Report at 9 (Figure 6-1).



**Figure 2: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia<sup>222</sup>**

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 Report, DOE/FE identified 18 unique submissions received from the general public, interest

<sup>222</sup> LCA GHG Report at 10 (Figure 6-2).

groups, industry, and academia/research institutions, which DOE/FE categorized into seven distinct comments.<sup>223</sup>

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<sub>2</sub> 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,  $[(415 - 1,063)/1,063 \times 100]$ ). The life cycle of baseload 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.

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<sup>223</sup> 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.

Table 12 shows the life cycle GHG emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and sulfur hexafluoride (SF<sub>6</sub>) 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 10: Life Cycle GHG Emissions from Natural Gas and Coal Systems  
(kg CO<sub>2</sub>e/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, Netherlands	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
<b>Total</b>	<b>629</b>	<b>1,089</b>	<b>787</b>	<b>1,095</b>

## **2. Boundaries of the LCA GHG Report**

### **a. Comments**

Sierra Club,<sup>224</sup> Food & Water Watch,<sup>225</sup> 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.

### **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

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<sup>224</sup> 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.

<sup>225</sup> Food & Water Watch submitted comments in the form of a letter signed by 85 individuals representing various national, state, and local public interest groups.

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.<sup>226</sup>

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<sup>226</sup> 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. Env'tl. 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>.

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<sub>2e</sub> 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 of 0.44 tonnes of CO<sub>2e</sub> per tonne of LNG; this GHG intensity is representative of a facility that consumes 12% of incoming natural gas as plant fuel.<sup>227</sup>

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

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<sup>227</sup> 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](http://www.netl.doe.gov/File_Library/Research/Energy_Analysis/Life_Cycle_Analysis/UP_Library/DS_Stage1_O_LNG_Liquefaction_2010-01.xls).

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.<sup>228</sup> 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.

## (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,<sup>229</sup> after NETL's model had been finalized and during the time that NETL was completing the LCA GHG Report. These

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<sup>228</sup> *See id.*

<sup>229</sup> U.S. Env'tl. 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>.

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.<sup>230</sup> They also match the factors used by EPA’s 2013 GHG inventory.<sup>231</sup>

NETL’s current model accounts for liquids unloading emissions from conventional wells, but does not account for liquids unloading from unconventional wells. Applying liquids 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.<sup>232</sup> 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,

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<sup>230</sup> *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*. Final Report (Sept. 21, 2012).

<sup>231</sup> U.S. Env’tl. Prot. Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (Apr. 12, 2013).

<sup>232</sup> See NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.

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<sub>2</sub>, 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 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 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.<sup>233</sup> 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 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.<sup>234</sup> Future versions of the Report will correct these duplicate

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<sup>233</sup> U.S. Env'tl. 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>.

<sup>234</sup> U.S. Env'tl. 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](http://www.epa.gov/ghgreporting/documents/pdf/2010/Subpart-W_TSD.pdf).

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.<sup>235</sup> The 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<sub>2</sub>e/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.

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<sup>235</sup> See, e.g., NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation*.

## 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%.<sup>236</sup> 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<sub>2</sub> and thus reduces methane venting to the atmosphere. Similarly, the combustion of natural gas by reboilers in a natural gas processing plant or by

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<sup>236</sup> See NETL, *Life Cycle Analysis of Natural Gas Extraction and Power Generation* (Section 6.2.1) (identifying reports that include various leakage rates).

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 percent, which DOE/FE believes is reasonable. Sierra Club is correct that NETL determined 1.3 percent and 1.4 percent to be the methane leakage rates for natural gas extracted using conventional extraction methods and extracted from the Marcellus Shale, respectively, as shown in Table 5-1 of the LCA GHG Report. But NETL determined that 1.2 percent is the expected cradle-through-transmission leakage rate for the *average* mix of domestic natural gas, which includes seven extraction sources. The contribution of the other five sources of domestic natural gas (offshore, associated, tight gas, Barnett Shale, and coal bed methane) lower the average methane leakage to 1.2 percent, below the 1.3 percent and 1.4 percent reported for actual gas extracted using conventional on-shore extraction and from the Marcellus Shale. This means that the extraction, processing, and transmission of 1 kg of natural gas<sup>237</sup> in the United States releases 0.012 kg of methane to the atmosphere from the average mix of natural gas produced in the United States (excluding Alaskan production). Thus, NETL's expected value and range on methane emission rate are calculated results that capture the underlying uncertainty and variability of the natural gas system average performance. This approach results in a reasonable estimate, and we reject Sierra Club's arguments to the contrary.

Next, 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

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<sup>237</sup> As a convention to improve comparability to other studies, NETL expresses leakage rate using delivered natural gas as a denominator; that is, methane emissions per unit of delivered natural gas, not methane emissions per unit of delivered methane.

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.<sup>238</sup> 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 also compares NETL's leakage rate to a shale gas analysis conducted by Weber et al.<sup>239</sup> We have reviewed Weber et al.'s work and do not see any mention of leakage rate.

It is 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

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<sup>238</sup> 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.

<sup>239</sup> 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.

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<sup>240</sup> do not match the bottom-up calculations by NETL and other analysts.<sup>241</sup> 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.

With the above concepts in mind, the Department’s judgment is that, based on the scientific studies available at the time the analysis in this proceeding was performed, bottom-up studies are a more appropriate basis for analysis of methane emissions from U.S. natural gas systems than available top-down studies. The broad boundaries of top-down measurements may capture all emissions from natural gas production facilities within a study region; however, these emissions are not always distinguishable from emissions from nearby oil production activities, or emissions from other sectors that operate in the same region such as agriculture. Further, top-down measurements capture methane emissions only at a particular place and time. The top-

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<sup>240</sup> 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).

<sup>241</sup> For purposes of this discussion, bottom-up *data* account for emissions at the device level (*e.g.*, liquid unloading equipment, compressors, etc.), and bottom-up *models* aggregate multiple processes to compose a system. In contrast, top-down *data* account for emissions from an entire system (*e.g.*, a sector or geographical region), and top-down *models* apportion system emissions to the products of the system. Currently, the bottom-up models for natural gas systems are based mostly on engineering relationships and represent long-term operating regimes, while top-down models for natural gas systems represent measurements collected for specific regions during narrow time frames.

down studies cited by Sierra Club represent valuable research that advance our understanding of methane emissions, but they do not form a robust basis for estimating the leakage rate from U.S. natural gas systems in the aggregate. For these reasons we do not agree that using a top-down approach would have yielded a more reasonable methane leakage rate.

The Department has also determined that NETL's upstream natural gas results are not lower than those calculated by other bottom-up studies. When cradle-through transmission boundaries are maintained and uncertainty is accounted for, NETL's natural gas results are comparable to the results from other studies. In fact, the Weber, *et al.* study reconciled the boundaries from six studies (including work by NETL and Burnham) and demonstrated that the expected values and uncertainty ranges of NETL's upstream natural gas GHG emissions closely match the results for most other studies. For these reasons, we do not agree that NETL's methane leakage rate is significantly lower than those used or calculated by other bottom-up studies.

Another commenter, 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.<sup>242</sup> 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 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

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<sup>242</sup> 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.

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.<sup>243</sup>

## **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

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<sup>243</sup> Based on current knowledge concerning the methane GWPs, DOE/FE believes that using 20- and 100-year methane GWPs of 87 and 36 would be most appropriate today, and that climate carbon feedbacks should be captured in the GWP values for methane. *See supra* at 129-30 (discussing basis for NETL’s selection of methane GWPs during analysis for LCA GHG Report). We emphasize, however, that using these values would not have materially affected the conclusions of the LCA GHG Report. There is no one-for-one relationship between the GWP of methane and the total life-cycle GHG impact of U.S.-exported LNG because methane is not the only type of GHG emission. Natural gas energy systems release both methane and carbon dioxide. On a life cycle basis for delivered electricity, combustion at the power plant—which produces carbon dioxide emissions—accounts for the majority of GHG emissions.

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.

## **XI. DISCUSSION AND CONCLUSIONS**

In reviewing Bear Head LNG's Application to export natural gas to Canada for liquefaction and subsequent export as LNG to non-FTA countries, DOE/FE has considered both its obligation under NGA section 3(a) to ensure that the proposed LNG exports are not inconsistent with the public interest and its obligations under NEPA. To accomplish these purposes, DOE/FE has examined a wide range of information addressing non-environmental and environmental factors, including:

- Bear Head LNG's Application and its Project Update Letters;
- 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 Bear Head LNG and NEES (the single protestor in this proceeding),<sup>244</sup> to the extent that DOE/FE has not already addressed the same or substantially similar arguments in its responses to comments on the 2012 LNG Export Study, the Addendum, or the LCA GHG Report.

## **A. Procedural Issues**

### **1. Motions to Intervene**

Bear Head LNG does not oppose either motion to intervene submitted in this proceeding. Additionally, we find that both NEES and Saint John Gas have articulated a sufficient interest in the outcome of this proceeding to warrant intervention. Therefore, NEES's and Saint John Gas's motions to intervene in this proceeding have been granted. 10 C.F.R. § 590.303(g).

### **2. NEES's Request for Additional Procedures**

As described above, NEES has requested that DOE/FE direct Bear Head LNG to comply with additional procedures concerning the Application under 10 C.F.R. § 590.206, including the filing of supplemental written comments, written interrogatories, and/or other discovery procedures, a conference, verbal presentation, and/or adjudication. Alternatively, under 10 C.F.R. § 590.310, NEES requests the opportunity to submit and to receive answers to written interrogatories and supplemental information from Bear Head LNG. In its motion, NEES asserts that the Application is "vague" and leaves "numerous unanswered questions"—including about Bear Head LNG's relationship with the M&N Pipeline and various pipeline expansion projects—

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<sup>244</sup> We note that NEES did not title its motion as a "protest." Nevertheless, in its request for relief, NEES asks DOE/FE to deny the Application, so we construe NEES's motion as a protest of the Application.

such that including interrogatories and other procedures will better enable DOE/FE to make a determination in this matter.<sup>245</sup>

Under DOE's regulations, NEES's request for additional procedures was denied by operation of law when DOE/FE did not rule on it within 30 days. 10 C.F.R. § 590.302(c). Even if NEES's request was not denied by operation of law, we disagree with NEES and find that its request for additional procedures should be denied. The record in this proceeding is both complete and adequate to support a finding that the proposed exports using the existing capacity of the M&N US Pipeline will not be inconsistent with the public interest, for the reasons set forth in this Order. We have taken the evidence submitted by Bear Head LNG, which NEES did not attempt to rebut, into account in our reasoning and in the scope of this authorization. Accordingly, no additional procedures, including interrogatories, are necessary.

### **3. NEES's Request to Suspend Non-FTA Approvals**

In its motion, NEES asks DOE/FE to "suspend any further LNG export approvals to non-FTA nations" until the U.S. Energy Information Administration (EIA) is able to provide more accurate information concerning the interactions between U.S. energy prices and the global economy.<sup>246</sup>

Under DOE's regulations, NEES's request to suspend non-FTA export approvals was denied by operation of law when DOE/FE did not rule on those requests within 30 days after they were filed. 10 C.F.R. § 590.302(c). Even if NEES's request for suspension was not denied by operation of law, we disagree with NEES's suggestion that the National Energy Modeling System (NEMS) model and—by extension, the 2012 EIA Study—produce inaccurate results, such that DOE/FE is unable to make an informed decision in this or other proceedings. As

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<sup>245</sup> NEES Mot. at 3; *see also supra* at 73.

<sup>246</sup> *Id.* at 2.

discussed above, 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 as the second part of the 2012 LNG Export Study. NERA found that the United States would experience net economic benefits from increased LNG exports in all cases studied, and NEES provides no evidence to refute this finding. Accordingly, contrary to NEES' argument, there is no need to suspend the processing of LNG export applications until such time as EIA prepares a study of macroeconomic impacts.

### **B. Applicability of Natural Gas Section 3(a) Public Interest Review**

We find it necessary to review the Application in this proceeding under section 3(a) of the NGA, rather than section 3(c). Section 3(a), 15 U.S.C. §717b(a), requires a full public interest review of a natural gas export application and authorizes DOE/FE to attach such terms and conditions to the authorization as necessary to ensure that the authorization is consistent with the public interest. By contrast, section 3(c), 15 U.S.C. §717b(c), states that applications to export natural gas to FTA countries must be deemed in the public interest and requires DOE/FE to grant such applications without delay or modification.

In this proceeding, we confront Bear Head LNG's proposal to export natural gas by pipeline to Canada, a FTA country, for the primary purpose of re-exporting the U.S.-sourced natural gas (after liquefaction in Canada) in the form of LNG to non-FTA countries. We find that, notwithstanding the fact that Canada is a FTA country, Bear Head LNG's proposal must be reviewed under NGA section 3(a), instead of section 3(c). This is because the U.S.-sourced natural gas to be liquefied and re-exported is intended to be delivered for end use to non-FTA countries.<sup>247</sup> The destination of the U.S.-sourced natural gas or LNG for end use is critical to our

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<sup>247</sup> See *supra* at 3 n. 11 (defining "end use" for purposes of this Order as the combustion or other chemical reaction conversion process (*e.g.*, conversion to methanol).

determination, as is the trade status of the destination country or countries. If DOE were to determine that Bear Head LNG's proposed arrangement were *not* subject to section 3(a), we would fail to give effect to Congress' intent that all exports destined for non-FTA countries be reviewed for their consistency with the public interest. We would be enabling Bear Head LNG (and other potential applicants) to evade the public interest protections set forth in section 3(a) of the NGA for non-FTA exports simply by transiting the U.S.-sourced natural gas or LNG through a FTA country prior to its liquefaction and re-export to a non-FTA country.<sup>248</sup> Accordingly, we will review the Application under NGA section 3(a).

### **C. Non-Environmental Issues**

In considering non-environmental issues in this proceeding, we have reviewed the Application and Project Update Letters submitted by Bear Head LNG, the two motions to intervene, 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. For the following reasons, the record in this proceeding does not demonstrate that a grant of the requested authorization, if limited to use of the existing capacity of the M&N US Pipeline, would be inconsistent with the public interest.

#### **1. Pipeline Capacity Issues**

We agree with those commenters and intervenors who have observed that this proceeding presents issues of first impression. This is among the first two proceedings in which DOE/FE has been asked to review an application to export U.S.-sourced natural gas by pipeline to Canada for liquefaction in Canada, for subsequent re-export of that natural gas in the form of LNG to non-FTA countries.<sup>249</sup> In addition, this proceeding presents an unusual factual circumstance.

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<sup>248</sup> See *supra* at 3-4 (discussing same).

<sup>249</sup> See also *Pieridae Energy (USA) Ltd.*, DOE/FE Order No. 3768, discussed *supra* at 5 n.17.

Most applications to DOE/FE for authority to export natural gas to non-FTA countries involve the ready availability of natural gas through an integrated grid of multiple interstate natural gas pipelines. This Application, by contrast, calls for the transportation of U.S.-sourced natural gas through a single interstate natural gas pipeline (the M&N US Pipeline). Yet, as discussed *infra*, it has not been established whether the capacity of the M&N Pipeline is adequate to transport the proposed export volumes to the designated cross-border facilities at the United States-Canada border. We have reviewed the Application with these observations in mind.

NEES raises the question of pipeline capacity—specifically, whether the capacity of the M&N US Pipeline is sufficient for the proposed export authorization. After reviewing the record, we find that Bear Head LNG has not established that the existing capacity of the M&N US Pipeline is sufficient to transport the volumes contemplated for export in the Application. We take administrative notice of FERC’s determinations in its 2007 and 2009 Orders that the relevant cross-border facilities for the proposed exports have a capacity of 833,317 Dth/d (which we estimate is equivalent to 0.81 Bcf/d of natural gas).<sup>250</sup> Those determinations, however, do not address the capacity of the M&N Pipeline that would be used to transport natural gas from Dracut, Massachusetts, in a northerly direction to the cross-border facilities. The Application states that the existing capacity of the M&N US Pipeline is equivalent to 833,317 Dth/d—or 0.81 Bcf/d of natural gas—whereas the amount of U.S.-sourced natural gas proposed to be exported by Bear Head LNG to Canada is equivalent to 1.2 Bcf/d of natural gas.<sup>251</sup> Bear Head LNG thus

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<sup>250</sup> See *supra* nn. 15-16.

<sup>251</sup> See *supra* at 3-4.

concedes that the M&N Pipeline is not presently capable of transporting the full volume of proposed exports.<sup>252</sup>

Further, there is no evidence in the record to establish the capacity of the M&N US Pipeline should the flow of natural gas on the system be reversed and the system otherwise adapted and/or expanded for purposes of moving natural gas in a northerly direction. We note that NEES argues that the requested export authorization will incentivize the expansion of the M&N US Pipeline and, possibly, other pipelines. Insofar as such capacity expansions may result proximately from the issuance of export authorizations by this agency, DOE/FE is responsible for evaluating the impacts of the capacity expansion as part of its public interest review under section 3(a) of the NGA and its environmental review under NEPA.

Bear Head LNG suggests in its Application that, in prior non-FTA export application proceedings, DOE/FE has not afforded weight in its public interest review to the capacity of the interstate pipelines delivering natural gas for export. That may well be correct. However, as discussed above, DOE/FE has not dealt previously with circumstances where, as here, the applicant identifies only a single pipeline capable of transporting natural gas to an LNG terminal for export and that pipeline may not presently have the capacity to meet the anticipated demand for export volumes.

Accordingly, we will grant Bear Head LNG's Application in a modified volume and authorize exports up to 0.81 Bcf/d of natural gas (296 Bcf/yr). Additionally, we will impose a limitation on the authorization requiring Bear Head LNG to submit a new export application should it wish to make use of any new or upgraded capacity on M&N US Pipeline or other cross-border pipelines to support its authorized export operations. Pipeline capacity will be considered

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<sup>252</sup> We also note that, in the parallel *Pieridae US* proceeding, *Pieridae US* asserts that the existing capacity of the southern portion of the M&N US Pipeline is significantly less than 0.81 Bcf/d—only 0.42 Bcf/d of natural gas. *See Pieridae US*, DOE/FE Order No. 3768, at 18.

“new” or “upgraded” for purposes of this limitation if it is the result of physical changes that increase the northbound capacity of such a pipeline and any such changes require an amendment to the pipeline’s certificate issued by FERC under NGA section 7, 15 U.S.C. §717f. By imposing this limitation on the requested authorization, we ensure that DOE and the public will have an opportunity to review and to comment, respectively, on the potential public interest and environmental impacts of any facilities’ expansion connected with Bear Head LNG’s export operations.

## **2. Natural Gas Supplies and Domestic Demand**

The unrebutted record in this proceeding indicates that there are ample supplies of natural gas within the lower-48 states to meet the demands of consumers in the market territory of the M&N US Pipeline and also to meet Bear Head LNG’s proposed export operations up to 0.81 Bcf/d of natural gas. For example, Bear Head LNG has pointed to data from AEO 2014 showing that total U.S. dry gas production is projected to be 37.54 Tcf by 2040 in the Reference Case, with a 1.6 percent annual growth rate between 2012 and 2040. The Ziff Report, on which Bear Head LNG relies, finds that the Appalachian Basin region (encompassing the Marcellus and Utica shale play regions) has produced only five percent of its ultimate potential, with 757 Tcf remaining.<sup>253</sup> These projected supplies are further confirmed by data from AEO 2015 which, as discussed *supra*, shows total recoverable reserves of 2,266 Tcf and an increasing domestic supply base to 2035.

## **3. Pipeline Rate Impacts**

In circumstances where the local capacity of a distribution company or, in this instance, an interstate pipeline, is stressed over the potentially competing demands of consumers in domestic and export markets, a freely functioning market will incentivize the development of

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<sup>253</sup> See Bear Head LNG App. at 17-18.

increased capacity to meet rising demand. The record in this proceeding shows that there are several pending proposals to increase pipeline capacity into the market territory currently traversed by M&N US Pipeline. The success of these proposals cannot be assumed and we make no such assumption. Nevertheless, we think it reasonable to observe that the success of such proposals will make it more likely that additional pipeline capacity will become available to meet the demand occasioned by this authorization plus the local and regional demand in the states served by M&N US Pipeline. Alternatively, if no additional pipeline projects move forward, the likely effect will be increased competition for pipeline capacity. This could result in higher rates for interstate natural gas transportation services. Yet the rates charged for interstate pipeline capacity are subject to review by FERC under sections 4 and 5 of the NGA, 15 U.S.C. §§ 717c and 717d. FERC is charged under these sections of the NGA with ensuring that the rates for interstate pipeline services are just and reasonable. Given this backstop on the potential pipeline rate impact of increased throughput on the M&N US Pipeline, which is uncontroverted in the record, we do not find that it has been shown that rate increases occasioned by or related to the exports proposed by Bear Head LNG will be contrary to the public interest.

#### **4. Commodity Price Impacts**

As discussed above, the 2012 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 10.82 Bcf/d of natural gas). The 2012 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 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.

In urging DOE/FE to suspend its review of LNG export applications, NEES criticizes EIA's use of the NEMS model and argues that EIA relied on "outdated and unreliable" data for its analyses.<sup>254</sup> We do not agree with NEES's arguments concerning this purportedly old or "unreliable" data, or its view that more recent data would illustrate that the proposed exports are contrary to the public interest. As discussed herein, the more recent AEO 2015 projections 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.<sup>255</sup> Accordingly, we reject NEES's arguments on the merits and find that NEES has not overcome the statutory presumption that the requested authorization is consistent with the public interest.

### **5. Significance of the 2012 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 2012 LNG Export Study provides substantial support for granting Bear Head LNG's Application. The conclusion of the 2012 LNG Export Study is that the United States will

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<sup>254</sup> NEES Mot. at 2.

<sup>255</sup> See *supra* § VIII.A.

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. As discussed above, various commenters in that proceeding, as well NEES in this proceeding, have criticized the data used as inputs to the 2012 LNG Export Study and/or numerous aspects of the models, assumptions, and design of the Study. 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 2012 LNG Export Study is fundamentally sound and supports the proposition that the proposed authorization will not be inconsistent with the public interest.

## **6. 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.”<sup>256</sup>

We have also considered the international consequences of our decision, including those addressed by Bear Head LNG in its Application. We review applications to export LNG to non-FTA nations under section 3(a) of the NGA. The United States’ commitment to free trade is one factor bearing on that review. An efficient, transparent international market for natural gas with

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<sup>256</sup> National Export Initiative, 75 Fed. Reg. 12,433 (Mar. 16, 2010).

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 2012 LNG Export Study.

#### **D. Environmental Issues**

In reviewing the potential environmental impacts of Bear Head LNG's proposal to export LNG, DOE/FE has considered its obligations under NEPA and its separate obligation under NGA section 3(a) to ensure that the proposal is not inconsistent with the public interest. We have also reviewed the motions, protests, and comments submitted in response to the Notice of Application.

##### **1. Issuance of Categorical Exclusion**

DOE's regulations at 10 C.F.R. Part 1021, Subpart D, Appendix B, list categorical exclusions that apply to DOE actions. Item B5.7 provides a categorical exclusion where approvals or disapprovals of authorizations to import or export natural gas under NGA section 3 involve minor operational changes, but not new construction. We find that the present authorization falls within the scope of the B5.7 categorical exclusion for two reasons. First, Bear Head LNG will construct the natural gas liquefaction facility at issue in this case—the proposed Bear Head Project—in Canada. This construction outside of the United States is beyond the scope of our environmental review under NEPA. Second, as explained above, this Order only

authorizes exports on existing facilities. On this basis, DOE/FE issued the Categorical Exclusion on January 28, 2016.<sup>257</sup>

The issuance of the Categorical Exclusion supports a determination that no further environmental review of Bear Head LNG’s Application is required under NEPA. In light of the issuance of the Categorical Exclusion, we find that no environmental conditions need to be imposed on this authorization.

## **2. Scope of NEPA Review**

Many commenters in the 2012 LNG Export Study proceeding urged DOE/FE to consider the indirect effects of induced natural gas production in the United States associated with each LNG export application—including but not limited to impacts on climate change from GHG emissions associated with the production, transport, and combustion of the natural gas—as well as impacts associated with the construction and/or expansion of various pipeline and liquefaction facility infrastructure.

We find that a detailed environmental analysis of increased natural gas production and/or pipeline construction or expansion would be too speculative for consideration in this proceeding because these possible impacts cannot be described with sufficient specificity to make their consideration useful for reasoned decision-making. Such increased production and possible pipeline build-out is not “reasonably foreseeable” for purposes of NEPA analysis. We therefore find that NEPA does not require our environmental review to include induced upstream natural gas production, nor does it require us to consider impacts associated with pending or anticipated projects not related to this authorization. As explained herein, this authorization is expressly

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<sup>257</sup> See U.S. Dep’t of Energy, Categorical Exclusion Determination, *Bear Head LNG Corp. v. Bear Head LNG (USA), LLC*, FE Docket No. 15-33-LNG (Jan. 28, 2016).

conditioned on Bear Head LNG using the capacity of the M&N US Pipeline in service as of the date of this Order.<sup>258</sup>

Further, 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.<sup>259</sup> 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

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<sup>258</sup> See *infra* §§ XIII (Terms & Conditions Para. J) & XIV (Ordering Para. A).

<sup>259</sup> See LNG Export Study – Related Documents, available at <http://energy.gov/fe/services/natural-gas-regulation/lng-export-study> (EIA 2012 Study) at 10-11.

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.<sup>260</sup>

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.<sup>261</sup>

### **3. Cumulative Environmental Impacts**

Many commenters to the 2012 LNG Export Study proceeding assert that our environmental review must consider the cumulative environmental impacts from all proposed and previously approved export authorizations—and/or all proposed pipeline projects—and suggest that some form of EIS is legally required for these purposes. We disagree. In issuing the Categorical Exclusion under NEPA in this proceeding, we have determined that no new construction will be required in the United States to support the proposed exports. As noted above, this authorization does not apply to any future construction or operational changes to expand the capacity of the M&N Pipeline or other facilities located within the United States caused either in whole or in part by Bear Head LNG’s export operations. We further find that

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<sup>260</sup> 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 n.161 (Nov. 15, 2013) (FLEX II Conditional Order).

<sup>261</sup> *Sabine Pass*, DOE/FE Order No. 2961-A, at 11 (quoting 40 C.F.R. § 1508.7).

other aspects of our review, including the Addendum and the LCA GHG Report, take into account all reasonably foreseeable cumulative environmental impacts relating to the exports of LNG proposed in this proceeding. Therefore, we are satisfied that all cumulative environmental impacts relevant to this proceeding have been considered.

#### **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.<sup>262</sup> 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.

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 (or re-exports) of U.S.-sourced natural gas in the form of LNG 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

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<sup>262</sup> Addendum at 2.

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.<sup>263</sup> In 2013, EPA updated those regulations to include storage tanks,<sup>264</sup> 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.<sup>265</sup> 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.”<sup>266</sup> Specifically, as part of the Administration’s efforts to address climate change, EPA has initiated 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.<sup>267</sup> EPA issued a proposed rule in September 2015, with a final rule expected to follow in 2016.<sup>268</sup>

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

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<sup>263</sup> U.S. Env’tl. 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).

<sup>264</sup> U.S. Env’tl. Prot. Agency, Oil and Natural Gas Sector: Reconsideration of Certain Provisions of New Source Performance Standards; Final Amendments, 77 Fed. Reg. 58,416 (Sept. 23, 2013).

<sup>265</sup> U.S. Env’tl. 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* § IX.C.

<sup>266</sup> U.S. Env’tl. 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 <http://www.epa.gov/airquality/oilandgas/pdfs/20150114fs.pdf>.

<sup>267</sup> 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-climate-action-plan-anno-1> (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.”).

<sup>268</sup> U.S. Env’tl. Prot. Agency, Oil and Natural Gas Sector: Emission Standards for New and Modified Sources; Proposed Rule, 80 Fed. Reg. 56,593 (Sept. 18, 2015). EPA subsequently extended the public comment period on this proposed rule and two related proposed rules until December 4, 2015. See 80 Fed. Reg. 70,719 (Nov. 13, 2015).

to forego entirely the economic and international benefits discussed herein, but would have little more than a modest, incremental impact on the environmental issues raised by commenters to the 2012 LNG Export Study. For these reasons, we conclude that the environmental concerns associated with natural gas production do not establish that re-exports of U.S.-sourced natural gas in the form of LNG to non-FTA nations are inconsistent with the public interest.

## **5. Greenhouse Gas Impacts Associated with U.S. LNG Exports**

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.

### **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).”<sup>269</sup> 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.”<sup>270</sup> Likewise, “[s]witching from natural gas to coal is less significant in later years, partially as a result of a greater proportion of switching into renewable generation.”<sup>271</sup> 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.<sup>272</sup> 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.<sup>273</sup> Therefore, EIA’s analysis did not include the impacts

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<sup>269</sup> 2012 EIA Study at 18.

<sup>270</sup> *Id.*

<sup>271</sup> *Id.*

<sup>272</sup> *Id.*

<sup>273</sup> 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.”).

that EPA's Mercury and Air Toxics Standard<sup>274</sup> and its Transport Rule<sup>275</sup> 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 expected to reduce the extent to which the increased use of coal would compensate for reduced use of natural gas. These rules, finalized in the fall of 2015, impose limits on GHG emissions from both new and existing coal-fired power plants.<sup>276</sup> In particular, these 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):

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<sup>274</sup> U.S. Env'tl. 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).

<sup>275</sup> U.S. Env'tl. 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).

<sup>276</sup> U.S. Env'tl. Protection Agency, Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,510 (Oct. 23, 2015); U.S. Env'tl. Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662 (Oct. 23, 2015) (effective Dec. 22, 2015).

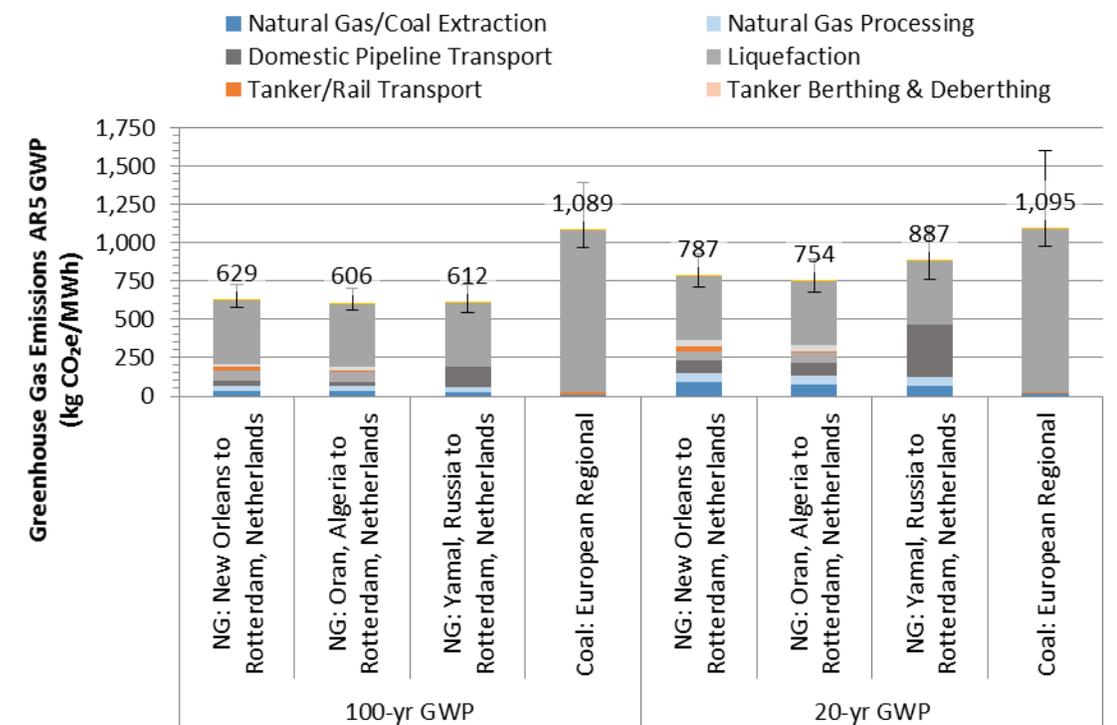
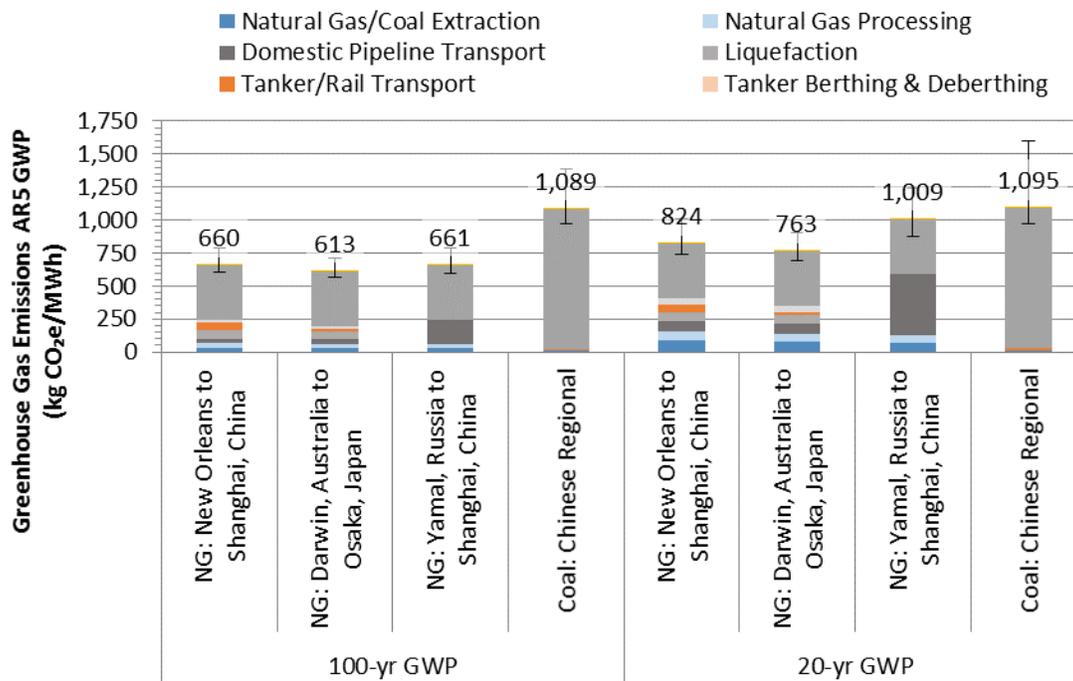


Figure 3: Life Cycle GHG Emissions for Natural Gas and Coal Power in Europe<sup>277</sup>

<sup>277</sup> LCA GHG Report at 9 (Figure 6-1).



**Figure 4: Life Cycle GHG Emissions for Natural Gas and Coal Power in Asia<sup>278</sup>**

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.<sup>279</sup>

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, indigenous natural gas, synthetic natural gas derived from coal, and other resources, as well as

<sup>278</sup> LCA GHG Report at 10 (Figure 6-2).

<sup>279</sup> *Id.* at 9, 18.

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 not only would 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.<sup>280</sup>

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.<sup>281</sup> For India, installed electric generation capacity in 2014 is 59% coal and 9% natural gas.<sup>282</sup> 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 generation from fossil fuels was 74% of total generation in 2011 and 89% in 2012 after the Fukushima disaster.<sup>283</sup> In Europe, use of fossil fuels is slightly less than in the Asian nations

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<sup>280</sup> Sierra Club has observed 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.

<sup>281</sup> U.S. Energy Information Administration, China Analysis Brief (last updated Feb. 4, 2014), *available at*: <http://www.eia.gov/countries/cab.cfm?fips=CH>.

<sup>282</sup> U.S. Energy Information Administration, India Analysis Brief (last updated June 26, 2014), *available at* <http://www.eia.gov/beta/international/analysis.cfm?iso=IND>  
U.S. Energy Information Administration, Japan Analysis Brief (last updated Jan. 30, 2015), *available at* <http://www.eia.gov/countries/cab.cfm?fips=JA>.

<sup>283</sup> 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

noted above but still significant, comprising 68% and 49% of electric generation in the United Kingdom and Spain for 2012, respectively.<sup>284</sup>

The comparison cases used in the LCA GHG Report were well-chosen. When U.S.-exported LNG enters the marketplace, it will compete with LNG sourced from other countries. Therefore, the comparison of U.S.-sourced LNG to foreign-sourced LNG is clearly instructive. U.S.-exported LNG also will compete directly with pipeline deliveries from Russia in some markets, another form of “gas-on-gas” competition. Because the availability of U.S.-exported LNG may affect the electric power generation mix in importing countries, the LCA GHG Report also compared U.S.-exported LNG to coal produced domestically in both Europe and Asia. This comparison is likewise instructive because, as we explain herein, coal remains a prevalent choice for electric power generation in LNG-importing countries and competes with natural gas as a source of baseload power.

It is important, however, to recognize DOE/FE’s limited aims in making these comparisons. We emphasize that the comparisons to coal and foreign-sourced gas in the LCA GHG Report do not themselves answer how U.S. LNG exports may affect the global GHG balance because U.S. LNG may compete with other resources as well. Nonetheless, given the prevalence of coal and natural gas as sources of electric generation in LNG-importing countries, the comparison provides valuable information.

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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.*

<sup>284</sup> 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.

Additionally, as noted above, DOE/FE has not attempted to calculate a more precise prediction regarding global GHG impacts because the compounded uncertainties in estimating how the availability of U.S. LNG exports would affect the market for every potential energy source in every importing country—together with the interventions of foreign governments in those markets—would render such an analysis too speculative to inform our public interest determination. For example, even in the unlikely scenario that *all* U.S. LNG were exported to Japan, those exports would affect the global price of LNG, which in turn would affect energy systems in numerous countries besides Japan. To the extent that U.S.-exported LNG lowers the price of natural gas in a given country, that price change could affect dispatch and retirement decisions facing existing units as well as decisions of what new units to build. Even with respect to new capacity, it may not be valid to assume that natural gas would compete directly with renewables in all nations given the potential intervention of public policy and the different role these resources play in an integrated electric system.

In sum, the conclusions of the LCA GHG Report, combined with the observation that many LNG-importing nations rely heavily on fossil fuels for electric generation, suggest 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.

#### **E. Other Considerations**

Our decision is not premised on an uncritical acceptance of the general conclusion of the 2012 LNG Export Study of net economic benefits from LNG exports. Both the 2012 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 taken into account factors that could mitigate such impacts, such as the current oversupply situation and data indicating that the 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 Bear Head LNG's proposed re-exports of U.S.-sourced natural gas in the form of LNG 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<sup>285</sup> that, under most circumstances, the market is the most efficient means of allocating natural gas supplies. However, contrary to arguments made by IECA in its Protest (*supra* § VII.D.4), we recognize that 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.<sup>286</sup> Given these

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<sup>285</sup> 49 Fed. Reg. at 6684.

<sup>286</sup> Some commenters on the 2012 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).

possibilities, DOE/FE recognizes the need to monitor market developments closely as the impact of successive authorizations of LNG exports unfolds.

## F. Conclusion

We have reviewed the evidence in the record and relevant precedent in earlier non-FTA export decisions and have not found an adequate basis to conclude that Bear Head LNG's proposed export of U.S.-sourced natural gas to Canada—in a modified volume of 0.81 Bcf/yr of natural gas—using the existing facilities of the M&N US Pipeline for liquefaction and re-export in the form of LNG from Canada for end use in non-FTA countries will be inconsistent with the public interest. For that reason, we are granting the non-FTA portion of Bear Head LNG's Application in this modified volume 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 10.82 Bcf/d of natural gas, or 3.949 trillion cubic feet per year, for the 14 final authorizations issued to date—Sabine Pass Liquefaction, LLC (2.2 Bcf/d),<sup>287</sup> Carib Energy (USA) LLC (0.04 Bcf/d),<sup>288</sup> Cameron LNG, LLC (1.7 Bcf/d),<sup>289</sup> FLEX I (1.4 Bcf/d),<sup>290</sup> FLEX II (0.4 Bcf/d),<sup>291</sup> Dominion Cove Point LNG,

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<sup>287</sup> *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 Export Liquefied Natural Gas From Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (Aug. 7, 2012).

<sup>288</sup> *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).

<sup>289</sup> *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).

<sup>290</sup> *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

LP (0.77 Bcf/d),<sup>292</sup> Cheniere Marketing, LLC and Corpus Christi Liquefaction, LLC (2.1 Bcf/d),<sup>293</sup> Sabine Pass Liquefaction, LLC Expansion Project (1.38 Bcf/d),<sup>294</sup> American Marketing LLC (0.008 Bcf/d),<sup>295</sup> Emera CNG, LLC (0.008 Bcf/d),<sup>296</sup> Floridian Natural Gas Storage Company, LLC,<sup>297</sup> Air Flow North American Corp. (0.002 Bcf/d), this Order (0.81 Bcf/d), and the authorization being issued concurrently to Pieridae US (DOE/FE No. 3768).<sup>298</sup>

We note that the volumes authorized for export in the *Carib* and *Floridian* orders are both 14.6 Bcf/yr of natural gas (0.04 Bcf/d), yet are not additive to one another because the source of LNG approved under both orders is from the Floridian Facility.<sup>299</sup> Likewise, the volumes authorized

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Freeport LNG Terminal on Quintana Island, Texas, to Non-Free Trade Agreement Nations (Nov. 14, 2014) (FLEX I Final Order).

<sup>291</sup> *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).

<sup>292</sup> *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).

<sup>293</sup> *Cheniere Marketing, LLC and Corpus Christi Liquefaction, LLC*, DOE/FE Order No. 3638, FE Docket No. 12-97-LNG, Final Order and Opinion 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).

<sup>294</sup> *Sabine Pass Liquefaction, LLC*, DOE/FE Order No. 3669, FE Docket Nos. 13-30-LNG, 13-42-LNG, & 13-121-LNG, 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 Free Trade Agreement Nations (June 26, 2015).

<sup>295</sup> *American LNG Marketing LLC*, DOE/FE Order No. 3690, FE Docket No. 14-209-LNG, Final Opinion and Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at the Proposed Hialeah Facility near Medley, Florida, and Exported by Vessel to Non-Free Trade Agreement Nations (Aug. 7, 2015).

<sup>296</sup> *Emera CNG, LLC*, DOE/FE Order No. 3727, FE Docket No. 13-157-CNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Compressed Natural Gas by Vessel From a Proposed CNG Compression and Loading Facility at the Port of Palm Beach, Florida, to Non-Free Trade Agreement Nations (Oct. 19, 2015).

<sup>297</sup> *Floridian Natural Gas Storage Co., LLC*, DOE/FE Order No. 3744, FE Docket No. 15-38-LNG, Final Opinion and Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas in ISO Containers Loaded at the Proposed Floridian Facility in Martin County, Florida, and Exported by Vessel to Non-Free Trade Agreement Nations (Nov. 25, 2015).

<sup>298</sup> *Pieridae Energy (USA) Ltd.*, DOE/FE Order No. 3768, *supra* at 5 n.17.

<sup>299</sup> *See Floridian Natural Gas Storage Co., LLC*, DOE/FE Order No. 3744, at 22 (stating that the quantity of LNG authorized for export by Floridian “will be reduced by the portion of the total approved export volume of 14.6 Bcf/yr that is under firm contract directly or indirectly to Carib Energy (USA), LLC”); *see also id.* at 21 (Floridian “may not treat the volumes authorized for export in the [*Carib* and *Floridian*] proceedings as additive to one another”).

for export in this Order and the Pieridae US order are not additive; together, they are limited to a maximum of 0.81 Bcf/d to reflect the current capacity of the M&N US Pipeline. In sum, the 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.

DOE/FE will continue taking a measured approach in reviewing the other pending applications to export natural gas. 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 2012 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 phenomenon 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, 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.

## **XII. 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 and Condition are explained below. Bear Head LNG must abide by each Term and Condition or face rescission of its authorization or other appropriate sanction.

### **A. Term of the Authorization**

Bear Head LNG has requested a 25-year term for the authorization commencing from the date export operations begin. However, because the NERA Study contains projections over a 20-year period beginning from the date of first export,<sup>300</sup> we believe that caution recommends limiting this authorization to no longer than a 20-year term beginning from the date of first commercial export. 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. We also note that a 20-year term is consistent with our practice in the final and conditional non-FTA export authorizations issued to date. Accordingly, the 20-year term will begin on the date when Bear Head LNG commences commercial re-export of U.S.-sourced natural gas in the form of LNG from the proposed Bear Head Project, but not before.

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<sup>300</sup> NERA Study at 5 (“Results are reported in 5-year intervals starting in 2015. These calendar years should not be interpreted literally but represent intervals after exports begin. Thus if the U.S. does not begin LNG exports until 2016 or later, one year should be added to the dates for each year that exports commence after 2015.”).

## **B. Commencement of Operations Within Seven Years**

Bear Head LNG requested that this authorization commence on the earlier of the date of first re-export or 10 years from the date of the issuance of this Order. Consistent with the final and conditional non-FTA authorizations issued to date,<sup>301</sup> DOE/FE will add as a condition of the authorization that Bear Head LNG must commence commercial LNG re-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 or re-export operations.

## **C. Commissioning Volumes**

Bear Head LNG will be permitted to apply for short-term authorizations to re-export Commissioning Volumes prior to the commencement of the first commercial re-exports of U.S.-sourced natural gas in the form of LNG from the Bear Head Project. “Commissioning Volumes” are defined as the volume of LNG produced and exported (or re-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 re-exports pursuant to Bear Head LNG’s long-term contracts.<sup>302</sup> The Commissioning Volumes will not be counted against the maximum level of volume authorized in Bear Head LNG’s FTA order (DOE/FE Order No. 3681) or in this Order.

## **D. Make-Up Period**

Bear Head LNG 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

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<sup>301</sup> See, e.g., *Freeport LNG Expansion, L.P., et al.*, DOE/FE Order No. 3357-B, at 100.

<sup>302</sup> 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).

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 authorized for export or re-export in Bear Head LNG’s FTA order (DOE/FE Order No. 3681) or in this Order. Insofar as Bear Head LNG may seek to export or re-export additional volumes not previously authorized, 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.<sup>303</sup> 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. Accordingly, Bear Head LNG shall be required to comply with DOE/FE’s procedures governing a change in control<sup>304</sup>

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<sup>303</sup> 10 C.F.R. § 590.405.

<sup>304</sup> 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. 65,541 (Nov. 5, 2014) [hereinafter Procedures for Changes in Control].

## F. Agency Rights

Bear Head LNG requests authorization to re-export U.S.-sourced natural gas in the form of LNG on its own behalf and as agent for other entities that hold title to the LNG at the time of re-export, pursuant to long-term sales and purchase agreements with Bear Head LNG. DOE/FE previously addressed the issue of Agency Rights in Order No. 2913,<sup>305</sup> 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 export must be held by the authorization holder at the point of export.<sup>306</sup> 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*.<sup>307</sup> 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.<sup>308</sup>

To ensure that the public interest is served, the authorization granted herein shall be conditioned to require that where Bear Head LNG proposes to re-export U.S.-sourced natural gas

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<sup>305</sup> *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*].

<sup>306</sup> *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.

<sup>307</sup> *Gulf Coast LNG Export, LLC*, DOE/FE Order No. 3163, FE Docket No. 12-05-LNG, Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Proposed Brownsville Terminal to Free Trade Agreement Nations (Oct. 16, 2012).

<sup>308</sup> *See id.* at 7-8.

in the form of LNG 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 re-export the LNG in accordance with the procedures and requirements described herein.

**G. Contract Provisions for the Sale or Transfer of U.S.-Sourced Natural Gas in the Form of LNG to be Re-Exported**

DOE/FE's regulations require applicants to supply transaction-specific factual information "to the extent practicable."<sup>309</sup> 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.<sup>310</sup>

DOE/FE will require that Bear Head LNG file or cause to be filed with DOE/FE any relevant long-term commercial agreements, including sale and purchase agreements, pursuant to which Bear Head LNG re-exports U.S.-sourced natural gas in the form of LNG as agent for a Registrant.

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 of two years, an agreement to provide gas processing or liquefaction services at the proposed Bear Head Project, a long-term sales contract involving U.S.-sourced natural gas stored or liquefied at the Bear Head Project, or an agreement to provide long-term re-export services from the Bear Head Project.

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<sup>309</sup> 10 C.F.R. § 590.202(b).

<sup>310</sup> *Id.* § 590.202(e).

In addition, DOE/FE finds that section 590.202(c) of DOE/FE's regulations<sup>311</sup> requires that Bear Head LNG file, or cause to be filed, all long-term contracts associated with the long-term supply of U.S.-sourced natural gas to the proposed Bear Head Project, whether signed by Bear Head LNG or the Registrant, within 30 days of their execution.

DOE/FE recognizes that some information in Bear Head LNG's or a Registrant's long-term commercial agreements associated with the re-export of U.S.-sourced natural gas in the form of LNG, and/or long-term contracts associated with the long-term supply of U.S.-sourced natural gas to the proposed Bear Head Project, may be commercially sensitive. DOE/FE therefore will provide Bear Head LNG the option to file or cause to be filed either unredacted contracts, or in the alternative (A) Bear Head LNG 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 that future contracts for the sale or transfer of U.S.-sourced natural gas in the form of LNG re-exported pursuant to this Order shall include an acknowledgement of these requirements.

#### **H. Export Quantity**

As further discussed below in Paragraph J, we are not granting the Application in the full export quantity requested by Bear Head LNG (equivalent to 440 Bcf/yr, or 1.2 Bcf/d, of natural

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<sup>311</sup> *Id.* § 590.202(c).

gas), and instead will grant the requested authorization in a volume to reflect the capacity of the M&N US Pipeline's cross-border facilities in service as of the date of this Order (equivalent to 0.81 Bcf/d of natural gas). DOE/FE's policy is not to authorize exports that exceed the capacity of a LNG export terminal, and we find that the same principle applies in this proceeding to pipeline capacity at the cross-border facilities.<sup>312</sup> Consequently, we authorize the export of LNG up to the equivalent of 0.81 Bcf/d of natural gas (296 Bcf/yr), which is within the anticipated maximum liquefaction capacity of the Bear Head Facility.<sup>313</sup>

### **I. Combined FTA and Non-FTA Export Authorization Volumes**

Bear Head LNG is currently authorized in DOE/FE Order No. 3681 to export U.S.-sourced natural gas by pipeline from the United States to Canada for end use in Canada and/or, after liquefaction in Canada, by vessel from the proposed Bear Head Project to FTA countries for end use in FTA countries. The volume authorized in the FTA order is the full amount requested in the Application—440 Bcf/yr of natural gas—consistent with the statutory mandate in NGA section 3(a), 15 U.S.C. § 717b(c). For the reasons explained herein, however, we are not granting the Application in the full amount requested for this non-FTA export authorization, and instead are authorizing the export of LNG in a lesser volume equivalent to 296 Bcf/yr (0.81 Bcf/d). Accordingly, Bear Head LNG may not treat the FTA export or re-export volume authorized in DOE/FE Order No. 3681 as additive to the non-FTA volume authorized in this Order.

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<sup>312</sup> See FLEX II Conditional Order at 162 (“There is no basis for authorizing exports in excess of the maximum liquefaction capacity of a planned facility.”).

<sup>313</sup> As noted above (*supra* § IV.B), Bear Head LNG estimates that the Bear Head Project will be capable of producing LNG in a volume equivalent to approximately 397.6 Bcf/yr of natural gas.

## **J. Export Authorization Volumes on the M&N Pipeline**

This export authorization is limited to volumes of natural gas that Bear Head LNG exports to Canada using the capacity of the M&N US Pipeline's cross-border facilities in service as of the date of this Order. Should Bear Head LNG wish to use new or upgraded pipeline capacity to transport volumes for export to non-FTA countries, it will be required to apply to DOE/FE for new export authorization.<sup>314</sup>

## **K. Environmental Review**

As explained above, the Application qualifies for a categorical exclusion, which DOE/FE issued on January 28, 2016. No additional environmental review or environmental conditions are necessary.

## **XIII. 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 Bear Head LNG's Application should be granted subject to the Terms and Conditions set forth herein. The following Ordering Paragraphs reflect current DOE/FE practice.

## **XIV. ORDER**

Pursuant to section 3 of the Natural Gas Act, it is ordered that:

A. Bear Head LNG Corporation and Bear Head LNG (USA), LLC (collectively, Bear Head LNG) are jointly authorized to export U.S.-sourced natural gas using the capacity of the M&N US Pipeline in service as of the date of this Order to Canada for liquefaction and re-export in the form of LNG in a volume up to the equivalent of 296 Bcf/yr of natural gas. Should Bear

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<sup>314</sup> As set forth above, pipeline capacity will be considered "new" or "upgraded" for purposes of this limitation if it is the result of physical changes that increase the northbound capacity of an existing or new pipeline with cross-border facilities and any such changes require a new certificate of public convenience and necessity or an amendment to a pipeline certificate previously issued by FERC under NGA section 7, 15 U.S.C. §717f. *See supra* at 158-59.

Head LNG seek to use pipeline facilities to implement this authorization other than the existing capacity of the M&N US Pipeline's cross-border facilities in service as of the date of this Order, it shall apply for new export authorization. Bear Head LNG is authorized to re-export the LNG subject to this authorization by vessel from the proposed Bear Head Project, to be located near the town of Port Hawkesbury, on the Strait of Canso, in Richmond County, Cape Breton, Nova Scotia, Canada. This authorization is for a term of 20 years to commence from the date of first commercial re-export, but not before. Bear Head LNG is authorized to re-export this LNG on its own behalf and as agent for other entities who hold title to the natural gas, pursuant to one or more long-term contracts (a contract greater than two years).

B. Bear Head LNG may export (or re-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 Bear Head LNG's FTA order (DOE/FE Order No. 3681) or in this Order.

C. Bear Head LNG 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 authorized for export or re-export in Bear Head LNG's FTA order (DOE/FE Order No. 3681) or in this Order. Insofar as Bear Head LNG may seek to export or re-export additional volumes not previously authorized, it will be required to obtain appropriate authorization from DOE/FE.

D. Bear Head LNG must commence re-export operations using the planned liquefaction facilities no later than seven years from the date of issuance of this Order.

E. The quantity of U.S.-sourced natural gas in the form of LNG authorized for re-export in this Order (equivalent to 296 Bcf/yr of natural gas) is not additive to the export volume in Bear Head LNG's FTA authorization, set forth in DOE/FE Order No. 3681, or the export volume in Pieridae US's non-FTA authorization in FE Docket No. 14-179-LNG, set forth in DOE/FE Order No. 3768.

F. This U.S.-sourced natural gas in the form of LNG may be re-exported to any country with which the United States does not have a FTA requiring the national treatment for trade in natural gas (non-FTA countries) and/or to FTA countries for end use in non-FTA countries, which currently have or in the future develop the capacity to import LNG, and with which trade is not prohibited by U.S. law or policy.

G. Bear Head LNG shall ensure that all transactions authorized by this Order are permitted and lawful under U.S. laws and policies, including the rules, regulations, orders, policies, and other determinations of the Office of Foreign Assets Control of the U.S. Department of the Treasury. Failure to comply with these requirements could result in rescission of this authorization and/or other civil or criminal remedies.

H. (i) Bear Head LNG shall file, or cause others to file, with the Office of Regulation and International Engagement a non-redacted copy of all executed long-term contracts associated with the long-term re-export of U.S.-sourced natural gas in the form of LNG as agent for other entities from the Bear Head Project. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Bear Head LNG 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, Bear Head LNG 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, Bear Head LNG shall state why the redacted or non-disclosed information should be exempted from public disclosure.

(ii) Bear Head LNG shall file, or cause others to file, with the Office of Regulation and International Engagement a non-redacted copy of all executed long-term contracts associated with the long-term supply of natural gas to the Bear Head Project. The non-redacted copies may be filed under seal and must be filed within 30 days of their execution. Additionally, if Bear Head LNG 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, Bear Head LNG shall also 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, Bear Head LNG shall state why the redacted or non-disclosed information should be exempted from public disclosure.

I. Bear Head LNG, or others for whom Bear Head LNG acts as agent, shall include the following provision in any agreement or other contract for the sale or transfer of U.S.-sourced natural gas in the form of LNG re-exported pursuant to this Order:

Customer or purchaser acknowledges and agrees that it will resell or transfer U.S.-sourced natural gas in the form of LNG purchased hereunder for delivery only to countries identified in Ordering Paragraph F of DOE/FE Order No. 3770, issued February 5, 2016, in FE Docket No. 15-33-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 Bear Head LNG Corporation and Bear Head LNG (USA), LLC that identifies the country (or countries) into which the re-exported LNG or natural gas was actually delivered and/or received for end use, and to include in any resale contract for such LNG the necessary conditions to insure that Bear Head LNG Corporation and Bear Head LNG (USA), LLC is made aware of all such countries.

J. Bear Head LNG is permitted to use its authorization in order to re-export U.S.-sourced natural gas in the form of 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 Bear Head LNG with all information necessary to permit Bear Head LNG 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 H of this Order.

K. Each registration submitted pursuant to this Order shall have current information on file with DOE/FE. Any changes in company name, contact information, length 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).

L. As a condition of this authorization, Bear Head LNG shall ensure that all persons required by this Order to register with DOE/FE have done so. Any failure by Bear Head LNG to ensure that all such persons or entities are registered with DOE/FE shall be grounds for rescinding the authorization in whole or in part.

M. Within two weeks after Bear Head LNG's first re-export of U.S.-sourced natural gas in the form of LNG occurs from the Bear Head Project, Bear Head LNG shall provide written notification of the date that the first re-export of LNG authorized in Ordering Paragraph A above occurred.

N. Bear Head LNG shall file with the Office of Regulation and International Engagement, on a semi-annual basis, written reports describing the status of the proposed Bear Head Project. The reports shall be filed on or by April 1 and October 1 of each year, and shall include information on the status of the Bear Head Project, the date the Bear Head Project is expected to commence first re-exports of LNG, and the status of the long-term contracts associated with the long-term re-export of LNG and any long-term supply contracts.

O. With respect to any change in control of the authorization holder, Bear Head LNG must comply with DOE/FE's Procedures for Change in Control Affecting Applications and Authorizations to Import or Export Natural Gas.<sup>315</sup> 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 Bear Head LNG, 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.<sup>316</sup>

P. Monthly Reports: With respect to the LNG re-exports authorized by this Order, Bear Head LNG shall file with the Office of Regulation and International Engagement, within 30 days following the last day of each calendar month, a report indicating whether re-exports of LNG have been made. The first monthly report required by this Order is due not later than the 30<sup>th</sup> day of the month following the month of first export. In subsequent months, if re-exports have not occurred, a report of "no activity" for that month must be filed. If re-exports of LNG have occurred, the report must give the following details of each LNG cargo: (1) the name(s) of the

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<sup>315</sup> See Procedures for Changes in Control at 65,541-42.

<sup>316</sup> See *id.* at 65,542.

authorized exporter registered with DOE/FE; (2) the name of the Canadian export terminal; (3) the name of the LNG tanker; (4) the date of departure from the Canadian export terminal; (5) the country (or countries) into which the LNG and/or natural gas is actually delivered and/or received for end use; (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)

Q. The motions to intervene submitted by NEES and Saint John Gas, respectively, are granted.

R. NEES's request for additional procedures and its request to suspend non-FTA approvals each have been denied by operation of law. 10 C.F.R. § 590.302(c).

Issued in Washington, D.C., on February 5, 2016.

  
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Christopher A. Smith  
Assistant Secretary  
Office of Fossil Energy