

UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

IN THE MATTER OF)
)
Pangea LNG (North America) Holdings, LLC) FE DOCKET NO. 12-184-LNG
)

SIERRA CLUB'S MOTION TO INTERVENE, PROTEST, AND COMMENTS

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Pangea LNG (North America) Holdings, LLC (“Pangea”) requests authorization to export approximately 1.09 billion cubic feet per day (bcf/d) of natural gas as liquefied natural gas (LNG) from a proposed liquefaction facility and terminal proposed to be located at the Port of Corpus Christi in Ingleside, Texas. This proposal cannot move forward without extensive environmental and economic analyses that Pangea has not provided to the Department of Energy Office of Fossil Energy (DOE/FE). In any event, the available evidence demonstrates that this proposal is inconsistent with the public interest.

In particular, Pangea argues that the proposal would increase natural gas production in the United States. *See, e.g.*, App. at 9, 34, 38. DOE/FE cannot authorize exports without fairly weighing significant environmental and economic impacts of this production. *See Udall v. Federal Power Comm’n*, 387 U.S. 428, 450 (1967). Exports will also harm the public interest by increasing domestic gas prices and likely increasing global greenhouse gas emissions. Further, although Pangea asserts that the project will economically benefit the U.S, Pangea overstates the economic benefits of the project, ignores economic harm exports will cause, and disregards even the local environmental impacts.

Because Sierra Club’s members have a direct interest in ensuring that environmental harms resulting from domestic natural gas production are minimized, and that any exports do not adversely affect domestic consumers, the Club moves to intervene in this proceeding and protests Pangea’s application.

I. Sierra Club Should be Granted Intervention

Sierra Club members live and work throughout the area that will be affected by Pangea's export plan, including in the regions adjacent to the proposed facility and any associated infrastructure. Sierra Club members also live in the domestic gas fields that will likely see increased production as a result of the proposed exports. Sierra Club members everywhere will also be affected by the increased gas prices that would result from completion of proposed LNG export facilities like Pangea's. As of January 2013, Sierra Club had 21,527 members in Texas and 583,913 members overall.¹

To protect our members' interests, Sierra Club moves to intervene in this proceeding, pursuant to 10 C.F.R. § 590.303. Consistent with that rule, Sierra Club states that its rights and interests in this matter include, but are not limited to, the following:

- The environmental consequences of any gas exports from the Pangea facility, including emissions and other pollution associated with the liquefaction process, environmental damage associated with construction and operation of the facility and associated infrastructure, environmental impacts caused by shipping traffic, and the emissions associated with all phases of the process from production to combustion.
- The environmental and economic consequences of any expansion or change in natural gas production, especially in shale gas plays, as a result of increased gas exports. Members living in these regions will be affected by the damage to air, land, and water resources caused by the increasing development of these plays, and the public health risks caused by these harms.
- The economic impacts of any gas exports from the Pangea facility, whether individually or in concert with exports from other such facilities, including the consequences of price changes upon members' finances, consumer behavior generally, and industrial and electrical generating facilities whose fuel choices may be affected by price changes. Sierra Club, in particular, works to reduce U.S. and global dependence on fossil fuels, including coal, gas, and oil, and to promote clean energy and efficiency in order to protect public health and the environment. To the extent changes in gas prices increase the use and production of coal and oil, Sierra Club's interests in this proceeding are directly implicated.
- The public disclosure, in National Environmental Protection Act and other documents, of all environmental, cultural, social, and economic consequences of Pangea's proposal, and of all alternatives to that proposal.

In short, Sierra Club's members have vital economic, aesthetic, spiritual, personal, and professional interests in the project.

¹ Attached Declaration of Yolanda Andersen at ¶ 7, attached as Exhibit 1.

The Club has demonstrated the vitality of these interests in many ways. Sierra Club runs national advocacy and organizing campaigns dedicated to reducing American dependence on fossil fuels, including natural gas, and to protecting public health. These campaigns, including its Beyond Coal campaign and its Beyond Natural Gas campaign, are dedicated towards promoting a swift transition away from fossil fuels and to reducing the impacts of any remaining natural gas extraction.

Thus, although 10 C.F.R. § 590.303 states no particular standard for intervention, Sierra Club has interests in this proceeding that would be sufficient to support intervention on any standard. This motion to intervene must be granted.²

II. Service

Pursuant to 10 C.F.R. § 590.303, Sierra Club identifies the following persons for service of correspondence and communications regarding this application.

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III. Sierra Club Protests this Application Because It Is Not In the Public Interest and Is Not Supported by Adequate Environmental and Economic Analysis

Section 3 of the Natural Gas Act provides that DOE/FE cannot authorize exports unless it finds the exports to be in the public interest. 15 U.S.C. § 717b. DOE/FE must consider environmental factors in the course of this public interest analysis. Accordingly, DOE/FE cannot proceed with Pangea's application without fully evaluating the environmental impacts of Pangea's proposal. The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4332 *et seq.*, provides the congressionally mandated procedure for assessment of these impacts, and NEPA requires that these procedures be completed "at the earliest possible time," *i.e.*, "*before* decisions are made and *before* actions are taken." 40 C.F.R. §§ 1501.2, 1500.1(b) (emphases added). Accordingly, DOE/FE cannot proceed with

² If any other party opposes this motion, we respectfully request leave to reply. *Cf.* 10 C.F.R. §§ 590.302, 590.310 (allowing for procedural motions and briefing in these cases).

Pangea's request for conditional export authorization until the NEPA process is completed, including preparation of an Environmental Impact Statement.

Pangea's application is essentially silent as to the environmental impacts of the proposal, wrongly arguing that consideration of these impacts can be deferred to a later stage. As we explain below, the proposal will cause three types of significant environmental harm, and these harms must be considered as part of DOE/FE's public interest analysis. First, the construction and operation of the terminal, pipeline expansion, and any other associated infrastructure will directly impact local water quality, habitats, and air quality. Second, the project will induce additional natural gas production in the United States, primarily hydraulic fracturing (fracking) of unconventional gas sources, thus causing the myriad environmental harms associated with such production. Third, the project will increase domestic gas prices, likely causing an increase in coal-fired electricity generation and thus increasing emissions of greenhouse gases, conventional, and toxic air pollutants.

Moreover, DOE/FE must reject Pangea's economic arguments in support of its proposal. Contrary to Pangea's contentions, the increase in domestic gas prices resulting from LNG export will have adverse and wide-ranging effects on the domestic economy, harming domestic consumers and, as noted above, increasing coal-fired electricity generation. LNG exports will also result in net domestic job losses and economic harm to most Americans, overwhelming the purported economic benefits Pangea asserts. Pangea's predictions of economic benefit are derived from a flawed input-output model that provides no consideration of counterfactuals and is therefore unable to identify which of the purportedly "supported" jobs and benefits would have existed anyway or recognize that jobs created will be offset by jobs lost in manufacturing and other energy dependent industries. Pangea's economic arguments also ignore the substantial distributional inequalities that exports would herald.

For these reasons and the other reasons set forth below, Sierra Club files this protest, pursuant to 10 C.F.R. § 590.304.

A. Legal Standards

DOE/FE has significant substantive and procedural obligations to fulfill before it can authorize Pangea's export proposal. Here, we discuss some of these obligations created by the Natural Gas Act, National Environmental Policy Act, Endangered Species Act, and the National Historic Preservation Act before explaining why these obligations preclude Pangea's request for conditional authorization.

1. Natural Gas Act

Pursuant to the Natural Gas Act and subsequent delegation orders, DOE/FE must determine whether Pangea's proposal to export LNG to nations which have not signed a free trade agreement (FTA) with the United States is in the public interest.³ Courts, DOE/FE, and the Federal Energy Regulatory Commission (FERC) all agree that the "public interest" at issue in this provision includes environmental impacts.

Section 3 of the Act provides:

[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 [DOE/FE] authorizing it do so. [DOE/FE] shall issue such order upon application unless, after opportunity for hearing, it finds that the proposed exportation or importation will not be consistent with the public interest.

15 U.S.C. § 717b(a).⁴

Courts interpreting this provision have held that the "public interest" encompasses the environment. Although the public interest inquiry is rooted in the Natural Gas Act's "fundamental purpose [of] assur[ing] the public a reliable supply of gas at reasonable prices," *United Gas Pipe Line Co v. McCombs*, 442 U.S. 529 (1979), the Natural Gas Act also grants DOE/FE "authority to consider conservation, environmental, and antitrust questions." *NAACP v. Federal Power Comm'n*, 425 U.S. 662, 670 n.4 (1976) (citing 15 U.S.C. § 717b as an example of a public interest provision); *see also id.* at 670 n.6 (explaining that the public interest includes environmental considerations). Subsequent cases have confirmed *NAACP's* holding that the purposes of the Natural Gas Act include environmental issues. *Pub. Utilities Comm'n of State of Cal. v. F.E.R.C.*, 900 F.2d 269, 281 (D.C. Cir. 1990). In interpreting an analogous public interest provision applicable to hydroelectric power and dams, the Court has explained that the public interest determination "can be made only after an exploration of all issues relevant to the 'public interest,' including future power demand and supply, alternate sources of power, the public interest in preserving reaches of wild rivers and wilderness areas, the

³ The Natural Gas Act separately provides that DOE/FE must approve exports to nations that have signed a free trade agreement requiring national treatment for trade in natural gas "without modification or delay." 15 U.S.C. § 717b(c).

⁴ The statute vests authority in the "Federal Power Commission," which has been dissolved. DOE/FE has been delegated the former Federal Power Commission's authority to authorize natural gas exports. Department of Energy Redelelegation Order No. 00-002.04E (Apr. 29, 2011). The Federal Energy Regulatory Commission has separately been delegated authority regarding the permitting, siting, construction and operation of export facilities. Department of Energy Delegation Order No. 00-004.00A. *See also* Executive Orders 12038 & 10485 (vesting any executive authority to allow construction of export facility in the Federal Power Commission and its successors).

preservation of anadromous fish for commercial and recreational purposes, and the protection of wildlife.” *Udall v. Fed. Power Comm’n*, 387 U.S. 428, 450 (1967) (interpreting § 7(b) of the Federal Water Power Act of 1920, as amended by the Federal Power Act, 49 Stat. 842, 16 U.S.C. § 800(b)). Other courts have applied *Udall’s* holding to the Natural Gas Act. *See, e.g., N. Natural Gas Co. v. Fed. Power Comm’n*, 399 F.2d 953, 973 (D.C. Cir. 1968) (interpreting section 7 of the Natural Gas Act).⁵

DOE has also acknowledged the breadth of the public interest inquiry and recognized that it encompasses environmental concerns. Deputy Assistant Secretary Smith has testified that “[a] wide range of criteria are considered as part of DOE’s public interest review process, including . . . U.S. energy security . . . [i]mpact on the U.S. economy . . . [e]nvironmental considerations . . . [and] [o]ther issues raised by commenters and/or interveners deemed relevant to the proceeding.”⁶ DOE rules require export applicants to provide information documenting “[t]he potential environmental impact of the project.” 10 C.F.R. § 590.202(b)(7). In a previous LNG export proceeding, DOE determined that the public interest inquiry looks to “domestic need” as well as “other considerations” that specifically included the environment.⁷ Finally, DOE has applied its “policy guidelines” regarding the public interest to focus review “on the domestic need for the natural gas proposed to be exported; whether the proposed exports pose a threat to the security of natural gas supplies, *and any other issue determined to be appropriate.*” Opinion and Order Conditionally Granting Long-Term Authorization to Export [LNG] from Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations (“*Sabine Pass*”), DOE/FE Order 2961 at 29 (May 20, 2011) (citing 49 Fed. Reg. 6,684 (Feb. 22, 1984)) (emphasis added).⁸

FERC has agreed that environmental issues are included in the public interest calculus. In FERC’s recent order approving siting, construction, and operation of LNG export facilities in Sabine Pass, Louisiana, FERC considered potential environmental impacts of the terminal as part of its public interest assessment, which is analogous to DOE/FE’s. 139 FERC ¶ 61,039, PP 29-30 (Apr. 14, 2012).⁹

⁵ Further support for the inclusion of environmental factors in the public interest analysis is provided by NEPA, which declares that all federal agencies must seek to protect the environment and avoid “undesirable and unintended consequences.” 42 U.S.C. 4331(b)(3).

⁶ The Department of Energy’s Role in Liquefied Natural Gas Export Applications: Hearing Before the S. Comm. on Energy and Natural Resources, 112th Cong. 4 (2011) (testimony of Christopher Smith, Deputy Assistant Secretary of Oil and Gas), attached as Exhibit 2.

⁷ *Phillips Alaska Natural Gas Corporation and Marathon Oil Company*, 2 FE ¶ 70,317, DOE FE Order No. 1473, 1999 WL 33714706, *22 (April 2, 1999).

⁸ Although germane here, these Policy Guidelines policy guidelines are merely guidelines: they “cannot create a norm binding the promulgating agency.” *Panhandle Producers and Royalty Owners Ass’n v. Economic Regulatory Administration*, 822 F.2d 1105, 1110-1111 (D.C. Cir. 1987).

⁹ Sierra Club contends that other aspects of this order were wrongly decided, as was FERC’s subsequent denial of Sierra Club’s petition for rehearing, as we explain below.

Although DOE/FE has adopted a presumption that LNG export applications are consistent with the public interest, this presumption is rebuttable and not determinative. The D.C. Circuit has explained to DOE/FE that this presumption is “highly flexible, creating *only* rebuttable presumptions and leaving parties free to assert other factors.” *Panhandle Producers & Royalty Owners Ass’n v. Economic Regulatory Admin.*, 822 F.2d 1105, 1110-11, 1113 (D.C. Cir. 1987) (emphasis added) (internal quotation marks omitted). Put differently, although DOE/FE may “presume” that an application should be granted, this presumption is not determinative, and DOE/FE retains an independent duty to determine whether an application is, in fact, in the public interest. See 10 C.F.R. § 590.404.

Nor should DOE/FE blindly apply its outdated *import* guidance document here. In 1984, DOE published *Policy Guidelines and Delegation Orders Relating to the Regulation of Imported Natural Gas*, 49 Fed. Reg. 6,684 (Feb. 22, 1984). The primary issue confronted these guidelines was whether to directly regulate prices at which gas could be imported from Canada.¹⁰ In the passages discussed by Pangea, App. at 17-18, DOE/FE explained that rather than directly regulating prices for imported gas, it would seek to ensure that future imports were structured to be responsive to changes in market conditions, frowning upon “import arrangements with contract terms and conditions that restrict the competitiveness of the gas over time.”¹¹ DOE/FE further determined that, if U.S. buyers were willing to pay market rates for imported gas, this would generally demonstrate a need for that gas.¹² This reasoning does not apply to exports, notwithstanding DOE/FE’s reference to this guidance in the *Sabine Pass* and *Phillips Alaska* proceedings.¹³ It would be nonsensical to assume that a foreign purchaser’s willingness to pay for gas exported from the United States provides a presumptive indication that there was not a domestic need for that gas. Similarly, a foreign purchaser’s willingness to pay for U.S. exports is independent of the environmental impacts that will result from producing that gas: because DOE/FE must consider the latter as part of its public interest analysis, DOE/FE cannot simply presume that the market will reflect the public interest.

2. National Environmental Policy Act

NEPA requires federal agencies to consider and disclose the “environmental impacts” of proposed agency actions. 42 U.S.C. § 4332(C)(i). This requirement is implemented via a

¹⁰ 49 Fed. Reg. at 6,684-85.

¹¹ 49 Fed. Reg. at 6,687.

¹² *Id.*

¹³ Pangea also cites DOE/FE’s authorization of re-export of previously imported LNG from Sabine Pass. Cheniere Marketing Inc., *Order Granting Authorization to Export Liquefied Natural Gas*, DOE/FE Dkt. 08-77, DOE/FE Order 2651 (June 8, 2009). As explained in that order, concerns regarding re-export of previously imported LNG do not implicate the same concerns as exports of domestically produced natural gas. *Id.* at 11-12.

set of procedures that “insure [sic] that environmental information is available to public officials and citizens *before* decisions are made and *before* actions are taken.” 40 C.F.R. § 1500.1(b) (emphases added). Agencies must “carefully consider [] detailed information concerning significant environmental impacts” and NEPA “guarantees that the relevant information will be made available” to the public. *Dep’t of Transp. v. Public Citizen*, 541 U.S. 752, 768 (2004) (quoting *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989)). The Council on Environmental Quality (CEQ) directs agencies to “integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values.” 40 C.F.R. § 1501.2. “It is DOE’s policy to follow the letter and spirit of NEPA; comply fully with the [CEQ] Regulations and apply the NEPA review process early in the planning stages for DOE proposals.” 10 C.F.R. § 1021.100. DOE has adopted CEQ’s NEPA regulations in full. *Id.* § 1021.103. The NEPA rules apply to “any DOE action affecting the quality of the environment of the United States, its territories or possessions.” *Id.* § 1021.102.

For purposes of the intersection of NEPA and the NGA, the NGA designated the former Federal Power Commission as the “lead agency” for NEPA purposes. 15 U.S.C. § 717n. The lead agency prepares NEPA documents for an action that falls within the jurisdiction of multiple federal agencies. FERC has since generally filled that role, preparing the NEPA documents for LNG export and import decisions, as it did in *Sabine Pass*. See 10 C.F.R. § 1021.342 (providing for interagency cooperation). Whether or not FERC takes a lead role, however, DOE’s ultimate NEPA obligations are the same: It may not move forward until the full scope of the action *it* is considering – here, the approval of LNG export – has been properly considered. Thus, if the NEPA analysis FERC prepares in its capacity as lead agency is inadequate to fully inform DOE/FE’s decision or discharge DOE/FE’s NEPA obligations, DOE/FE must prepare a separate EIS.¹⁴

NEPA requires preparation of an “environmental impact statement” (EIS) where, as here, the proposed major federal action would “significantly affect[] the quality of the human environment.” 42 U.S.C. § 4332(C). DOE/FE regulations similarly provide that “[a]pprovals or disapprovals of authorizations to import or export natural gas . . . involving major operational changes (such as a major increase in the quantity of liquefied natural gas imported or exported)” will “normally require [an] EIS.” 10 C.F.R. Part 1021, Appendix D, D9. As we explain in more detail below, a full EIS is required here.

An EIS must describe:

¹⁴ See *Sabine Pass LNG*, FERC Dkt. CP11-72-001, 140 FERC ¶ 61,076 P 32 (July 26, 2012) (“DOE has separate statutory responsibilities with respect to authorizing the export of LNG from Sabine Pass; thus it has an independent legal obligation to comply with NEPA.”), DOE/FE Dkt. 10-111-LNG, Order 2961-A, 27 (Aug. 7, 2012) (DOE/FE recognizes that it is “responsible for conducting an independent review” of FERC’s analysis and determining whether “the record needs to be supplemented in order for DOE/FE to meet its statutory responsibilities under section 3 of the NGA and under NEPA.”).

- i. the environmental impact of the proposed action,
- ii. any adverse environmental effects which cannot be avoided should the proposal be implemented,
- iii. alternatives to the proposed action,
- iv. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- v. any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

42 U.S.C. § 4332(C). The alternatives analysis “is the heart of the environmental impact statement.” 40 C.F.R. § 1502.14. Here, the proposed action is to export LNG from the proposed facility; DOE/FE must consider alternatives to this action. DOE/FE must take care not to define the project purpose so narrowly as to prevent the consideration of a reasonable range of alternatives. *See, e.g., Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997). If it did otherwise, it would lack “a clear basis for choice among options by the decisionmaker and the public.” *See* 40 C.F.R. § 1502.14.

An EIS must also describe the direct and indirect effects and the cumulative impacts of a proposed action. 40 C.F.R §§ 1502.16, 1508.7, 1508.8; *N. Plains Resource Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1072-73 (9th Cir. 2011). These terms are distinct from one another: Direct effects are “caused by the action and occur at the same time and place.” 40 C.F.R. § 1508.8(a). Indirect effects are also “caused by the action” but:

are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effect on air and water and other natural systems, including ecosystems.

40 C.F.R. § 1508.8(b). Cumulative impacts, finally, are not causally related to the action. Instead, they are:

the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative

impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7. The EIS must give each of these categories of effect fair emphasis.

Agencies may also prepare “programmatic” EISs, which address “a group of concerted actions to implement a specific policy or plan; [or] systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive.” 40 C.F.R. § 1508.17(b)(3); *see also* 10 C.F.R. § 1021.330 (DOE regulations discussing programmatic EISs). As we discuss below, such an EIS is appropriate here.

Finally, while an EIS is being prepared “DOE shall take no action concerning the proposal that is the subject of the EIS” until the EIS is complete and a formal Record of Decision has been issued. 10 C.F.R. § 1021.211. During this time, DOE may take no action which would tend to “limit the choice of reasonable alternatives,” or “tend[] to determine subsequent development.” 40 C.F.R. § 1506.1.

3. Endangered Species Act

The Endangered Species Act (ESA) directs that all agencies “shall seek to conserve endangered species.” 16 U.S.C. § 1531(c)(1). Consistent with this mandate, DOE/FE must ensure that its approval of Pangea’s proposal “is not likely to jeopardize the continued existence of any endangered species . . . or result in the destruction or adverse modification of [critical] habitat of such species.” 16 U.S.C. § 1536(a)(2). “Each Federal agency shall review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat.” 50 C.F.R. § 402.14(a); *see also* 16 U.S.C. § 1536(a)(2).

Here, DOE/FE’s section 1536 inquiry must be wide-ranging, because Pangea’s export proposal will increase gas production activities nationwide. Thus, DOE/FE must consider not just species impacts at the proposed project site (although it must at least do that), but the effects of increased gas production across the full region the plant affects.

To make this determination, DOE/FE should, first, conduct a biological assessment, including the “results of an on-site inspection of the area affected,” “[t]he views of recognized experts on the species at issue,” a review of relevant literature, “[a]n analysis of the effects of the action on the species and habitat, including consideration of cumulative effects, and the results of any related studies,” and “[a]n analysis of alternate actions considered by the Federal agency for the proposed action.” *See* 50 C.F.R. § 402.12(f). If that assessment determines that impacts are possible, DOE/FE must enter into formal consultation with the Fish and Wildlife Service and the National Marine Fisheries Service, as appropriate, to avoid jeopardy to endangered species or

adverse modification of critical habitat as a result of its approval of Pangea's proposal. 16 U.S.C. § 1536(a), (b).

4. National Historic Preservation Act

DOE/FE must also fulfill its obligations under the National Historic Preservation Act (NHPA) to "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470f; *see also Pit River Tribe v. U.S. Forest Serv.*, 469 F.3d 768, 787 (9th Cir. 2006) (discussing the requirements of the NHPA). Because "the preservation of this irreplaceable heritage is in the public interest," 16 U.S.C. § 470(b)(4), it behooves DOE/FE to proceed with caution.

DOE/FE must, therefore, initiate the NHPA section 106 consultation and analysis process in order to "identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties." 36 C.F.R. § 800.1(a). NHPA regulations make clear that the scope of a proper analysis is defined by the project's area of potential effects, *see* 36 C.F.R. § 800.4, which in turn is defined as "the geographic area . . . within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties," 36 C.F.R. § 800.16(d). This area is "influenced by the scale and nature of an undertaking." *Id.* The area of potential effects should sweep quite broadly here because, as in the ESA and NEPA contexts, the reach of Pangea's proposal extends to the entire area in which it will increase gas production. Thus, to approve Pangea's proposal, DOE/FE must first understand and mitigate its impacts on any historic properties which it may affect. *See also* DOE Policy P.141.1 (May 2001) (providing that DOE will fully comply with the NHPA and many other cultural resources preservation statutes).

The regulations governing this process provide that "[c]ertain individuals and organizations with a demonstrated interest in the undertaking may participate as consulting parties" either "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties." 36 C.F.R. § 800.2(c)(5). Sierra Club meets that test, because the organization and its members are interested in preserving intact historic landscapes for their ecological and social value, and reside through the regions affected by the Pangea's proposal. Our members have worked for years to protect and preserve the rich human and natural fabric of these regions, and would be harmed by any damage to those resources. Sierra Club must therefore be given consulting party status under the NHPA for this application.

B. All Pending Export Applications, Pipelines, and Studies Must Be Incorporated Into DOE/FE's NEPA, NGA, and Other Analyses

As explained above, the NGA, NEPA, ESA and NHPA all require DOE/FE's determination to be informed by the context in which the proposed project would occur. DOE/FE's analysis must not be confined to local, direct effects of the particular application; DOE/FE must consider the broader constellation of indirect and cumulative effects. Here, to accurately analyze Pangea's application in context, DOE/FE must also take into account the other LNG export proposals pending before DOE/FE and FERC. Further, to ensure adequate consideration of the proposed project's impacts in conjunction with the impacts of other terminal proposals, DOE/FE must not act on Pangea's application until DOE/FE has received and evaluated comments on its recently released study on the economic impacts of exports. In addition, the broader backdrop of related and similar projects, in turn, must inform the NEPA alternatives analysis. Finally, DOE/FE must not grant conditional authorization prior to completion of the NEPA process, including the above analyses.¹⁵

1. A Full Environmental Impact Statement, Rather than an Environmental Assessment, Is Required Here

The proposed exports and terminal would have severe adverse environmental impacts, plainly surpassing the threshold of "significance" that mandates preparation of a full EIS. NEPA requires an EIS where a proposed major federal action would "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(C). As we explain elsewhere, LNG exports will induce additional gas production that, every year, will potentially emit millions of tons of methane pollution, emit tens of thousands of tons of VOC and hazardous air pollutants, and require of hundreds of millions of tons of fresh water.¹⁶ DOE/FE regulations categorically state that "[a]pprovals or disapprovals of authorizations to import or export natural gas . . . involving major operational changes (such as a major increase in the quantity of liquefied natural gas imported or exported)" will "normally require [an] EIS." 10 C.F.R. Part 1021, Appendix D, D9. FERC's recent orders have consistently repeatedly determined that greenfield export facilities, such as Pangea proposes, require a full EIS.¹⁷ For these reasons, it is clear that, at a minimum, there is a "substantial question" as to whether Pangea's proposed exports would have a significant impact on the environment, and an EIS is therefore required. *Klamath Siskiyou Wildlands Center v. Boody*, 468 F.3d 549, 561-62 (9th Cir. 2006)

¹⁵ Similarly, Sierra Club protests any request for final, rather than conditional, authorization prior to completion of NEPA review.

¹⁶ Sierra Club, *et al.*, comment on NERA Macroeconomic Study at 32, 40.

¹⁷ Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Oregon LNG Export Project and Washington Expansion Project, 77 Fed. Reg. 59,603 (Sept. 28, 2012), Notice of Intent to Prepare an Environmental Impact Statement for the Planned Lake Charles Liquefaction Project, 77 Fed. Reg. 58,373 (Sept. 20, 2012), Notice of Intent to Prepare an Environmental Impact Statement for the Planned Jordan Cove Liquefaction and Pacific Connector Pipeline Projects, 77 Fed. Reg. 48,138 (Aug. 13, 2012), *but see* Notice of Intent To Prepare an Environmental Assessment for the Planned Corpus Christi LNG Terminal and Pipeline Project, 77 Fed. Reg. 34034 (June 8, 2012).

2. DOE/FE Must Consider the Cumulative Effect of All Pending Export Proposals, and Should Do So Using a Programmatic EIS

Pangea's export proposal is only one of many before DOE/FE. Because the effects of these projects are cumulative, and because each approval alters the price and production effects of exports, DOE/FE must consider these projects' interactions. We note that in three similar proceedings EPA has requested consideration of this broader context. EPA, *Scoping Comments – The Jordan Cove Energy Project LP*, FERC Dkts. PF12-7 and PF12-17, at 3 (Oct. 29, 2012) (“[W]e recommend discussing the proposed project in the context of the larger energy market, including existing export capacity and export capacity under application to the Department of Energy, and clearly describe how the need for the proposed action has been determined.”),¹⁸ EPA, *Scoping Comments – Cove Point Liquefaction Project*, FERC Dkt. PF12-16-000, at 2 (Nov. 15, 2012) (“We recommend discussing the proposed project in the context of the broader energy market, including existing and proposed LNG export capacity.”),¹⁹ EPA, *Scoping Comments – The Oregon LNG Export Project and Washington Expansion Project*, FERC Dkts. PF12-18 and PF12-20, at 3 (Dec. 26, 2012).²⁰

Cumulative consideration of the pending export proposals is particularly important with regard to evaluation of the price impacts of the proposed Pangea project. The public, after all, will not experience each proposed terminal as an individual project: It will experience them cumulatively, through the gas and electricity prices that they will raise and the environmental damage that they will cause. Proposals for 28.54 bcf/d of exports to non-free trade agreement nations have been filed with DOE/FE.²¹ This is over 34% domestic gas production.²² The highest volume export case Pangea considers assumes less than a third of this level of export (less than 8 bcf/d), and even the EIA's model only considers scenarios in which export creates 6 or 12 bcf/d of additional demand.²³ Indeed, this is less than the 21.5 bcf/d of nFTA export applications that will be reviewed by DOE/FE or *prior to* Pangea's application.²⁴

¹⁸ Attached as Exhibit 3.

¹⁹ Attached as Exhibit 4.

²⁰ Attached as Exhibit 5.

²¹ Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of March 7, 2013), available at http://fossil.energy.gov/programs/gasregulation/reports/summary_lng_applications.pdf and attached as Exhibit 6.

²² Specifically, it is over 34% of domestic production for the highest month in the past year, November 2012, when monthly production was 83.54 bcf/d. EIA, Monthly Natural Gas Gross Production Report (January 31, 2013), attached as Exhibit 7. Over the entire year, average monthly production is lower, and thus the percentage is greater.

²³ *EIA Export Study*, *supra* n.29, at 1. Note that the Pangea and EIA price scenarios look at the demand created by exports (i.e., the gas exported as well as the gas used in operating liquefaction equipment, typically an extra 10% of the exported volume), whereas the DOE/FE figure for total volume of proposed

The cumulative volume of exports must be considered because several models indicate that prices increase non-linearly with export volumes. That is, several models predict that going from 4 to 6 bcf/d in exports, for example, impacts domestic prices more than going from 0 to 2 bcf/d.²⁵ One reason prices may increase this way is that domestic gas consumers differ in their ability to reduce gas consumption.²⁶ As export volumes increase, increasing numbers of inflexible domestic consumers are forced to compete with exports, further driving up prices. When export volumes are lower, by contrast, even small price increases will lead price-sensitive domestic consumers to reduce their consumption, freeing gas supplies for exports and limiting price impacts.²⁷ Pangea's Black and Veatch report asserts that its model found the opposite effect, App at 32. However, Black and Veatch concede that this result is surprising, and insofar as Pangea has not provided the data necessary for DOE/FE or the public to determine how Black and Veatch reached this surprising result, DOE/FE cannot credit it.

Consideration of the full volume of proposed exports is not only the prudent means of fully evaluating the decisions before DOE/FE, but is also a required component of DOE/FE's NEPA and public interest analyses. DOE/FE cannot authorize this proposed export project or any other export proposal on the assumption that authorized activity will not actually occur. Under NEPA, an agency may only exclude analysis of an event and its consequences when the event "is so 'remote and speculative' as to reduce the effective probability of its occurrence to zero." See *New York v. NRC*, 681 F.3d 471, 482 (D.C. Cir. 2012); see also *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Comm'n*, 449 F.3d 1016, 1031 (9th Cir. 2006) (same). Here, DOE/FE cannot rule out as

exports provided above only considers the gas actually exported. Thus, potential demand resulting from exports could be 10% higher than the 28.54 bcf/d figure DOE/FE provides.

²⁴ See Pending Long-Term Applications to Export LNG to Non-FTA Countries - Listed in Order DOE Will Commence Processing, available at http://fossil.energy.gov/programs/gasregulation/publications/export_applications_order_of_precedence.pdf, and Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of March 7, 2013), available at http://fossil.energy.gov/programs/gasregulation/reports/summary_lng_applications.pdf.

²⁵ Robert Brooks, *Using GPCM to Model LNG Exports from the US Gulf Coast* 5 (2012), available at <http://www.rbac.com/press/LNG%20Exports%20from%20the%20US.pdf>, attached as Exhibit 8. The Deloitte Study submitted in connection with the Excelerate application similarly predicts that doubling exports will more than double price impacts thereof. Deloitte MarketPoint, *Analysis of Economic Impact of LNG Exports from the United States*, at 3, 24 ("Deloitte Study"), attached as Exhibit 9 (originally filed as Appendix F to Excelerate Liquefaction Solutions I, LLC, *Application for Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Countries*, DOE/FE Dkt. 12-146-LNG (Oct. 5, 2012)).

²⁶ Robert Brooks, *Using GPCM to Model LNG Exports from the US Gulf Coast*, 7 (2012).

²⁷ Estimates of exports' price impacts differ in their assumption of price sensitivity of domestic consumers. The Robert Brooks study cited *supra* n.25, which estimates low price-sensitivity, predicts significantly higher price increases than either Pangea's Black and Veatch report or the EIA study. *Id.* at 5, 7.

speculative the possibility of all proposed exports occurring. Although the NERA report concluded that only a portion of the proposed exports were likely to occur, several assumptions underlying the NERA report lead it to understate the likelihood of exports, as explained in Sierra Club's Initial and Reply Comments regarding the NERA report.²⁸

In summary, to determine whether any one export proposal is consistent with the public interest, DOE/FE must consider not only the effect of the particular proposal, but the effect of that proposal in conjunction with all proposals so far approved and all reasonably foreseeable future proposals. Moreover, this analysis must examine the possibility that all proposals that receive approval will export to the fully authorized extent.

DOE/FE can best conduct this analysis in the context of a programmatic EIS (whether prepared by FERC or DOE/FE) that considers the impacts of *all* gas export proposals at once. DOE/FE has the discretion to prepare a programmatic EIS, even if it determines that it does not have the duty to do so. *See* 40 C.F.R. § 1508.18(b)(3); 10 C.F.R. § 1021.330. Such a programmatic EIS would allow DOE/FE and the public to understand these proposals' relationship and their cumulative environmental and economic impacts, thus improving DOE/FE's ability to make informed decisions on export applications and allowing DOE/FE, the public, and industry to identify prudent alternatives to serve the public interest and minimize environmental impacts. In acting on the many pending LNG export applications, DOE/FE is making what is functionally a programmatic decision to radically alter the U.S. natural gas market by allowing for large-scale LNG export. DOE/FE has already acknowledged that a programmatic approach is appropriate for discussion of the economic impacts of exports, commissioning nationwide studies of the impacts of exports from EIA and NERA. Environmental impacts should be similarly analyzed. DOE/FE should conduct an EIS that is adequate to inform this programmatic decision, rather than conducting piecemeal, application-by-application analysis.

3. DOE/FE Must Not Act Until It Has Thoroughly Reviewed the Recently Released Study of LNG Exports' Economic Impacts and Comments on that Study

DOE/FE has commissioned two broad studies of exports' economic impacts. In the first, it requested that the Energy Information Administration ("EIA") analyze "the impacts of increased domestic natural gas demand, as exports."²⁹ We discuss this study in detail in

²⁸ Sierra Club Initial NERA Comment at 12-13, *infra* n.34; Sierra Club Reply NERA Comment at 11-12, *infra* n.34.

²⁹ EIA, *Effect of Increased Natural Gas Exports on Domestic Energy Markets*, 1 (2012) ("EIA Export Study"), attached as Exhibit 10. DOE/FE has stated that this study, the NERA Study cited *infra* note 32, and the various comments thereon (including Sierra Club initial and reply comments cited *infra* note 34) will be

part III.C.1.c below. The EIA Export Study predicts price increases from all gas export scenarios, economic impacts to residential and industrial users, and environmental harm as gas-fired electricity generators switch to coal power.³⁰ The study did not, however, consider the macroeconomic impacts of these effects.³¹

The second study, performed by an outside consultant and currently undergoing public comment, attempts to consider macroeconomic impacts.³² DOE has committed to withholding final authorization of any pending export application until review of these studies is complete.³³ DOE/FE must honor this commitment to withhold authorization pending full review of the study and the comments submitted on it with respect to Pangea's application. Indeed, to the extent DOE/FE or FERC rely on the NERA study in completing the NEPA analysis of Pangea's application, DOE/FE is required to accept public comments on the study pursuant to ordinary NEPA principles. See 40 CFR § 1503.1.

Moreover, as explained in initial and reply comments on the NERA study submitted by Sierra Club and its allies, DOE/FE is obligated to complete the additional analysis needed to fully appreciate the environmental and economic consequences of export before granting Pangea's or any other would-be exporter's application. Among other things, DOE/FE must prepare a thorough description of exports' implications for the economy not just on a macroeconomic scale, but also at local and regional levels; it must consider the effects of increasing U.S. dependence on resource exports on gasfield communities, domestic industry, and the environment; and it must consider counterfactuals, allowing it to evaluate whether the national would be better off without LNG export, or with lower export volumes.³⁴ As we explain below, no thorough analysis of exports' effects on domestic jobs has as of yet been presented to DOE/FE, although the available information strongly indicates that exports will decrease U.S. employment.

4. The Alternatives Analysis Must Consider This Broader Context

included in the individual LNG export application dockets. Sierra Club includes copies of these documents as exhibits here as a convenience, but they should be added to the docket separately as well.

³⁰ *Id.* at 6.

³¹ *Id.* at 3.

³² NERA Economic Consulting, *Macroeconomic Impacts of LNG Exports from the United States* (2012) ("NERA Study"), attached as Exhibit 11.

³³ Federal Register Notice Inviting Comments on the LNG Export Study (Dec. 5, 2012); see also Letter from Christopher Smith, DOE Deputy Assistant Secretary for Oil and Natural Gas, to Representative Edward J. Markey (February 24, 2012), in Democratic Staff, House Natural Resources Comm., *Drill Here, Sell There, Pay More: The Painful Price of Exporting Natural Gas*, App. 1 at 3-4 (2012), attached as Exhibit 6.

³⁴ See Initial Comments of Sierra Club *et al.*, Jan. 24, 2013, ("Sierra Club Initial NERA Comment"), available at <http://www.sierraclub.org/pressroom/downloads/NERA-Study-Comments-01-24-2013.pdf>, attached as Exhibit 12; see also Reply Comments of Sierra Club *et al.*, Feb. 25, 2013 ("Sierra Club Reply NERA Comment"), available at <http://www.sierraclub.org/pressroom/downloads/NERA-Reply-Comments-0225.pdf>, attached as Exhibit 13.

Both NEPA and the NGA require DOE/FE to fully consider alternatives to Pangea's proposal. Specifically, the NGA public interest analysis requires an "exploration of all issues relevant to the 'public interest'," an inquiry which the Supreme Court held in *Udall* must be wide-ranging. In that case, which concerned hydropower, the regulatory agency was required to consider, for instance, "alternate sources of power," the state of the power market generally, and options to mitigate impacts on wildlife. 387 U.S. at 450. Here, likewise, DOE/FE must consider alternatives to Pangea's export proposal that would better serve the public interest, broadly analyzing other approaches to structuring LNG exports and gas use generally, given exports' sweeping effects on the economy.

NEPA is designed to support this sort of broad consideration. As mentioned, the alternatives analysis is "the heart of the environmental impact statement," designed to offer "clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14. Crucially, the alternatives must include "reasonable alternatives not within the jurisdiction of the lead agency," and must include "appropriate mitigation measures not already included in the proposed action or alternatives." *Id.* Because alternatives are so central to decisionmaking and mitigation, "the existence of a viable but unexamined alternative renders an environmental impact statement inadequate." *Oregon Natural Desert Ass'n*, 625 F.3d at 1122 (internal alterations and citations omitted).

Here, DOE/FE must consider a broad range of alternatives to Pangea's proposal, including alternatives that would alter or minimize the economy-wide impacts of the many pending export proposals. Even if DOE/FE does not have jurisdiction to directly order implementation of some of these alternatives, it must include them nonetheless.

DOE/FE should consider, at a minimum and without limitation, the following alternatives:

- (1) Whether, consistent with the EIA Export Study, exports, if allowed, should move forward in smaller quantities or on a slower time table to mitigate the domestic economic and environmental impacts associated with large export volumes or rapid export schedules;
- (2) Whether export from other locations would better serve the public interest by mitigating or better distributing economic or environmental impacts;
- (3) Whether limitations on the sources of exported gas – e.g., limiting export from particular plays, formations, or regions – would help to mitigate environmental and economic impacts;

- (4) Whether conditioning export on the presence of an adequate regulatory framework, including the fulfillment of the recommendations for safe production made by the DOE's Shale Gas Subcommittee, would better serve the public interest by ensuring that the production increases associated with export will not increase poorly regulated unconventional gas production;
- (5) Whether to delay, deny, or condition exports based upon their effect on the U.S. utility market (including changes in air pollution emissions associated with the impacts of increased export demand on fuel choice);
- (6) Whether to require exporters to certify that any unconventional gas produced as a result of their proposal (or shipped through their facilities) has been produced in accordance with all relevant environmental laws and according to a set of best production practices (such as that discussed by the DOE's Shale Gas Subcommittee);
- (7) Whether to permit exports only if the export facilities are designed and operated so as to minimize their environmental impacts;
- (8) Whether to deny export proposals altogether as contrary to the public interest.

Other alternatives are no doubt also available, but DOE/FE must at a minimum consider the possibilities listed above, as they are reasonable and bear directly on the public interest determination before it.

5. DOE/FE May Not Conditionally Approve Pangea's Proposal Prior to NEPA Review

DOE/FE must reject Pangea's request for a conditional order prior to NEPA review. App. at 11. As we have discussed at length above, DOE/FE cannot complete a public interest determination without weighing environmental factors. Because these factors are integral to DOE/FE's decision, DOE/FE must weigh environmental interests at the same time that it weighs all other interests. It may not parcel them into a separate process without irrationally ignoring important aspects of the problem before it. Thus, although DOE regulations permit "conditional" orders in general, *see* 10 C.F.R. § 590.402, this authority cannot extend to the specific context of LNG export authorizations. Indeed, because an EIS is required here, DOE regulations specifically prohibit taking any action prior to completion of the EIS. 10 C.F.R. § 1021.211.

Section 1021.211 explicitly provides that DOE "*shall take no action*" concerning a proposal that is the subject of an EIS until the EIS is completed. 10 C.F.R. § 1021.211

(emphasis added).³⁵ Similarly, CEQ's generally applicable NEPA regulations prohibit agencies from taking any action on a proposal prior to completion of NEPA review if that action if that action tends to "limit the choice of reasonable alternatives," or "determine subsequent development." 40 C.F.R. § 1506.1. Here, because an EIS is required but has not yet been completed, DOE/FE cannot issue a conditional authorization now. A conditional approval would limit alternatives, and determine subsequent choices, in precisely the manner the regulations forbid.

The authorities Pangea cites are inapplicable or have been superseded by this regulation. Pangea first cites DOE's thirty-year old guidance, published as Import and Export of Natural Gas, 46 Fed. Reg. 44,696 (Sept. 4, 1981). In that guidance, DOE opined that, in proposals for LNG import, "[b]efore expending the time and resources needed to develop an EIS, the FERC would benefit from a preliminary indication from [DOE/FE] regarding consistency of the importation with the public interest." *Id.* at 44,700. This guidance is inapplicable here for several reasons. First, it has been superseded by DOE/FE's subsequent publication, in 1992, of 10 C.F.R. § 1021.211, which prohibits any action on proposals subject to an EIS (which this proposal must be). Similarly, this guidance document cannot displace DOE/FE's obligations under NEPA and CEQ's implementing regulations, such as the requirement that DOE/FE avoid any action that would limit alternatives or prejudge the issues prior to completion of NEPA review. *See* 40 C.F.R. § 1506.1. Finally, the portion of the guidance approving conditional authorization concerns LNG imports, and the reasoning underlying it poorly fits the export context. Imports, by introducing natural gas to U.S. markets, do not impose the range or severity of domestic environmental effects imposed by exports. As we explain below, exports will induce domestic gas production that must be considered in DOE/FE's public interest analysis.

The three court cases Pangea cites in support of conditional authorization concerned agencies other than DOE (the Interstate Commerce Commission, the Department of Transportation, and FERC), none of which appears to have had a regulation containing the clear prohibition on action found in section 1021.211. *State of Idaho By & Through Idaho Pub. Utilities Comm'n v. I.C.C.*, 35 F.3d 585, 598 (D.C. Cir. 1994), *City of Grapevine, Tex. v. Dept. of Transp.*, 17 F.3d 1502, 1509 (D.C. Cir. 1994), *Pub. Utilities Comm'n of State of Cal. v. F.E.R.C.*, 900 F.2d 269, 281 (D.C. Cir. 1990).

The two prior DOE/FE orders Pangea cites are also inapplicable here. *Rochester Gas & Elec. Corp.*, FE Dkt. No. 90-05-NG (May 16, 1991),³⁶ precedes enactment of 10 C.F.R. § 1021.211, is superseded thereby, and concerns imports rather than exports. Although it

³⁵ Although this regulation states that it applies when "DOE is preparing an EIS that is required" under NEPA, it should be interpreted as applying to any proposed DOE action that is a "major action" requiring preparation of an EIS, regardless of whether the EIS is authored by DOE or another agency.

³⁶ The order is available at

<http://www.fossil.energy.gov/programs/gasregulation/authorizations/orders/ord503.pdf>.

may have been possible, at least prior to the passage of 10 C.F.R § 1021.211, for DOE/FE to make a preliminary public interest determination regarding imports without the information provided by NEPA review, DOE/FE cannot make even a preliminary determination whether export proposals, which may subject the public to massive environmental harms, are in the public interest without balancing exports' benefits against environmental and other costs. DOE/FE's conditional authorization in *Sabine Pass*, the other decision Pangea cites, is also inapplicable. Pertinent to the question of conditional authorization, in *Sabine Pass*, the proposal was for conversion of an existing LNG import terminal to an export facility. Relying on the EIS that had been prepared for the initial facility, FERC concluded that a new EIS was not required, instead preparing solely an EA.³⁷ DOE/FE joined in this conclusion.³⁸ On its face, this decision is inapplicable here, where Pangea proposes a greenfield facility for which a full EIS is required. More generally, the *Sabine Pass* orders were wrongly decided. Although DOE/FE recently denied our petition for rehearing in that matter, DOE/FE did so without reaching the merits of our arguments. DOE/FE Order 2961-B.

Indeed, the *Sabine Pass* proceedings illustrate the problem of DOE/FE conditional approval prior to completion of NEPA review. In *Sabine Pass*, DOE/FE expressed its "conditional" view that the project was in the public interest, conditioned on "the satisfactory completion of the environmental review process [by FERC] and on issuance by DOE/FE of a finding of no significant impact or a record of decision pursuant to NEPA." *Sabine Pass*, DOE/FE Order 2961 at 41.

This decision was, first, irrational: As we have discussed at length above, DOE/FE cannot complete a public interest determination without weighing environmental factors. Because these factors are integral to DOE/FE's decision, DOE/FE must weigh environmental interests at the same time that weighs all other interests. It may not parcel them into a separate process without irrationally ignoring important aspects of the problem before it.

Second, DOE/FE's approval, even if nominally "conditional," plainly influenced the NEPA process. In the *Sabine Pass* Environmental Assessment, although FERC acknowledged that DOE/FE was making a broad public interest determination, FERC functionally treated DOE/FE's decision as already made. As such, in its alternatives analysis, FERC summarily rejected the "no-action" alternative because "the no-action alternative could not meet the purpose and need for the Project."³⁹ This statement reveals FERC's belief that DOE/FE had already made its decision, and thus that the EA was not truly designed assist DOE/FE in deciding *whether* to allow gas exports. An analysis premised on the

³⁷ See 139 FERC ¶ 61,039, ¶ 46.

³⁸ DOE/FE Order 2961-A, 27.

³⁹ FERC, *Environmental Assessment for the Sabine Pass Liquefaction Project*, Dkt. CP11-72, at 3-1 (2011) ("Sabine Pass EA").

understanding that the decision had *not* been made after the conditional approval would not have summarily ruled out the no-action alternative. The fact that FERC felt that it was not free to give the no-action alternative serious consideration indicates that conditional approvals in fact tend to limit alternatives and influence decisionmaking.

If DOE/FE nonetheless decides to issue a conditional order prior to NEPA review (in violation of the above prohibitions), this conditional order must provide for further future analysis. As we explain above, DOE/FE has an independent duty to review NEPA documents prepared by FERC and to consider how environmental impacts will affect the public interest. Thus, even if DOE/FE wrongly issues a conditional order prior to completion of NEPA review, DOE/FE must revisit its public interest determination after NEPA review is completed: DOE/FE cannot immediately or automatically grant final authorization once FERC concludes the NEPA process.

To reiterate, however, even this alternative course of action would violate DOE/FE's NGA and NEPA obligations. To avoid placing premature and illegal restrictions on its decisionmaking, DOE/FE may not approve the Pangea's export proposal, conditionally or finally, until it has considered the effects of the proposal and the alternatives to it through the NEPA and NGA processes.

C. Pangea's Proposal Will Have Numerous Harmful Environmental and Other Effects and Is Contrary to The Public Interest

Pangea's application drastically overstates the benefits of the project while ignoring its costs. Environmentally, the proposal will harm the environment around the terminal site, in the gas plays where additional production occurs, and nationwide as it induces additional coal use. These environmental injuries all cause economic damage as well. In terms of more purely economic impact, the proposal will raise domestic gas prices, eliminate jobs in manufacturing and other domestic industries, disrupt communities, and regressively transfer wealth from working class families to large corporations and Pangea's overwhelmingly foreign owners. Even putting intra-US distributional effects aside, available evidence suggests that Pangea's proposal would lead to a net loss of wealth for the U.S. Purdue University economists Kemal Sarica and Wallace E. Tyner predict that exports will lead to a net decrease in GDP.⁴⁰ Although NERA predicted a slight increase in GDP in response to exports, the NERA study assumed domestic

⁴⁰ See Kemal Sarica & Wallace E. Tyner, *Economic and Environmental Impacts of Increased US Exports of Natural Gas* (Purdue Univ., Working Paper, 2013) (available from the authors); see also Wallace Tyner, Initial Comment on NERA Study (Jan. 14, 2013) (summarizing the results of the above study), available at http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/30_Wallace_Tyner01_14_13.pdf, attached as Exhibit 14 ("Tyner Comment").

ownership of liquefaction providers and domestic construction of liquefaction equipment, assumptions inapplicable in the context of Pangea's proposal.⁴¹

All of these impacts require additional consideration in the NEPA process and in DOE/FE's ongoing review of the economic impacts of gas exports. Even the incomplete available record, however, demonstrates that these harms to the public interest outweigh the project's benefits, which Pangea has drastically overstated.

The harms caused by Pangea's proposal can be divided into three categories: direct effects of the terminal and any associated infrastructure, indirect effects of the additional gas production the project will induce, and non-localized indirect effects resulting from increased domestic gas prices and resulting increases in coal combustion. As we explain below, each of these categories of effects must be considered in DOE/FE's NEPA and NGA analyses, and each weighs against finding that the proposed project is consistent with the public interest.⁴² In light of these costs and a more sober assessment of the project's benefits, if DOE/FE were to make a decision on the available record (rather than engaging in further study of these issues, as is warranted here), DOE/FE would have to conclude that these impacts outweigh any possible benefit of the project.

1. Local Environmental Impacts

Construction and operation of liquefaction and export facilities will have a range of adverse environmental effects. Sierra Club cannot provide a thorough discussion of local impacts in this filing, because the precise nature and extent of these impacts will depend on the final site design and plan, but Pangea has not yet determined this plan. App at 12 (explaining that specific site plans and layout are unknown at this time). To take one example, because Pangea has provided no information regarding how its compressors will be powered, Sierra Club cannot predict the facility's likely local air emissions or the impacts thereof. However, these effects undoubtedly impact the public interest; DOE/FE must consider these impacts in its public interest analysis; and Sierra Club, together with the broader public, must be given an opportunity to comment on these issues once additional information is available. At this time, we identify the types of issues that the facility is likely to have, informed by the designs of other facilities. Adverse environmental effects include (but are not limited to) air pollution, disruption of aquatic habitat, increased noise and light pollution, and impacts on fish and wildlife related to the preceding impacts. These impacts must be considered in both the NEPA analysis and in DOE/FE's public interest determination.

a. Local Air Emissions

⁴¹ The NERA Study's GDP predictions are further flawed for the reasons explained in our comments thereon.

⁴² Sierra Club anticipates providing additional information regarding these impacts as part of the NEPA process, when additional information regarding the proposal, and FERC's assessment thereof, is made available.

Whatever design is ultimately used, both construction⁴³ and operation phases of Pangea's proposed liquefaction and associated facilities will emit harmful quantities of carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic chemicals (VOC), greenhouse gases (GHGs), sulfur dioxides (SO_x), particulate matter (PM₁₀ and PM_{2.5}), and hydrogen sulfide (H₂S).

VOC and NO_x

Liquefaction and export equipment will emit harmful amounts of VOC and NO_x. Sources of these pollutants include the liquefaction trains, pipeline compressor stations, ships, and other equipment. Liquefaction trains in particular can emit many thousands of tons per year of NO_x when powered by simple-cycle gas turbines, as has been proposed for the Sabine Pass, Louisiana and Corpus Christi, Texas LNG export terminals.⁴⁴

These emissions will harm the environment because VOC and NO_x contribute to the formation of ground-level ozone (also called smog). Smog pollution harms human respiratory systems and has been linked to premature death, heart failure, chronic respiratory damage, and premature aging of the lungs.⁴⁵ Smog may also exacerbate existing respiratory illnesses, such as asthma and emphysema, or cause chest pain, coughing, throat irritation and congestion. Children, the elderly, and people with existing respiratory conditions are the most at risk from ozone pollution.⁴⁶ Significant ozone pollution also damages plants and ecosystems.⁴⁷

Ozone also contributes substantially to global climate change over the short term. According to a recent study by the United Nations Environment Program (UNEP), behind carbon dioxide and methane, ozone is now the third most significant contributor to human-caused climate change.⁴⁸

⁴³ Although Pangea indicates that its anticipated design will incorporate a floating component built elsewhere, Pangea will construct extensive terminal and pipeline facilities in and near the Corpus Christi site.

⁴⁴ Sabine Pass EA, *supra* n.39, at 2-56, t.2.7-7; Corpus Christi Liquefaction *et al.*, FERC Dkt. CP12-507, Resource Report 9, 9-7 to 9-9 (Aug. 31, 2012).

⁴⁵ EPA, *Proposed New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry: Regulatory Impact Analysis*, 4-25 (July 2011) ("O&G NSPS RIA"), available at <http://www.epa.gov/ttnecas1/regdata/RIAs/oilnaturalgasfinalria.pdf>, attached as Exhibit 15; Jerrett *et al.*, *Long-Term Ozone Exposure and Mortality*, *New England Journal of Medicine* (Mar. 12, 2009), available at <http://www.nejm.org/doi/full/10.1056/NEJMoa0803894#t=articleTop>, attached as Exhibit 16.

⁴⁶ See EPA, *Ground-Level Ozone, Health Effects*, available at <http://www.epa.gov/glo/health.html> attached as Exhibit 17. EPA, *Nitrogen Dioxide, Health*, available at <http://www.epa.gov/air/nitrogenoxides/health.html>, attached as Exhibit 18.

⁴⁷ O&G NSPS RIA, *supra* n.45, at 4-26.

⁴⁸ *Id.* See also United Nations Environment Programme and World Meteorological Organization, (2011): *Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers*

CO

Operation of LNG export terminals such as the proposed project also causes emissions of CO. The Sabine Pass project has the potential to emit 4,759 tons per year of CO from liquefaction activities.⁴⁹ Even where more stringent pollution controls are proposed, such as in the Oregon LNG project, anticipated direct emissions exceed 150 tpy of CO, with an additional 197.18 tpy from marine vessels.⁵⁰ Construction of LNG export terminals can also emit substantial amounts of CO. For example, construction of the Sabine Pass terminal is anticipated to cause 164 tpy of CO emissions in the heaviest construction year.⁵¹

CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues.⁵² CO can be particularly harmful to persons with various types of heart disease, who already have a reduced capacity for pumping oxygenated blood to the heart. "For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion."⁵³

GHGs

Operation of LNG export terminals such as the proposed project also results in emission of greenhouse gases. To again use the Sabine Pass and Oregon LNG proposals as examples, these facilities are anticipated to emit 2.6 and 3.9 million tpy of carbon dioxide equivalent in greenhouse gases.⁵⁴ These greenhouse gas emissions will increase global warming, harming both the local and global environments. The impacts of global warming include "increased air and ocean temperatures, changes in precipitation patterns, melting and thawing of global glaciers and ice, increasingly severe weather events, such as hurricanes of greater intensity, and sea level rise."⁵⁵ A warming climate will also lead to loss of coastal land in densely populated areas, shrinking snowpack in Western states, increased wildfires, and reduced crop yields.⁵⁶ More frequent heat waves as a result of global warming have already affected public health, leading to

(hereinafter "UNEP Report," available at http://www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf), at 7, attached as Exhibit 19.

⁴⁹ Sabine Pass EA, *supra* n.39, at 2-56 t.2.7-7.

⁵⁰ LNG Development Company, LLC, *d/b/a Oregon LNG*, FERC Dkt. No. PF12-18, Draft Resource Report 9 at 9-16 to 9-18 (Aug. 31, 2012) ("Oregon LNG RR").

⁵¹ *Id.* at 2-52 to 2-53, t.2.7-5 (2011).

⁵² EPA, Carbon Monoxide, Health, <http://www.epa.gov/air/carbonmonoxide/health.html>, last visited Dec. 14, 2012, attached as Exhibit 20.

⁵³ *Id.*

⁵⁴ Sabine Pass EA, *supra* n.39, at 2-57 t.2.7-8, Oregon LNG RR, *supra* n.50 at RR 9-16 to 9-19.

⁵⁵ Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. at 52,738, 52,791-22 (citing U.S. EPA, 2011 U.S. GREENHOUSE GAS INVENTORY REPORT EXECUTIVE SUMMARY (2011)), attached as Exhibit 21.

⁵⁶ *Id.* at 66,532-33.

premature deaths, and threats to public health are only expected to increase as global warming intensifies. For example, a warming climate will lead to increased incidence of respiratory and infectious disease, greater air and water pollution, increased malnutrition, and greater casualties from fire, storms, and floods.⁵⁷ Vulnerable populations—such as children, the elderly, and those with existing health problems—are the most at risk from these threats.

Sulfur Dioxide

The Oregon LNG proposal, for example, would directly emit an estimated 72 tpy of SO₂, with an additional 80.88 tpy emitted by marine vessel traffic.⁵⁸ Sulfur dioxide causes respiratory problems, including increased asthma symptoms. Short-term exposure to sulfur dioxide has been linked to increased emergency room visits and hospital admissions. Sulfur dioxide reacts in the atmosphere to form particulate matter (PM), an air pollutant which causes a great deal of harm to human health.⁵⁹ PM is discussed separately below. Sulfur dioxide can also cause haze, or decreased visibility.

Particulate Matter/Fugitive Dust

Operation of LNG export terminals such as the proposed project also results in emission of particulate matter. For example, the proposed Oregon LNG terminal and compressor stations will directly emit an estimated 14.9 tpy of particulate matter, with an additional 51.2 tpy emitted by marine vessel traffic.⁶⁰

PM consists of tiny particles of a range of sizes suspended in air. Small particles pose the greatest health risk. These small particles include “inhalable coarse particles,” which are smaller than 10 micrometers in diameter (PM₁₀), and “fine particles” which are less than 2.5 micrometers in diameter (PM_{2.5}). PM₁₀ is primarily formed from crushing, grinding or abrasion of surfaces. PM_{2.5} is primarily formed by incomplete combustion of fuels or through secondary formation in the atmosphere.⁶¹

Construction of LNG terminals can also be a significant source of particulate matter as well. Construction PM emissions result from fugitive dust raised by construction activities; dust generated can be substantial, depending on the size of the area disturbed and the nature of the construction activities. For the Sabine Pass proposal,

⁵⁷ EPA, *Climate Change, Health and Environmental Effects*, available at <http://epa.gov/climatechange/effects/health.html>, attached as Exhibit 22.

⁵⁸ Oregon LNG RR, *supra* n.50, at 9-16 to 9-19.

⁵⁹ EPA, Sulfur Dioxide, Health, available at <http://www.epa.gov/air/sulfurdioxide/health.html>, attached as Exhibit 23.

⁶⁰ Oregon LNG RR, *supra* n.50, at 9-16 to 9-19.

⁶¹ See EPA, Particulate Matter, Health, available at <http://www.epa.gov/pm/health.html>, attached as Exhibit 24; BLM, *West Tavaputs Plateau Natural Gas Full Field Development Plan Final Environmental Impact Statement* (“West Tavaputs FEIS”), at 3-19 (July 2010), available at http://www.blm.gov/ut/st/en/fo/price/energy/Oil_Gas/wtp_final_eis.html.

construction was estimated to cause 658 tpy of PM₁₀ and 99 tpy of PM_{2.5} fugitive dust emissions, even after application of dust suppressant controls.⁶²

PM causes a wide variety of health and environmental impacts. PM has been linked to respiratory and cardiovascular problems, including coughing, painful breathing, aggravated asthma attacks, chronic bronchitis, decreased lung function, heart attacks, and premature death. Sensitive populations, include the elderly, children, and people with existing heart or lung problems, are most at risk from PM pollution.⁶³ PM also reduces visibility,⁶⁴ and may damage important cultural resources.⁶⁵ Black carbon, a component of PM emitted by combustion sources such as flares and older diesel engines, also warms the climate and thus contributes to climate change.⁶⁶

b. Other Local Impacts

The proposed project will also likely impact local water quality, fish and wildlife, and other environmental resources. Likely water impacts include the effects of water withdrawals necessary for terminal construction and pipeline pressure testing, stormwater runoff from the facility, discharge and suspension or re-suspension of sediment as a result of dredging and ship transits. These water quality impacts, as well as other disturbances from construction and operation, will affect local fish and wildlife. The Sierra Club intends to submit comments during the NEPA process that more fully explore local environmental impacts in light of the project design.

2. Induced Gas Production

Further, and likely greater, environmental impacts will result from increased gas production. Pangea, the EIA, NERA, essentially every other LNG export applicant, and other informed commenters all agree that LNG exports will induce additional production in the United States.

Available tools allow DOE to predict where increased production will occur, although such localized predictions are not necessary for meaningful analysis of environmental impacts. NEPA and the NGA therefore require DOE/FE to consider the effects of this additional production. Although DOE/FE recently refused to consider induced production in the *Sabine Pass* proceeding, that order applied the wrong legal standard of foreseeability and is factually incorrect (and factually distinct from the present case) as it understates DOE's ability to predict induced drilling.

⁶² Sabine Pass EA, *supra* n.39, at 2-52 t.2.7-4.

⁶³ O&G NSPS RIA, *supra* n.45, at 4-19; EPA, Particulate Matter, Health

⁶⁴ EPA "Visibility – Basic Information" <http://www.epa.gov/visibility/what.html>, attached as Exhibit 25.

⁶⁵ See EPA, Particulate Matter, Health, *supra* n.61; West Tavaputs EIS, *supra* n.61, at 3-19; O&G NSPS RIA, *supra* n.45, at 4-24.

⁶⁶ UNEP Report at 6; IPCC (2007) at Section 2.4.4.3.

a. Pangea's Proposal Will Induce Additional U.S. Gas Production

Pangea's application and supporting reports, and the EIA, agree that exports will induce additional production. EIA has the capacity to predict where this additional production will occur, and the Black and Veatch report submitted by Pangea implies a similar capability.

The EIA predicts that "about 60 to 70 percent" of additional demand created by LNG exports would be met by increases in domestic production, with "about three quarters of this increased production [coming] from shale sources."⁶⁷ Although Pangea's application does not provide a specific estimate, it repeatedly asserts that its proposed exports will increase domestic gas production. *See, e.g.*, App. at 9, 38 (discussing job creation resulting from increased gas production), App. at 34 (asserting that exports will induce additional production and thereby stabilize gas prices). Moreover, as explained below, it appears that Black and Veatch, in preparing the price impacts analysis submitted by Black and Veatch, must have arrived at their own forecast of how production would increase in response to Pangea's proposed exports, although Black and Veatch do not provide this estimate in their report.

Available models not only predict the extent to which domestic gas production will increase in response to exports—the models can also predict where these production increases will occur. EIA's core analytical tool is the National Energy Modeling System ("NEMS"). NEMS was used to produce the EIA exports study. NEMS models the economy's energy use through a series of interlocking modules that represent different energy sectors on geographic levels.⁶⁸ Notably, the "Natural Gas Transmission and Distribution" module models the relationship between U.S. and Canadian gas production, consumption, and trade, specifically projecting U.S. production, Canadian production, imports from Canada, *etc.*⁶⁹ For each region, the module links supply and demand annually, taking transmission costs into account, in order to project how demand will be met by the transmission system.⁷⁰ Importantly, the Transmission Module is *already* designed to model LNG imports and exports, and contains an extensive modeling apparatus allowing it to do so on the basis of production in the U.S., Canada, and Mexico.⁷¹ At present, the Module focuses largely on LNG imports, reflecting U.S. trends up to this point, but it also already links the Supply Module to the

⁶⁷ *Id.* at 6.

⁶⁸ EIA, *The National Energy Modeling System: An Overview*, 1-2 (2009), attached as Exhibit 26, available at [http://www.eia.gov/oiaf/aeo/overview/pdf/0581\(2009\).pdf](http://www.eia.gov/oiaf/aeo/overview/pdf/0581(2009).pdf).

⁶⁹ *Id.* at 59.

⁷⁰ EIA, *Model Documentation: Natural Gas Transmission and Distribution Module of the National Energy Modeling System*, 15-16 (2012), attached as Exhibit 27, available at [http://www.eia.gov/FTP/ROOT/modeldoc/m062\(2011\).pdf](http://www.eia.gov/FTP/ROOT/modeldoc/m062(2011).pdf).

⁷¹ *See id.* at 22-32.

existing Alaskan *export* terminal and projects exports from that site and their impacts on production.⁷²

Similarly, EIA's "Oil and Gas Supply" module models individual regions and describes how production responds to demand across the country. Specifically, the Supply Module is built on detailed state-by-state reports of gas production curves across the country.⁷³ As EIA explains, "production type curves have been used to estimate the technical production from known fields" as the basis for a sophisticated "play-level model that projects the crude oil and natural gas supply from the lower 48."⁷⁴ The module distinguishes coalbed methane, shale gas, and tight gas from other resources, allowing for specific predictions distinguishing unconventional gas supplies from conventional supplies.⁷⁵ The module further projects the number of wells drilled each year, and their likely production – which are important figures for estimating environmental impacts.⁷⁶ In short, the supply module "includes a comprehensive assessment method for determining the relative economics of various prospects based on future financial considerations, the nature of the undiscovered and discovered resources, prevailing risk factors, and the available technologies. The model evaluates the economics of future exploration and development from the perspective of an operator making an investment decision."⁷⁷ Thus, for each play in the lower 48 states, the EIA is able to predict future production based on existing data. The model is also equipped to evaluate policy changes that might impact production; according to EIA, "the model design provides the flexibility to evaluate alternative or new taxes, environmental, or other policy changes in a consistent and comprehensive manner."⁷⁸

Thus, there is no technical barrier to modeling where exports will induce production going forward. Indeed, EIA used this model for its export study, which forecast production and price impacts.

Pangea's own consultant, Black and Veatch, also claims to have the ability to predict where production will increase in response to exports, and Black and Veatch imply that they have actually done so, although these predictions are not provided in Pangea's application materials. In general terms, Pangea and Black and Veatch generally predict that the gas exported by Pangea's proposal would come from the Eagle Ford Shale in

⁷² See *id.* at 30-31.

⁷³ EIA, *Documentation of the Oil and Gas Supply Module*, 2-2 (2011), attached as Exhibit 28, available at [http://www.eia.gov/FTP/ROOT/modeldoc/m063\(2011\).pdf](http://www.eia.gov/FTP/ROOT/modeldoc/m063(2011).pdf).

⁷⁴ *Id.* at 2-3.

⁷⁵ *Id.* at 2-7.

⁷⁶ See *id.* at 2-25 to 2-26.

⁷⁷ *Id.* at 2-3.

⁷⁸ *Id.*

South Texas, because this the closest production region to the terminal site.⁷⁹ App. at 15, 26. The Black and Veatch report states an ability to make much more sophisticated predictions, explaining that their model is detailed to the level of individual “production regions,” including a “basin-by-basin, play-by-play” approach to assessing supply. App at 29-30. Insofar as this basin and play specific modeling is part of the integrated model Black and Veatch performed here, it appears that Black and Veatch have already made these predictions.

Deloitte Marketpoint, another private modeler, has provided similar but more detailed discussion of the ways exports will induce domestic production.⁸⁰ Deloitte explains that its “World Gas Model” includes detailed global gas resources, including modeling of “575 plays in the US alone.”⁸¹ For this model, “Within each major region are very detailed representations of many market elements: production, liquefaction, transportation, market hubs, regasification and demand by country or sub area.” *Id.* at 24. This includes modeling individual “producers, pipelines, refineries, ships, distributors, and consumers.” *Id.* Deloitte applied this model to another proposal and derived specific volumes of predicted production increases in five distinct shale gas plays. *Id.* at 14. While Deloitte only provides as aggregate estimates for other shale plays and for non-shale sources, it appears that Deloitte’s model is capable of providing geographically specifying where this aggregated production will occur. We offer no opinion at this time about the strengths or weaknesses of Deloitte’s models relative to EIA’s. We simply note that multiple tools exist which allow predictions of how and where production will respond to exports.

b. Induced Production Must Be Considered in the NEPA and NGA Analyses

NEPA regulations, applicable case law, and recent EPA scoping comments all call for DOE/FE to consider the environmental effects of induced production. As noted above, NEPA requires consideration of “indirect effects” of the proposed action, which include “growth inducing effects” and “reasonably foreseeable” effects “removed in distance” from the site of the proposed action. 40 C.F.R. § 1508.8(b). Here, induced production is not only an effect of the project – it is part of the justification offered for it. *See., e.g.,* App. at 9, 34, 38. It is therefore plainly a “reasonably foreseeable” effect that must be analyzed in NEPA.

⁷⁹ Pangea asserts that fact that Eagle Ford and other South Texas regions are logical sources of gas for the project “does not imply that, but for the [Pangea] Project, the resources in this area would not be produced.” App at 27. Sierra Club agrees that some production is likely to occur in these regions regardless of whether the Pangea project proceeds. Nonetheless, it is plain that the amount and of production in these areas will likely increase in light of the Pangea project. Indeed, Pangea proposes to export more gas than is currently produced from the Eagle Ford Shale. *Id.* (estimating 250-300 bcf/year of eagle ford production in 2012).

⁸⁰ Deloitte Study, *supra* n.25, at 14.

⁸¹ *Id.* at 25.

Several courts have held that natural resource production and other analogous upstream impacts induced by new infrastructure development must be considered in NEPA. The Eighth Circuit illustrated the “reasonably foreseeable” standard in analogous circumstances considering the converse of the dynamic here, holding that increased consumption was a reasonably foreseeable consequence of increased supply. *Mid States Coalition for Progress v. Surface Transportation Board*, 345 F.3d 520 (8th Cir. 2003). At issue there was Surface Transportation Board award of a certificate of “public convenience and necessity” for construction of a rail line under 49 U.S.C. § 10901. 345 F.3d at 533. This line would provide an additional, shorter, faster, and cheaper route to market for low-sulfur coal mined in the Powder River Basin. *Id.* at 549. Sierra Club argued that the project would therefore increase nationwide consumption of coal, consequently increasing emissions of many harmful air pollutants, and that NEPA required consideration of this effect. *Id.* The Board had refused to analyze the impacts of this increased coal consumption. Specifically, the Board argued that any changes in domestic coal consumption would occur regardless of whether the line was built, because existing rail lines already provided a route between the mines and existing demand. *Id.* The court rejected the Board’s view. The project would increase the availability of inexpensive low sulfur coal, making coal “a more attractive option” to potential consumers. *Id.* Provision of a cheaper and more plentiful supply of coal would “most assuredly affect the nation’s long-term demand for coal.” *Id.* Accordingly, an increase in coal consumption was reasonably foreseeable, and NEPA required consideration of this impact. *Id.*

Similarly, the Ninth Circuit recently held that, where the Surface Transportation Board was considering a proposal to expand a railway line which would enable increased coal production at several mines, NEPA required the Board to consider the impacts of increased mining. *N. Plains Resource Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1081-82 (9th Cir. 2011). In *Northern Plains*, the court pointed to the agency’s reliance on the induced coal mine development “to justify the financial soundness of the proposal,” *id.* at 1082. Because the agency anticipated induced coal production in justifying its proposal, such production was reasonably foreseeable, and NEPA analysis of its impacts was required. Here, a decision by DOE/FE to rely on the supposed economic benefits of increased production, while simultaneously ignoring the impacts of this production, would be squarely inconsistent with *Northern Plains*.

Border Power Plant Working Group v. DOE, 260 F. Supp. 2d 997 (S.D. Cal. 2003), also required consideration of upstream environmental impacts induced by the construction of new energy infrastructure. That case involved applications to construct and operate transmission lines across the U.S.-Mexico border. The court held that DOE was required to consider the environmental effects of upstream electricity generation induced by the new infrastructure, rejecting DOE’s decision to exclude these upstream impacts from

analysis.⁸² *Id.* at 1017. Consideration of induced impacts was required even though the upstream electricity generation would occur in Mexico, outside the jurisdiction of DOE or any other U.S. agency. *Id.* at 1016-17. Here, too, DOE/FE is required to consider the impacts of natural gas production induced by Pangea’s proposal, regardless of DOE’s regulatory authority over that production.

EPA has also argued, in scoping comments it submitted regarding three other LNG export proposals, that induced production should be included in NEPA review. In scoping comments for the Jordan Cove project, EPA opined that in light of the regulatory definition of indirect effects and the EIA Export Study’s prediction of induced production, “it is appropriate to consider available information about the extent to which drilling activity might be stimulated by the construction of an LNG export facility on the west coast, and any potential environmental effects associated with that drilling expansion.”⁸³ EPA used similar language regarding the Oregon LNG proposal.⁸⁴ EPA’s scoping comments for the Cove Point facility in Maryland also recommended analyzing “indirect effects related to gas drilling and combustion,” and stressed that, in addition to reviewing the *economic* impacts of induced drilling, DOE/FE should “thoroughly consider the indirect and cumulative *environmental* impacts” of export.⁸⁵

Although DOE/FE recently “accept[ed] and adopt[ed] [FERC’s] determination that induced shale gas production is not a reasonably foreseeable effect [of LNG exports] for purposes of NEPA analysis” in its August *Sabine Pass* order, DOE/FE should not follow *Sabine Pass* here. The *Sabine Pass* order factual and legal errors and thus should not be the basis for future DOE/FE decisions.⁸⁶ Although DOE/FE recently denied our petition for rehearing of that order, DOE/FE did so without reaching the merits of our petition, and as such, DOE/FE has not responded to the errors we identified therein.⁸⁷

The first flaw in DOE/FE’s *Sabine Pass* decision is that DOE/FE refused to analyze reasonably foreseeable future environmental effects based on its unlawful demand that these effects’ scope and nature first be known with a high degree of certainty. DOE/FE stated that it is “unknown” if “any” new production will result from the proposed exports. *Sabine Pass* at 28. Although it is true that the precise scope of production

⁸² The final EIS for the project at issue in *Border Power Plant Working Group*, produced after remand from the court, is available at <http://energy.gov/nepa/downloads/eis-0365-final-environmental-impact-statement>. Upstream air quality impacts are considered in pages 4-43 to 4-65 of this final EIS.

⁸³ EPA, *Scoping Comments – The Jordan Cove Energy Project LP*, *supra* n.18, at 14.

⁸⁴ EPA, *Scoping Comments – The Oregon LNG Export Project and Washington Expansion Project*, *supra* n.20

⁸⁵ EPA, *Scoping Comments – Cove Point Liquefaction Project*, *supra* n.19, at 2-3 (emphasis added).

⁸⁶ DOE is not bound by its prior decisions: it may reverse its position “with or without a change in circumstances” so long as it provides “a reasoned analysis” for the change. *Louisiana Pub. Serv. Comm’n v. FERC*, 184 F.3d 892, 897 (D.C. Cir. 1999) (quoting *Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 57 (1983)).

⁸⁷ DOE/FE Order 2961-B, Jan. 25, 2013.

impacts cannot be determined with complete certainty, certainty is not required. “An impact is ‘reasonably foreseeable’ if it is ‘sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision.’” *City of Shoreacres v. Waterworth*, 420 F.3d 440, 453 (5th Cir. 2005) (quoting *Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992)). NEPA requires “[r]easonable forecasting and speculation,” and courts “must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as ‘crystal ball inquiry.’” *Scientists’ Inst. for Pub. Info., Inc. v. Atomic Energy Comm’n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973). As explained above, every available source concludes that it is *likely* that the majority of exported gas will come from induced additional production. Thus, if exports occur, an aggregate production increase is unarguably “reasonably foreseeable.”

DOE/FE’s second error in *Sabine Pass* was to adopt FERC’s conclusion that induced production was outside the scope of NEPA analysis because “while it may be the case that additional shale gas development will result from the Liquefaction Project, the amount, timing and location of such development activity is simply unknowable at this time.” *Sabine Pass* at 13 (quoting 140 FERC ¶ 61,076, P9 (July 26, 2012)). Such specific, localized predictions are not required for meaningful environmental analysis, but even if they were, DOE/FE has the resources to provide them.

As a threshold matter, analysis of the environmental impacts of induced gas production does not require knowledge of the precise sites where additional production will occur. Environmental costs (and the economic costs that accompany them) can be determined in the aggregate. The net increases in, for instance, air pollution associated with the number of wells that will be induced can be quantified based on EPA’s emissions inventories, for instance. The net volumes of waste can similarly be derived from industry reports and state discharge figures. And these impacts can be localized, at a minimum, by region. Indeed, for some of the environmental impacts of production, such as emissions of many air pollutants and consumption of water, the impacts are likely to be experienced at the regional level, so there may be little value in localizing them further. Even for those impacts that are more closely tied to a specific location, such as habitat fragmentation, DOE/FE can and must acknowledge that the impact will occur, including an estimate of the severity of the impact averaged across potential locations. *See Scientists’ Inst. for Pub. Info.*, 481 F.2d at 1096-97 (where there are reasonable estimates of the deployment of nuclear power plants, the amount of waste produced, and the land needed to store waste, NEPA required analysis of the impacts of such storage even though the agency could not predict *where* such storage would occur).

Even if DOE/FE were to conclude, wrongly, that NEPA only requires analysis of induced drilling impacts that can be predicted to occur in a particular location, DOE/FE has the tools to make precisely that prediction, as explained in the previous section. If such local impact predictions are not yet in the record, NEPA regulations provide that DOE/FE

“shall” obtain this information unless DOE/FE demonstrates that the costs of obtaining it are “exorbitant.” 40 C.F.R. § 1502.22.

In summary, all the available evidence indicates that Pangea’s proposed exports will induce additional gas production in the U.S. This increase is reasonably foreseeable, and its environmental effects must be analyzed under NEPA.

c. Environmental Harm Resulting from Induced Production

Natural gas production—from both conventional and unconventional sources—is a significant air pollution source, can disrupt ecosystems and watersheds, leads to industrialization of entire landscapes, and presents challenging waste disposal issues. EIA must consider the increase in these environmental harms that exports are likely to stimulate.

Much of the induced production resulting from exports is likely to come from shale gas and other unconventional sources. EIA has concluded that “[o]n average, across all cases and export scenarios, the shares of the increase in total domestic production coming from shale gas, tight gas, [and] coalbed sources are 72 percent, 13 percent, [and] 8 percent,” respectively.⁸⁸ A subcommittee of the DOE’s Secretary of Energy’s Advisory Board recently highlighted “a real risk of serious environmental consequences” resulting from continued expansion of shale gas production. DOE, Secretary of Energy’s Advisory Board, *Shale Gas Production Subcommittee Second 90-Day Report* (2011) at 10.⁸⁹ Shale gas production (as well as coalbed and tight sands production) requires the controversial practice of hydraulic fracturing, or fracking. As we explain below, natural gas production in general, and fracking in particular, impose a large number of environmental harms. Although some states and federal agencies are taking steps to limit these harms, these efforts are uncertain and, even if fully implemented, will not eliminate the environmental harms.

i. Natural Gas Production is a Major Source of Air Pollution

Below, we briefly describe some of the primary air pollution problems caused by the industry. These issues include direct emissions from production equipment and indirect emissions caused by natural gas replacing cleaner energy sources. See Figure 1, below. EPA has moved to correct some of these problems with new air regulations finalized last year, but, as we later discuss, these standards do not fully address the problem. FERC must therefore consider the air pollution impacts of increased natural gas production despite EPA’s rules.

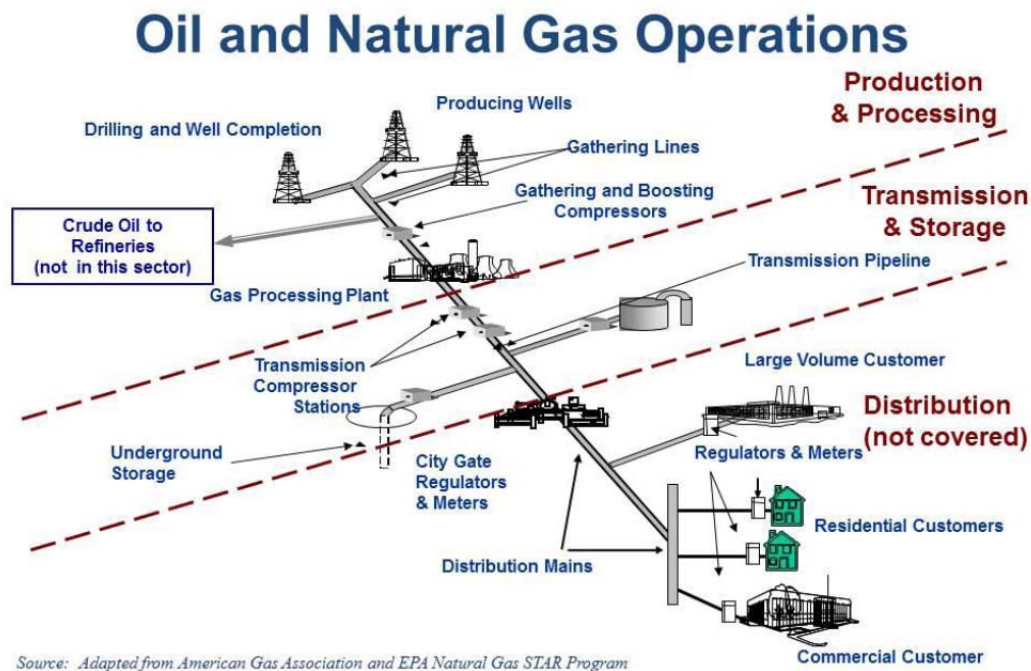
⁸⁸ EIA Export Study, *supra* n. 29, at 11.

⁸⁹ Attached as Exhibit 29. See also DOE, Shale Gas Production Subcommittee First 90-Day Report, attached as Exhibit 30.

Air Pollution Problems from Natural Gas

Natural gas production operations emit methane (CH₄), volatile organic compounds (VOCs), nitrogen oxides (NO_x), sulfur dioxide (SO₂), hydrogen sulfide (H₂S), and particulate matter (PM₁₀ and PM_{2.5}). These operations also emit listed hazardous air pollutants (HAPs) in significant quantities, and so contribute to cancer risks and other acute public health problems. Pollutants are emitted during all stages of natural gas development, including (1) oil and natural gas production, (2) natural gas processing, (3) natural gas transmission, and (4) natural gas distribution.⁹⁰ Within these development stages, the major sources of air pollution include wells, compressors, pipelines, pneumatic devices, dehydrators, storage tanks, pits and ponds, natural gas processing plants, and trucks and construction equipment.

Figure 1: The Oil and Natural Gas Sector



There is strong evidence that emissions from natural gas production are higher than have been commonly understood. In particular, a recent study by a consortium of researchers led by the National Ocean and Atmospheric Administration (NOAA) Earth System Research Laboratory recorded pollution concentrations near gas fields substantially greater than EPA estimates would have predicted. That study monitored

⁹⁰ EPA, Oil and Natural Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution, Background Technical Support Document for the Proposed Rules, at 2-4 (July 2011) ("2011 TSD"), attached as Exhibit 31.

air quality around oil and gas fields.⁹¹ The researchers observed high levels of methane, propane, benzene, and other volatile organic compounds in the air around the fields. According to the study authors, their “analysis suggests that the emissions of the species we measured” – that is, the cancer-causing, smog-forming, and climate-disrupting pollutants released from these operations – “are most likely underestimated in current inventories,” perhaps by as much as a factor of two, which would imply a leak rate of about 4.8% of production.⁹² A second NOAA study, recently announced, suggests that leak rates may be as high as 9%, suggesting even more severe consequences.⁹³

These emissions have dire practical consequences. A second research team, led by the Colorado School of Public Health, measured benzene and other pollutants released from unconventional well completions.⁹⁴ Elevated levels of these pollutants correspond to increased cancer risks for people living within half of a mile of a well⁹⁵ – a very large population which will increase as drilling expands.

We discussed the harmful effects of many of these pollutants in part III.C.1.a, above. Below, we detail the sources of emissions within the gas production industry and provide further information regarding the serious global, regional, and local impacts these exploration and production emissions entail:

Methane: Methane is the dominant pollutant from the oil and gas sector. Emissions occur as result of intentional venting or unintentional leaks during drilling, production, processing, transmission and storage, and distribution. For example, methane is emitted when wells are completed and vented, as part of operation of pneumatic devices and compressors, and as a result of leaks (fugitive emissions) in pipelines, valves, and other equipment. EPA has identified natural gas systems as the “single largest contributor to United States anthropogenic methane emissions.”⁹⁶ The industry is responsible for over 40% of total U.S. methane emissions.⁹⁷ Methane causes harm both because of its contributions to climate change and as an ozone precursor.

Methane is a potent greenhouse gas that contributes substantially to global climate change. Methane has at least 25 times the global warming potential of carbon dioxide

⁹¹ G. Petron *et al.*, *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 *J. of Geophysical Research* 4304, DOI 10.1029/2011JD016360 (2012), attached as Exhibit 32.

⁹² *Id.* at 4304.

⁹³ J. Tollefson, *Methane leaks erode green credentials of natural gas*, *Nature* (2013), attached as attached as Exhibit 33.

⁹⁴ L. McKenzie *et al.*, *Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources*, *Science of the Total Environment* (In Press, Mar. 22, 2012), attached as Exhibit 34.

⁹⁵ *Id.* at 2.

⁹⁶ Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 *Fed. Reg.* 52,738, 52,792 (Aug. 23, 2011), attached as Exhibit 35. 76 *Fed. Reg.* 52,738, *supra* n.55, at 52,792.

⁹⁷ *Id.* at 52,791–92.

over a 100 year time frame and at least 72 times the global warming potential of carbon dioxide over a 20-year time frame.⁹⁸ Because of methane's effects on climate, EPA has found that methane, along with five other well-mixed greenhouse gases, endangers public health and welfare within the meaning of the Clean Air Act.⁹⁹ The oil and gas production industry is a significant emitter of this dangerous pollutant; its methane emissions amount to 5% of all carbon dioxide equivalent (CO_{2e}) emissions in the country.¹⁰⁰

Methane also reacts in the atmosphere to form ozone.¹⁰¹ As we discuss elsewhere, ozone is a major public health threat, linked to a wide range of maladies. In addition to these public health harms, ozone can damage vegetation, agricultural productivity, and cultural resources. Ozone is also a greenhouse gas, meaning that methane is doubly damaging to climate – first in its own right, and then as an ozone precursor.

Volatile Organic Compounds (VOCs) and NO_x: The gas industry is also a major source of two other ozone precursors: VOCs and NO_x.¹⁰² VOCs are emitted from well drilling and completions, compressors, pneumatic devices, storage tanks, processing plants, and as fugitives from production and transmission.¹⁰³ The primary sources of NO_x are compressor engines, turbines, and other engines used in drilling and hydraulic fracturing.¹⁰⁴ NO_x is also produced when gas is flared or used for heating.¹⁰⁵

As a result of significant VOC and NO_x emissions associated with oil and gas development, numerous areas of the country with heavy concentrations of drilling are

⁹⁸ IPCC 2007—*The Physical Science Basis*, Section 2.10.2, and IPCC 2007- *Summary for Policymakers*, attached as Exhibit 36. We note that these global warming potential figures may be revised upward in the next IPCC report. A more recent study by Shindell *et al.* estimates methane's 100-year GWP at 33; this same source estimates methane's 20-year GWP at 105.

⁹⁹ EPA, Endangerment and Cause or Contribute Findings for Greenhouse Gases, 74 Fed. Reg. 66,496, 66,516 (Dec. 15, 2009) ("Endangerment Finding"), attached as Exhibit 37.

¹⁰⁰ 76 Fed. Reg. 52,738, *supra* n.96, at 52,791–92.

¹⁰¹ *Id.* at 52,791.

¹⁰² See, e.g., Al Armendariz, Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (Jan. 26, 2009), available at http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf (hereinafter "Barnett Shale Report") at 24, attached as Exhibit 38.

¹⁰³ See, e.g., 2011 TSD, *supra* n.90, at 4-7, 5-6, 6-5, 7-9, 8-1 (Exhibit 31); see also Barnett Shale Report, *supra* n.102, at 24 (Exhibit 38).

¹⁰⁴ See, e.g., 2011 TSD, *supra* n.90, at 3-6; Barnett Shale Report, *supra* n.102, at 24 (Exhibit 30); Air Quality Impact Analysis Technical Support Document for the Revised Draft Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project at 11 (Table 2.1.), attached as Exhibit 39.

¹⁰⁵ 2011 TSD, *supra* n.90, at 3-6; Colorado Department of Public Health and Environment, *Colorado Visibility and Regional Haze State Implementation Plan for the Twelve Mandatory Class I Federal Areas in Colorado*, Appendix D at 1 (2011), available at <http://www.cdphe.state.co.us/ap/RegionalHaze/AppendixD/4-FactorHeaterTreaters07JAN2011FINAL.pdf>, attached as Exhibit 40.

now suffering from serious ozone problems. For example, the Dallas Fort Worth area in Texas is home to substantial oil and gas development. Within the Barnett shale region, as of September 2011, there were more than 15,306 gas wells and another 3,212 wells permitted.¹⁰⁶ Of the nine counties surrounding the Dallas Fort Worth area that EPA has designated as “nonattainment” for ozone, five contain significant oil and gas development.¹⁰⁷ A 2009 study found that summertime emissions of smog-forming pollutants from these counties were roughly comparable to emissions from motor vehicles in those areas.¹⁰⁸

Oil and gas development has also brought serious ozone pollution problems to rural areas, such as western Wyoming.¹⁰⁹ On March 12, 2009, the governor of Wyoming recommended that the state designate Wyoming’s Upper Green River Basin as an ozone nonattainment area.¹¹⁰ The Wyoming Department of Environmental Quality conducted an extended assessment of the ozone pollution problem and found that it was “primarily due to local emissions from oil and gas . . . development activities: drilling, production, storage, transport, and treating.”¹¹¹ Last winter alone, the residents of Sublette County suffered thirteen days with ozone concentrations considered “unhealthy” under EPA’s current air-quality index, including days when the ozone pollution levels exceeded the worst days of smog pollution in Los Angeles.¹¹² Residents have faced repeated warnings regarding elevated ozone levels and the resulting risks of going outside.¹¹³

¹⁰⁶ Texas Railroad Commission history of Barnett Shale, attached as Exhibit 41.

¹⁰⁷ Barnett Shale Report, *supra* n.102, at 1, 3 (Exhibit 30).

¹⁰⁸ *Id.* at 1, 25-26.

¹⁰⁹ Schnell, R.C., *et al.* (2009), “Rapid photochemical production of ozone at high concentrations in a rural site during winter,” *Nature Geosci.* 2 (120 – 122). DOI: 10.1038/NGEO415, attached as Exhibit 42.

¹¹⁰ See Letter from Wyoming Governor Dave Freudenthal to Carol Rushin, Acting Regional Administrator, USEPA Region 8, (Mar. 12, 2009) (“Wyoming 8-Hour Ozone Designation Recommendations”), available at <http://deq.state.wy.us/out/downloads/Rushin%20Ozone.pdf>, attached as Exhibit 43; Wyoming Department of Environmental Quality, Technical Support Document I for Recommended 8-hour Ozone Designation of the Upper Green River Basin (March 26, 2009) (“Wyoming Nonattainment Analysis”), at vi-viii, 23-26, 94-05, available at http://deq.state.wy.us/out/downloads/Ozone%20TSD_final_rev%203-30-09_jl.pdf, attached as Exhibit 44.

¹¹¹ Wyoming Nonattainment Analysis, *supra* n.110, at viii (Exhibit 44).

¹¹² EPA, *Daily Ozone AQI Levels in 2011 for Sublette County, Wyoming*, available at http://www.epa.gov/cgi-bin/broker?msaorcountyName=countycode&msaorcountyValue=56035&poll=44201&county=56035&msa=-1&sy=2011&flag=Y&_debug=2&_service=data&_program=dataprog.trend_tile_dm.sas, attached as Exhibit 45; see also Wendy Koch, *Wyoming’s Smog Exceeds Los Angeles’ Due to Gas Drilling*, USA Today, available at <http://content.usatoday.com/communities/greenhouse/post/2011/03/wyomings-smog-exceeds-los-angeles-due-to-gas-drilling/1>, attached as Exhibit 46.

¹¹³ See, e.g., 2011 DEQ Ozone Advisories, Pinedale Online! (Mar. 17, 2011), <http://www.pinedaleonline.com/news/2011/03/OzoneCalendar.htm> (documenting ten ozone advisories in February and March 2011), attached as Exhibit 47; Wyoming Department of Environmental Quality, Ozone Advisory for Monday, Feb. 28, Pinedale Online! (Feb. 27, 2011), <http://www.pinedaleonline.com/news/2011/02/OzoneAdvisoryforMond.htm>, attached as Exhibit 48.

Ozone problems are mounting in other Rocky Mountain states as well. Northeastern Utah recorded unprecedented ozone levels in the Uintah Basin in 2010 and 2011. In the first three months of 2010—which was the first time that winter ozone was monitored in the region—air quality monitors measured more than 68 exceedances of the federal health standard. On three of these days, the levels were almost twice the federal standard.¹¹⁴ Between January and March 2011, there were 24 days where the National Ambient Air Quality Standard (NAAQS) for ozone were exceeded in the area. Again, ozone pollution levels climbed to nearly twice the federal standard.¹¹⁵ The Bureau of Land Management (BLM) has identified the multitude of oil and gas wells in the region as the primary cause of the ozone pollution.¹¹⁶

Rampant oil and gas development in Colorado and New Mexico is also leading to high levels of VOCs and NO_x. In 2008, the Colorado Department of Public Health and Environment concluded that the smog-forming emissions from oil and gas operations exceed vehicle emissions for the entire state.¹¹⁷ Moreover, significant additional drilling has occurred since 2008. Colorado is now home to more than 46,000 wells.¹¹⁸ There is also significant development in the San Juan Basin in southeastern Colorado and northwestern New Mexico, with approximately 35,000 wells in the Basin. As a result of this development and several coal-fired power plants in the vicinity, the Basin suffers from serious ozone pollution.¹¹⁹ This pollution is taking a toll on residents of San Juan County. The New Mexico Department of Public Health has documented increased emergency room visits associated with high ozone levels in the County.¹²⁰

VOC and NO_x emissions from oil and gas development are also harming air quality in national parks and wilderness areas. Researchers have determined that numerous “Class I areas” – a designation reserved for national parks, wilderness areas, and other

¹¹⁴ Scott Streater, *Air Quality Concerns May Dictate Uintah Basin's Natural Gas Drilling Future*, N.Y. TIMES, Oct. 1, 2010, available at <http://www.nytimes.com/gwire/2010/10/01/01greenwire-air-quality-concerns-may-dictate-uintah-basins-30342.html>, attached as Exhibit 49.

¹¹⁵ See EPA, AirExplorer, Query Concentrations (Ozone, Uintah County, 2011), available through the <http://www.epa.gov/airexplorer/> website and attached as Exhibit 50.

¹¹⁶ BLM, *GASCO Energy Inc. Uinta Basin Natural Gas Development Draft Environmental Impact Statement* (“GASCO DEIS”), at 3-13, available at http://www.blm.gov/ut/st/en/fo/vernal/planning/nepa/_gasco_energy_eis.html, attached as Exhibit 51.

¹¹⁷ Colo. Dept. of Public Health & Env't, Air Pollution Control Division, Oil and Gas Emission Sources, *Presentation for the Air Quality Control Commission Retreat*, at 3-4 (May 15, 2008), attached as Exhibit 52.

¹¹⁸ Colorado Oil & Gas Conservation Commission, *Colorado Weekly & Monthly Oil and Gas Statistics*, at 12 (Nov. 7, 2011), available at <http://cogcc.state.co.us/> (library—statistics—weekly/monthly well activity), attached as Exhibit 53.

¹¹⁹ See *Four Corners Air Quality Task Force Report of Mitigation Options*, at vii (Nov. 1, 2007), available at <http://www.nmenv.state.nm.us/aqb/4C/TaskForceReport.html>, attached as Exhibit 54.

¹²⁰ Myers *et al.*, *The Association Between Ambient Air Quality Ozone Levels and Medical Visits for Asthma in San Juan County* (Aug. 2007), available at <http://www.nmenv.state.nm.us/aqb/4c/Documents/SanJuanAsthmaDocBW.pdf>, attached as Exhibit 55.

such lands¹²¹ – are likely to be impacted by increased ozone pollution as a result of oil and gas development in the Rocky Mountain region. Affected areas include Mesa Verde National Park and Weminuche Wilderness Area in Colorado and San Pedro Parks Wilderness Area, Bandelier Wilderness Area, Pecos Wilderness Area, and Wheeler Peak Wilderness Area in New Mexico.¹²² These areas are all near concentrated oil and gas development in the San Juan Basin.¹²³

As oil and gas development moves into new areas, particularly as a result of the boom in development of shale resources, ozone problems are likely to follow. For example, regional air quality models predict that gas development in the Haynesville shale will increase ozone pollution in northeast Texas and northwest Louisiana and may lead to violations of ozone NAAQS.¹²⁴

Moreover, VOCs are not simply ozone precursors. They are also co-emitted with a stew “hazardous air pollutants” (HAPs) including benzene. HAPs, by definition, are toxic and also may be carcinogenic. High levels of carcinogens, including benzene compounds, are associated with gas production sites. Unsurprisingly, recent risk assessments from Colorado document elevated health risks for residents living near gas wells.¹²⁵ Indeed, levels of benzene and other toxics near wells in rural Colorado were “higher than levels measured at 27 out of 37 EPA air toxics monitoring sites ... including urban sites” in major industrial areas.”¹²⁶ These pollution levels are even more concerning than these high concentrations would suggest because several of the toxics emitted by gas operations are endocrine disruptors, which are compounds known to harm human health by acting on the endocrine system even at very low doses; some such compounds may, in fact, be especially dangerous specifically at the low, chronic, doses one would expect near gas operations.¹²⁷

Sulfur dioxide: Oil and gas production also emits sulfur dioxide, primarily from natural gas processing plants.¹²⁸ Sulfur dioxide is released as part of the sweetening process,

¹²¹ See 42 U.S.C. § 7472(a).

¹²² Rodriguez et al., *Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States*, 59 *Journal of the Air and Waste Management Association* 1111 (Sept. 2009), available at [http://www.wrapair.org/forums/amc/meetings/091111 Nox/Rodriguez et al OandG Impacts JAWMA9 09.pdf](http://www.wrapair.org/forums/amc/meetings/091111%20Nox/Rodriguez%20et%20al%20OandG%20Impacts%20JAWMA9%2009.pdf), attached as Exhibit 56.

¹²³ *Id.* at 1112.

¹²⁴ See Kembball-Cook et al., *Ozone Impacts of Natural Gas development in the Haynesville Shale* 44 *Environ. Sci. Technol.* 9357, 9362 (2010), attached as Exhibit 57.

¹²⁵ McKenzie, *supra* n.94.

¹²⁶ *Id.* at 5.

¹²⁷ See L. Vandenberg et al., *Hormones and Endocrine-Disrupting Chemicals: Low-Dose Effects and Nonmonotonic Dose Responses*, *Endocrine Disruption Review* (2012), attached as Exhibit 58.

¹²⁸ 76 Fed. Reg., *supra* n.96, at 52,756.

which removes hydrogen sulfide from the gas.¹²⁹ Sulfur dioxide is also created when gas containing hydrogen sulfide (discussed below) is combusted in boilers or heaters.¹³⁰

Hydrogen sulfide: Some natural gas contains hydrogen sulfide. Gas containing hydrogen sulfide above a specific threshold is classified as “sour gas.”¹³¹ According to EPA, there are 14 major areas in the U.S., found in 20 different states, where natural gas tends to be sour.¹³² All told, between 15 and 20% of the natural gas in the U.S. may contain hydrogen sulfide.¹³³

Given the large amount of drilling in areas with sour gas, EPA has concluded that the potential for hydrogen sulfide emissions from the oil and gas industry is “significant.”¹³⁴ Hydrogen sulfide may be emitted during all stages of development, including exploration, extraction, treatment and storage, transportation, and refining.¹³⁵ For example, hydrogen sulfide is emitted as a result of leaks from processing systems and from wellheads in sour gas fields.¹³⁶

Hydrogen sulfide emissions from the oil and gas industry are concerning because this pollutant may be harmful even at low concentrations.¹³⁷ Hydrogen sulfide is an air pollutant with toxic properties that smells like rotten eggs and can lead to neurological impairment or death. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.¹³⁸ Although hydrogen sulfide was originally included in the Clean Air Act’s list of hazardous air pollutants, it was removed with industry support.¹³⁹

¹²⁹ 2011 TSD, *supra* n.90, at 3-3 to 3-5.

¹³⁰ 76 Fed. Reg., *supra* n.96, at 52,756.

¹³¹ *Id.* at 52,756. Gas is considered “sour” if hydrogen sulfide concentration is greater than 0.25 grain per 100 standard cubic feet, along with the presence of carbon dioxide. *Id.*

¹³² EPA, Office of Air Quality Planning and Standards, *Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas* (EPA-453/R-93-045), at ii (1993) (hereinafter “EPA Hydrogen Sulfide Report”), attached as Exhibit 59.

¹³³ Lana Skrtic, *Hydrogen Sulfide, Oil and Gas, and People’s Health* (“Skrtic Report”), at 6 (May 2006), available at http://www.earthworksaction.org/pubs/hydrogensulfide_oilgas_health.pdf, attached as Exhibit 60.

¹³⁴ EPA Hydrogen Sulfide Report, *supra* n. 132, at III-35.

¹³⁵ *Id.* at ii.

¹³⁶ 2011 TSD, *supra* n.90, at 2-3.

¹³⁷ See James Collins & David Lewis, Report to CARB, *Hydrogen Sulfide: Evaluation of Current California Air Quality Standards with Respect to Protections of Children* (2000), available at <http://oehha.ca.gov/air/pdf/oehhah2s.pdf>, attached as Exhibit 61.

¹³⁸ EPA Hydrogen Sulfide Report, *supra* n. 132, at ii.

¹³⁹ See Pub. L. 102-187 (Dec. 4, 1991). We do not concede that this removal was appropriate. Hydrogen sulfide meets section 112 of the Clean Air Act’s standards for listing as a hazardous air pollutant and should be regulated accordingly.

Although direct monitoring of hydrogen sulfide around oil and gas sources is limited, there is evidence that these emissions may be substantial, and have a serious impact on people's health. For example, North Dakota reported 3,300 violations of an odor-based hydrogen sulfide standard around drilling wells.¹⁴⁰ People in northwest New Mexico and western Colorado living near gas wells have long complained of strong odors, including but not limited to hydrogen sulfide's distinctive rotten egg smell. Residents have also experienced nose, throat and eye irritation, headaches, nose bleeds, and dizziness.¹⁴¹ An air sample taken by a community monitor at one family's home in western Colorado in January 2011 contained levels of hydrogen sulfide concentrations 185 times higher than safe levels.¹⁴²

Particulate Matter (PM): The oil and gas industry is a major source of PM pollution. This pollution is generated by heavy equipment used to move and level earth during well pad and road construction. Vehicles also generate fugitive dust by traveling on access roads during drilling, completion, and production activities.¹⁴³ Diesel engines used in drilling rigs and at compressor stations are also large sources of fine PM/diesel soot emissions. VOCs are also a precursor to formation of PM_{2.5}.¹⁴⁴

PM emissions from the oil and gas industry are leading to significant pollution problems. For example, monitors in Uintah County and Duchesne County, Utah have repeatedly measured wintertime PM_{2.5} concentrations above federal standards.¹⁴⁵ These elevated levels of PM_{2.5} have been linked to oil and gas activities in the Uinta Basin.¹⁴⁶ Modeling also shows that road traffic associated with energy development is pushing PM₁₀ levels very close to violating NAAQS standards.¹⁴⁷

EPA's Air Rules Will Not Fully Address These Air Pollution Problems

Although EPA's recently finalized new source performance standards and standards for hazardous air pollutants¹⁴⁸ do reduce some of these pollution problems, they will not solve them. First, the rules do not even address some pollutants, including NO_x, methane, and hydrogen sulfide, so any reductions of these pollutants occur only as co-

¹⁴⁰ EPA Hydrogen Sulfide Report, *supra* n. 132, at III-35.

¹⁴¹ See Global Community Monitor, *Gassed! Citizen Investigation of Toxic Air Pollution from Natural Gas Development*, at 11-14 (2011), attached as Exhibit 62.

¹⁴² *Id.* at 21.

¹⁴³ See BLM, GASCO Energy Inc. Uinta Basin Natural Gas Development Project Draft Environmental Impact Statement, at App. J at 2 (Oct. 2010) ("GASCO DEIS").

¹⁴⁴ O&G NSPS RIA, *supra* n.45, at 4-18.

¹⁴⁵ GASCO DEIS, *supra* n.143, at 3-12.

¹⁴⁶ West Tavaputs FEIS, *supra* n.61, at 3-20.

¹⁴⁷ See GASCO DEIS, *supra* n.143, at 4-27.

¹⁴⁸ See EPA, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants, 77 Fed. Reg. 49,490 (Aug. 16, 2012), available at <http://www.gpo.gov/fdsys/pkg/FR-2012-08-16/pdf/2012-16806.pdf>.

benefits of the VOC reductions that the rules require.¹⁴⁹ Second, the rules do not control emissions from most transmission infrastructure.¹⁵⁰ Third, existing sources of air pollution are not controlled for any pollutant, meaning that increased use of existing infrastructure will produce emissions uncontrolled by the rules. Fourth, without full enforcement, the rules will not reduce emissions completely. Fifth, the rules will not address important emissions effects of LNG in particular, including LNG exports' tendency to increase the use of coal power. Thus, though DOE/FE might work with EPA to fully understand the emissions levels likely after the rules are fully implemented, it may not rely upon the EPA rules to avoid weighing and disclosing these impacts.

Pangea Itself Will Induce Significant Production-related Air Emissions

As we have discussed above, Pangea proposes to export about 398.5 bcf per year of natural gas, or approximately 1.09 bcf/d, and will demand an additional 10% of this gas for operation of on-site equipment. Thus, Pangea's proposal amounts to 438.35 of new gas demand. The EIA predict that about 63% of this export will come from new production.

EPA conversion factors allow us to estimate the emissions impacts of this new production. EPA's current greenhouse gas inventory implies that about 2.4% of gross gas production leaks to the atmosphere in one way or another.¹⁵¹ More recent work by National Oceanic and Atmospheric Administration ("NOAA") scientists based on direct measurement at gas fields, again suggests that this leak rate may be actually between 4.8% and 9%, at least in some fields.¹⁵² These leak rates, and EPA conversion factors between the typical volumes of methane, VOC, and HAP in natural gas,¹⁵³ make it possible to calculate the potential impact of increasing gas production in the way that LNG export would require.

The table below uses these conversion factors to calculate the emissions associated with producing 276.2 bcf/year of gas, the likely inducement specifically attributable to Pangea. We calculate for a 1% leak rate (which is below the current value, but is included as a conservative case to reflect successful air pollution controls more extensive than those which EPA has promulgated), the current EPA estimated rate of

¹⁴⁹ See *id.* at 49,513-14.

¹⁵⁰ See, e.g., *id.* at 49,523.

¹⁵¹ Alvarez *et al.*, *Greater focus needed on methane leakage from natural gas infrastructure*, Proceedings of the National Academy of Science (Apr. 2012) at 1, attached as Exhibit 63.

¹⁵² See G. Petron *et al.*, *Hydrocarbon emissions characterization in the Colorado Front*, *supra* n.91; J. Tollefson, *Methane leaks erode green credentials of natural gas*, *supra* n.93.

¹⁵³ See 2011 TSD, *supra* n.90, at Table 4.2. EPA calculated average composition factors for gas from well completions. These estimates, which are based on a range of national data are robust, but necessarily imprecise for particular fields and points along the line from wellhead to LNG terminal. Nonetheless, they provide a beginning point for quantitative work. EPA's conversions are: 0.0208 tons of methane per mcf of gas; 0.1459 lb VOC per lb methane; and 0.0106 lb HAP per lb methane.

2.4%, and the higher leak rates the NOAA studies suggest, generating results for methane, VOC, and HAP.¹⁵⁴

Table 1: Emissions Associated with Production of 276.2 bcf/y of Natural Gas

Leak Rate	Methane (tons)	VOC (tons)	HAP (tons)
1%	57,450	8,382	609
2.40%	137,879	20,117	1,462
4.80%	275,758	40,233	2,923
9%	517,046	75,437	5,481

Thus, Pangea, alone, would be responsible for tens of thousands of tons of increased air pollution. Notably, the threshold for major source permitting under the Clean Air Act is generally just tens of tons of pollution; for greenhouse gases, it is generally 75,000 tons. Pangea would thus greatly increase air pollution in the regions from which it draws its gas, imperiling public health and the global climate.

ii. Gas Production Disrupts Landscapes and Habitats

Increased oil and gas production will transform the landscape of regions overlying shale gas plays, bringing industrialization to previously rural landscapes and significantly affecting ecosystems, plants, and animals. These impacts are large and difficult to manage.

Land use disturbance associated with gas development impacts plants and animals through direct habitat loss, where land is cleared for gas uses, and indirect habitat loss, where land adjacent to direct losses loses some of its important characteristics.

Regarding direct losses, land is lost through development of well pads, roads, pipeline corridors, corridors for seismic testing, and other infrastructure. The Nature Conservancy (TNC) estimated that in Pennsylvania, “[w]ell pads occupy 3.1 acres on average while the associated infrastructure (roads, water impoundments, pipelines) takes up an additional 5.7 acres, or a total of nearly 9 acres per well pad.”¹⁵⁵ New York’s Department of Environmental Conservation reached similar estimates.¹⁵⁶ After initial

¹⁵⁴ These figures were calculated by multiplying the volume of gas to be exported (in bcf) by 1,000,000 to convert to mcf, and then by 63% to generate new production volumes. The new production volumes of gas were, in turn, multiplied by the relevant EPA conversion factors to generate tonnages of the relevant pollutants. These results are approximations: Although we reported the arithmetic results of this calculation, of course only the first few significant figures of each value should be the focus.

¹⁵⁵ TNC, Pennsylvania Energy Impacts Assessment, Report 1: Marcellus Shale Natural Gas and Wind 10, 18 (2010), attached as Exhibit 64.

¹⁵⁶ N.Y. Dep’t of Env’tl. Conservation, Revised Draft Supplemental General Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, 5-5 (2011) (“NY RDSGEIS”), available at <http://www.dec.ny.gov/energy/75370.html>.

drilling is completed the well pad is partially restored, but 1 to 3 acres of the well pad will remain disturbed through the life of the wells, estimated to be 20 to 40 years.¹⁵⁷ Associated infrastructure such as roads and corridors will likewise remain disturbed. Because these disturbances involve clearing and grading of the land, directly disturbed land is no longer suitable as habitat.¹⁵⁸

Indirect losses occur on land that is not directly disturbed, but where habitat characteristics are affected by direct disturbances. “Adjacent lands can also be impacted, even if they are not directly cleared. This is most notable in forest settings where clearings fragment contiguous forest patches, create new edges, and change habitat conditions for sensitive wildlife and plant species that depend on “interior” forest conditions.”¹⁵⁹ “Research has shown measureable impacts often extend at least 330 feet (100 meters) into forest adjacent to an edge.”¹⁶⁰

TNC’s study of the impacts of gas extraction in Pennsylvania is particularly telling. TNC mapped projected wells across the state, considering how the wells and their associated infrastructure, including roads and pipelines, interacted with the landscape. TNC’s conclusions make for grim reading. It concluded:

- About 60,000 new Marcellus wells are projected by 2030 in Pennsylvania with a range of 6,000 to 15,000 well pads, depending on the number of wells per pad;
- Wells are likely to be developed in at least 30 counties, with the greatest number concentrated in 15 southwestern, north central, and northeastern counties;
- Nearly two thirds of well pads are projected to be in forest areas, with forest clearing projected to range between 34,000 and 83,000 acres depending on the number of number of well pads that are developed. An additional range of 80,000 to 200,000 acres of forest interior habitat impacts are projected due to new forest edges created by well pads and associated infrastructure (roads, water impoundments);
- On a statewide basis, the projected forest clearing from well pad development would affect less than one percent of the state’s forests, but forest clearing and fragmentation could be much more pronounced in areas with intensive Marcellus development;

¹⁵⁷ *Id.* at 6-13.

¹⁵⁸ *Id.* at 6-68.

¹⁵⁹ Pennsylvania Energy Impacts Assessment, *supra* n.155, at 10.

¹⁶⁰ NY RDSGEIS, *supra* n.156, at 6-75.

- Approximately one third of Pennsylvania’s largest forest patches (>5,000 acres) are projected to have a range of between 1 and 17 well pads in the medium scenario;
- Impacts on forest interior breeding bird habitats vary with the range and population densities of the species. The widely-distributed scarlet tanager would see relatively modest impacts to its statewide population while black-throated blue warblers, with a Pennsylvania range that largely overlaps with Marcellus development area, could see more significant population impacts;
- Watersheds with healthy eastern brook trout populations substantially overlap with projected Marcellus development sites. The state’s watersheds ranked as “intact” by the Eastern Brook Trout Joint Venture are concentrated in north central Pennsylvania, where most of these small watersheds are projected to have between two and three dozen well pads;
- Nearly a third of the species tracked by the Pennsylvania Natural Heritage Program are found in areas projected to have a high probability of Marcellus well development, with 132 considered to be globally rare or critically endangered or imperiled in Pennsylvania. Several of these species have all or most of their known populations in Pennsylvania in high probability Marcellus gas development areas.
- Marcellus gas development is projected to be extensive across Pennsylvania’s 4.5 million acres of public lands, including State Parks, State Forests, and State Game Lands. Just over 10 percent of these lands are legally protected from surface development.¹⁶¹

Increased gas production will exacerbate these problems, which is bad news for the state’s lands and wildlife and the hunting, angling, tourism, and forestry industries that depend on them. Although TNC adds that impacts could be reduced with proper planning,¹⁶² more development makes mitigation more difficult. Indeed, the Pennsylvania Department of Conservation and Natural Resources recently concluded that “zero” remaining acres of the state forests are suitable for leasing with surface disturbing activities, or the forests will be significantly degraded.¹⁶³

These land disturbance effects will harm rural economies and decrease property values, as major gas infrastructure transforms and distorts the existing landscape. They will also

¹⁶¹ Pennsylvania Energy Impacts Assessment, *supra* n.155, at 29.

¹⁶² *See id.*

¹⁶³ Penn. Dep’t of Conservation and Natural Resources, Impacts of Leasing Additional State Forest for Natural Gas Development (2011), attached as Exhibit 65.

harm endangered species in regions where production would increase in response to Pangea's exports. Harm to these species and their habitat is inconsistent with the profound public interest in land and species conservation, as expressed in the Endangered Species Act and similar statutes.

iii. Gas Production Poses Risks to Ground and Surface Water

As noted above, most of the increased production that would result from Pangea's proposal will likely be from shale and other unconventional gas sources, and producing gas from these sources requires hydraulic fracturing, or fracking.¹⁶⁴ Hydraulic fracturing involves injecting a base fluid (typically water),¹⁶⁵ sand or other proppant, and various fracturing chemicals into the gas-bearing formation at high pressures to fracture the rock and release additional gas. Each step of this process presents a risk to water resources. Withdrawal of the water may overtax the water source. Fracking itself may contaminate groundwater with either chemicals added to the fracturing fluid or with naturally occurring chemicals mobilized by fracking. After the well is fracked, some water will return to the surface, composed of both fracturing fluid and naturally occurring "formation" water. This water, together with drilling muds and drill cuttings, must be disposed of without further endangering water resources.

Water Withdrawals

Fracking requires large quantities of water. The precise amount of water varies by the shale formation being fracked. The amount of water varies by well and by formation. For example, estimates of water needed to frack a Marcellus Shale wells range from 4.2 to over 7.2 million gallons.¹⁶⁶ In the Gulf States' shale formations (Barnett, Haynesville, Bossier, and Eagle Ford), fracking a single well requires from 1 to over 13 million gallons of water, with averages between 4 and 8 million gallons.¹⁶⁷ Fresh water constitutes 80% to 90% of the total water used to frack a well even where operators recycle "flowback"

¹⁶⁴ See DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.89, at 8.

¹⁶⁵ The majority of hydraulic fracturing operations are conducted with a water-based fracturing fluid.

Fracking may also be conducted with oil or synthetic-oil based fluid, with foam, or with gas.

¹⁶⁶ TNC, Pennsylvania Energy Impacts Assessment, *supra* n.155, at 10, 18; *accord* NY RDSGEIS, *supra* n.156, at 6-10 ("Between July 2008 and February 2011, average water usage for high-volume hydraulic fracturing within the Susquehanna River Basin in Pennsylvania was 4.2 million gallons per well, based on data for 553 wells."). Other estimates suggest that as much as 7.2 million gallons of frack fluid may be used in a 4000 foot well bore. NRDC, *et al.*, *Comment on NY RDSGEIS on the Oil, Gas and Solution Mining Regulatory Program* (Jan. 11, 2012) (Attachment 2, Report of Tom Myers, at 10), attached as Exhibit 66 ("Comment on NY RDSGEIS").

¹⁶⁷ Jean-Philippe Nicot, *et al.*, *Draft Report – Current and Projected Water Use in the Texas Mining and Oil and Gas Industry*, 52-54 (Feb. 2011) (water use from 1 to over 13 million gallons), attached as Exhibit 67; Jean-Philippe Nicot, *et al.*, *Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report* 11-14 (Sept. 2012) (updated data presented as averages), attached as Exhibit 68. DOE's Shale Gas Subcommittee generally states that nationwide, fracking an individual well requires between 1 and 5 million gallons of water. DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.89, at 19.

water from the fracking of previous wells for use in drilling the current one.¹⁶⁸ Many wells are fractured multiple times over their productive life.

Water withdrawals can drastically impact aquatic ecosystems and human communities. Reductions in instream flow negatively affect aquatic species by changing flow depth and velocity, raising water temperature, changing oxygen content, and altering streambed morphology.¹⁶⁹ Even when flow reductions are not themselves problematic, the intake structures can harm aquatic organisms.¹⁷⁰ Where water is withdrawn from aquifers, rather than surface sources, withdrawal may cause permanent depletion of the source. This risk is even more prevalent with withdrawals for fracking than it is for other withdrawals, because fracking is a consumptive use. Fluid injected during the fracking process is (barring accident) deposited below freshwater aquifers and into sealed formations.¹⁷¹ Thus, the water withdrawn from the aquifer will be used in a way that provides no opportunity to percolate back down to the aquifer and recharge it.

Groundwater Contamination

Fracturing poses a serious risk of groundwater contamination. Contaminants include chemicals added to the fracturing fluid and naturally occurring chemicals that are mobilized from deeper formations to groundwater via the fracking process. Contamination may occur through several methods, including where the well casing fails or where the fractures created through drilling intersect an existing, poorly sealed well. Although information on groundwater contamination is incomplete, the available research indicates that contamination has already occurred on multiple occasions.

One category of potential contaminants includes chemicals added to the drilling mud and fracturing fluid. The fluid used for slickwater fracturing is typically comprised of more than 98% fresh water and sand, with chemical additives comprising 2% or less of the fluid.¹⁷² Chemicals are added as solvents, surfactants, friction reducers, gelling agents, bactericides, and for other purposes.¹⁷³ New York recently identified 322 unique ingredients used in fluid additives, recognizing that this constituted a partial list.¹⁷⁴ These chemicals include petroleum distillates; aromatic hydrocarbons; glycols; glycol ethers; alcohols and aldehydes; amides; amines; organic acids, salts, esters and related

¹⁶⁸ NY RDSGEIS, *supra* n.156, at 6-13; *accord* Nicot 2012, *supra* n.167, at 54.

¹⁶⁹ NY RDSGEIS, *supra* n.156, at 6-3 to 6-4, *see also* Maya Weltman-Fahs, Jason M. Taylor, *Hydraulic Fracturing and Brook Trout Habitat in the Marcellus Shale Region: Potential Impacts and Research Needs*, 38 *Fisheries* 4, 6-7 (Jan. 2013), attached as Exhibit 69.

¹⁷⁰ NY RDSGEIS, *supra* n.156, at 6-4.

¹⁷¹ *Id.* at 6-5; First 90-Day Report, *supra* n.89, at 19 (“[I]n some regions and localities there are significant concerns about consumptive water use for shale gas development.”).

¹⁷² NY RDSGEIS, *supra* n.156, at 5-40.

¹⁷³ *Id.* at 5-49.

¹⁷⁴ *Id.* at 5-41.

chemicals; microbicides; and others. Many of these chemicals present health risks.¹⁷⁵ Of particular note is the use of diesel, which the DOE Subcommittee has singled out for its harmful effects and recommended be banned from use as a fracturing fluid additive.¹⁷⁶ The minority staff of the House Committee on Energy and Commerce has determined that, despite diesel's risks, between 2005 and 2009 "oil and gas service companies injected 32.2 million gallons of diesel fuel or hydraulic fracturing fluids containing diesel fuel in wells in 19 states."¹⁷⁷

Contamination may also result from chemicals naturally occurring in the formation. Flowback and produced water "may include brine, gases (e.g. methane, ethane), trace metals, naturally occurring radioactive elements (e.g. radium, uranium) and organic compounds."¹⁷⁸ For example, mercury naturally occurring in the formation becomes mixed in with water-based drilling muds, resulting in up to 5 pounds of mercury in the mud per well drilled in the Marcellus region.¹⁷⁹

There are several vectors by which these chemicals can reach groundwater supplies. Perhaps the most common or significant are inadequacies in the casing of the vertical well bore.¹⁸⁰ The well bore inevitably passes through geological strata containing groundwater, and therefore provides a conduit by which chemicals injected into the well or traveling from the target formation to the surface may reach groundwater. The well casing isolates the groundwater from intermediate strata and the target formation. This casing must be strong enough to withstand the pressures of the fracturing process—the very purpose of which is to shatter rock. Multiple layers of steel casing must be used, each pressure tested before use, then centered within the well bore. Each layer of casing must be cemented, with careful testing to ensure the integrity of the cementing.¹⁸¹

Separate from casing failure, contamination may occur when the zone of fractured rock intersects an abandoned and poorly sealed well or natural conduit in the rock.¹⁸² One

¹⁷⁵ *Id.* at 5-75 to 5-78.

¹⁷⁶ DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.89, at 25.

¹⁷⁷ Natural Resources Defense Council, Earthjustice, and Sierra Club, Comments [to EPA] on Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels 3, (June 29, 2011) (quoting Letter from Reps. Waxman, Markey, and DeGette to EPA Administrator Lisa Jackson 1 (Jan. 31, 2001)) ("Comment on Diesel Guidance"), attached as Exhibit 70.

¹⁷⁸ Shale Gas Production Subcommittee First 90-Day Report, *supra* n.89, at 21; *see also* Comment on NY RDSGEIS, *supra* n.166, attachment 3, Report of Glen Miller, at 2.

¹⁷⁹ Comment on NY RDSGEIS, *supra* n.166, attachment 1, Report of Susan Harvey, at 92.

¹⁸⁰ DOE, Shale Gas Production Subcommittee First 90-Day Report, *supra* n.89, at 20.

¹⁸¹ Comment on Diesel Guidance, *supra* n.177, at 5-9.

¹⁸² Comment on NY RDSGEIS, *supra* n.166, attachment 3, Report of Tom Myers, at 12-15.

recent study concluded, on the basis of geologic modeling, that frack fluid may migrate from the hydraulic fracture zone to freshwater aquifers in less than ten years.¹⁸³

Available empirical data indicates that fracking has resulting in groundwater contamination in at least five documented instances. One study “documented the higher concentration of methane originating in shale gas deposits . . . into wells surrounding a producing shale production site in northern Pennsylvania.”¹⁸⁴ By tracking certain isotopes of methane, this study – which the DOE Subcommittee referred to as “a recent, credible, peer-reviewed study” determined that the methane originated in the shale deposit, rather than from a shallower source.¹⁸⁵ Two other reports “have documented or suggested the movement of fracking fluid from the target formation to water wells linked to fracking in wells.”¹⁸⁶ “Thyne (2008)[¹⁸⁷] had found bromide in wells 100s of feet above the fracked zone. The EPA (1987)[¹⁸⁸] documented fracking fluid moving into a 416-foot deep water well in West Virginia; the gas well was less than 1000 feet horizontally from the water well, but the report does not indicate the gas-bearing formation.”¹⁸⁹

More recently, EPA has investigated groundwater contamination in Pavillion, Wyoming and Dimock, Pennsylvania. In the Pavillion investigation, EPA’s draft report concludes that “when considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing.”¹⁹⁰ EPA tested water from wells extending to various depths within the range of local groundwater. At the deeper tested wells, EPA discovered inorganics (potassium, chloride), synthetic organic (isopropanol, glycols, and tert-butyl alcohol), and organics (BTEX, gasoline and

¹⁸³ Tom Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers* (Apr. 17, 2012), attached as Exhibit 71.

¹⁸⁴ DOE, Shale Gas Production Subcommittee First 90-Day Report at 20 (citing Stephen G. Osborn, Avner Vengosh, Nathaniel R. Warner, and Robert B. Jackson, *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*, Proceedings of the National Academy of Science, 108, 8172-8176, (2011), attached as Exhibit 72).

¹⁸⁵ *Id.*

¹⁸⁶ Comment on NY RDSGEIS, *supra* n.166, attachment 3, Report of Tom Myers, at 13.

¹⁸⁷ Dr. Myers relied on Geoffrey Thyne, *Review of Phase II Hydrogeologic Study* (2008), prepared for Garfield County, Colorado, available at [http://cogcc.state.co.us/Library/Presentations/Glenwood_Spgs_HearingJuly_2009/\(1_A\)_ReviewofPhase-II-HydrogeologicStudy.pdf](http://cogcc.state.co.us/Library/Presentations/Glenwood_Spgs_HearingJuly_2009/(1_A)_ReviewofPhase-II-HydrogeologicStudy.pdf).

¹⁸⁸ Environmental Protection Agency, *Report to Congress, Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy*, vol. 1 (1987), available at nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20012D4P.txt, attached as Exhibit 73.

¹⁸⁹ Comment on NY RDSGEIS, *supra* n.166, attachment 3, Report of Tom Myers, at 13.

¹⁹⁰ EPA, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming, at xiii (2011), available at http://www.epa.gov/region8/superfund/wy/pavillion/EPA_ReportOnPavillion_Dec-8-2011.pdf, attached as Exhibit 74. EPA has not yet released a final version of this report, instead recently extending the public comment period to September 30, 2013. 78 Fed. Reg. 2396 (Jan. 11, 2013).

diesel range organics) at levels higher than expected.¹⁹¹ At shallower levels, EPA detected “high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons.”¹⁹² EPA determined that surface pits previously used for storage of drilling wastes and produced/flowback waters were a likely source of contamination for the shallower waters, and that fracturing likely explained the deeper contamination.¹⁹³ The U.S. Geological Survey, in cooperation with the Wyoming Department of Environmental Quality, also provided data regarding chemicals found in wells surrounding Pavillion.¹⁹⁴ Although the USGS did not provide analysis regarding the likely source of the contaminants found, an independent expert who reviewed the USGS and EPA data at the request of Sierra Club and other environmental groups concluded that the USGS data supports EPA’s findings.¹⁹⁵

EPA also identified elevated levels of hazardous substances in home water supplies near Dimock, Pennsylvania.¹⁹⁶ EPA’s initial assessment concluded that “a number of home wells in the Dimock area contain hazardous substances, some of which are not naturally found in the environment,” including arsenic, barium, bis(2(ethylhexyl)phthalate, glycol compounds, manganese, phenol, and sodium.¹⁹⁷ Arsenic, barium, and manganese were present in five home wells “at levels that could present a health concern.”¹⁹⁸ Many of these chemicals, including arsenic, barium, and manganese, are hazardous substances as defined under CERCLA section 101(14). See 42 U.S.C. § 9604(a); 40 C.F.R. § 302.4. EPA’s assessment was based in part on “Pennsylvania Department of Environmental Protection (PADEP) and Cabot Oil and Gas Corporation (Cabot) sampling information, consultation with an EPA toxicologist, the Agency for Toxic Substances and Disease Registry (ATSDR) Record of Activity (AROA), issued, 12/28/11, and [a] recent EPA well survey effort.”¹⁹⁹ The PADEP information provided reason to believe that drilling

¹⁹¹ *Id.* at xii.

¹⁹² *Id.* at xi.

¹⁹³ *Id.* at xi, xiii.

¹⁹⁴ USGS, *Groundwater-Quality and Quality-Control Data for two Monitoring Wells near Pavillion, Wyoming, April and May 2012*, USGS Data Series 718 p.25 (2012), attached as Exhibit 75.

¹⁹⁵ Tom Myers, *Assessment of Groundwater Sampling Results Completed by the U.S. Geological Survey* (Sept. 30, 2012), attached as Exhibit 76. Another independent expert, Rob Jackson of Duke University, has stated that the USGS and EPA data is “suggestive” of fracking as the source of contamination. Jeff Tollefson, *Is Fracking Behind Contamination in Wyoming Groundwater?*, *Nature* (Oct. 4, 2012), attached as Exhibit 77. See also Tom Myers, *Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming* (April 30, 2012) (concluding that EPA’s initial study was well-supported), attached as Exhibit 78.

¹⁹⁶ EPA Region III, Action Memorandum - Request for Funding for a Removal Action at the Dimock Residential Groundwater Site (Jan. 19, 2012), available at <http://www.epaos.org/sites/7555/files/Dimock%20Action%20Memo%2001-19-12.PDF>, attached as Exhibit 79; EPA, *EPA Completes Drinking Water Sampling in Dimock, Pa.* (Jul. 25, 2012), attached as Exhibit 80.

¹⁹⁷ EPA Region III Action Memorandum, *supra* n.196 , at 1, 3-4.

¹⁹⁸ *EPA Completes Drinking Water Sampling in Dimock, Pa.*, *supra* n.196.

¹⁹⁹ EPA Region III Action Memorandum, *supra* n.196 , at 1.

activities in the area led to contamination of these water supplies. Drilling in the area began in 2008, and was conducted using the hazardous substances that have since been discovered in well water. Shortly thereafter methane contamination was detected in private well water. The drilling also caused several surface spills. Although EPA ultimately concluded that the five homes with potentially unsafe levels of hazardous substances had water treatment systems sufficient to mitigate the threat,²⁰⁰ the Dimock example indicates the potential for gas development to contaminate groundwater.

The serious groundwater contamination problems experienced at the Pavillion and Dimock sites demonstrate a possibility of contamination, and attendant human health risks. Such risks are not uncommon in gas field sites, and will be intensified by production for export. DOE/FE must account for these risks, as well, in its economic evaluation.

Waste Management

Fracturing produces a variety of liquid and solid wastes that must be managed and disposed of. These include the drilling mud used to lubricate the drilling process, the drill cuttings removed from the well bore, the “flowback” of fracturing fluid that returns to the surface in the days after fracking, and produced water that is produced over the life of the well (a mixture of water naturally occurring in the shale formation and lingering fracturing fluid). Because these wastes contain the same contaminants described in the preceding section, environmental hazards can arise from their management and ultimate disposal.

On site, drilling mud, drill cuttings, flowback and produced water are often stored in pits. Open pits can have harmful air emissions, can leach into shallow groundwater, and can fail and result in surface discharges. Many of these harms can be minimized by the use of seal tanks in a “closed loop” system.²⁰¹ Presently, only New Mexico mandates the use of closed loop waste management systems, and pits remain in use elsewhere.

Flowback and produced water must ultimately be disposed of offsite. Some of these fluids may be recycled and used in further fracturing operations, but even where a fluid recycling program is used, recycling leaves concentrated contaminants that must be disposed of. The most common methods of disposal are disposal in underground injection wells or through water treatment facilities leading to eventual surface discharge.

Underground injection wells present risks of groundwater contamination similar to those identified above for fracking itself. Gas production wastes are not categorized as

²⁰⁰ EPA Completes Drinking Water Sampling in Dimock, Pa., *supra* n.196.

²⁰¹ See, e.g., NY RDSGEIS, *supra* n.156, at 1-12.

hazardous under the Safe Drinking Water Act, 42 U.S.C. § 300f *et seq.*, and may be disposed of in Class II injection wells. Class II wells are brine wells, and the standards and safeguards in place for these wells were not designed with the contaminants found in fracking wastes in mind.²⁰²

Additionally, underground injection of fracking wastes appears to have induced earthquakes in several regions. For example, underground injection of fracking waste in Ohio has been correlated with earthquakes as high as 4.0 on the Richter scale.²⁰³ Underground injection may cause earthquakes by causing movement on existing fault lines: “Once fluid enters a preexisting fault, it can pressurize the rocks enough to move; the more stress placed on the rock formation, the more powerful the earthquake.”²⁰⁴ Underground injection is more likely than fracking to trigger large earthquakes via this mechanism “because more fluid is usually being pumped underground at a site for longer periods.”²⁰⁵ In light of the apparent induced seismicity, Ohio has put a moratorium on injection in the affected region. Similar associations between earthquakes and injection have occurred in Arkansas, Texas, Oklahoma and the United Kingdom.²⁰⁶ In light of these effects, Ohio and Arkansas have placed moratoriums on injection in the affected areas.²⁰⁷ The recently released abstract of a forthcoming United States Geological Survey study affirms the connection between disposal wells and earthquakes.²⁰⁸

As an alternative to underground injection, flowback and produced water is also sent to water treatment facilities, leading to eventual surface discharge. This presents a separate set of environmental hazards, because these facilities (particularly publicly owned treatment works) are not designed to handle the nontraditional pollutants found in fracking wastes. For example:

²⁰² See NRDC et al., Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy (Sept. 8, 2010), attached as Exhibit 81.

²⁰³ Columbia University, Lamont-Doherty Earth Observatory, Ohio Quakes Probably Triggered by Waste Disposal Well, Say Seismologists (Jan. 6, 2012), available at <http://www.ideo.columbia.edu/news-events/seismologists-link-ohio-earthquakes-waste-disposal-wells>, attached as Exhibit 82.

²⁰⁴ *Id.*

²⁰⁵ *Id.*

²⁰⁶ *Id.*; see also Alexis Flynn, Study Ties Fracking to Quakes in England, Wall Street Journal (Nov. 3, 2011), available at <http://online.wsj.com/article/SB10001424052970203804204577013771109580352.html>, attached as Exhibit 83.

²⁰⁷ Lamont-Doherty Earth Observatory; Arkansas Oil and Gas Commission, Class II Commercial Disposal Well or Class II Disposal Well Moratorium (Aug. 2, 2011), available at <http://www.aogc.state.ar.us/Hearing%20Orders/2011/July/180A-2-2011-07.pdf>, attached as Exhibit 84.

²⁰⁸ Ellsworth, W. L., et al., Are Seismicity Rate Changes in the Midcontinent Natural or Manmade?, Seismological Society of America, (April 2012), available at http://www2.seismosoc.org/FMPro?-db=Abstract_Submission_12&-recid=224&-format=%2Fmeetings%2F2012%2Fabstracts%2Fsessionabstractdetail.html&-lay=MtgList&-find, attached as Exhibit 85.

One serious problem with the proposed discharge (dilution) of fracture treatment wastewater via a municipal or privately owned treatment plant is the observed increases in trihalomethane (THM) concentrations in drinking water reported in the public media (Frazier and Murray, 2011), due to the presence of increased bromide concentrations. Bromide is more reactive than chloride in formation of trihalomethanes, and even though bromide concentrations are generally lower than chloride concentrations, the increased reactivity of bromide generates increased amounts of bromodichloromethane and dibromochloromethane (Chowdhury, et al., 2010). Continued violations of an 80microgram/L THM standard may ultimately require a drinking water treatment plant to convert from a standard and cost effective chlorination disinfection treatment to a more expensive chloramines process for water treatment. Although there are many factors affecting THM production in a specific water, simple (and cheap) dilution of fracture treatment water in a stream can result in a more expensive treatment for disinfection of drinking water. This transfer of costs to the public should not be permitted.²⁰⁹

Similarly, municipal treatment works typically to not treat for radioactivity, whereas produced water can have high levels of naturally occurring radioactive materials. In one examination of three samples of produced water, radioactivity (measured as gross alpha radiation) were found ranging from 18,000 pCi / L to 123,000 pCi/L, whereas the safe drinking water standard is 15 pCi/L.²¹⁰

3. Other Nationwide and Global Impacts

a. Price Increases

Natural gas exports will increase domestic gas prices. There is a broad consensus on this issue, which Pangea does not dispute. Pangea errs at the threshold, however, by arguing that the impacts from its exports should be considered in isolation. As we explain above, DOE/FE must consider the cumulative impacts of the pending export proposals.²¹¹

²⁰⁹ Comment on NY RDSGEIS, *supra* n.166, attachment 3, Report of Glen Miller, at 13.

²¹⁰ *Id.* at 4.

²¹¹ Of course, even the price impacts Pangea predicts for its own terminal are significant.

Putting this error aside, Pangea has failed to explain why its predictions are lower than EIA's, Pangea overstates the available shale gas supply, and Pangea offers irrelevant arguments regarding gas price volatility.

Pangea's Black and Veatch report does not explain why its predictions strongly diverge from EIA's. It appears that, even if Pangea's proposed exports were considered in isolation, the price impacts of these exports would be significantly higher than Black and Veatch predict. Neither the public nor DOE/FE can adequately compare the Black and Veatch figures with other models, however, because Pangea and Black and Veatch's descriptions of Black and Veatch's modeled scenarios are confusing if not self-contradictory, and because the full models are not provided.

Although Pangea's Black and Veatch report is dated December 2012, but makes no mention of EIA's January 2012 report on the price impacts of LNG exports. In light of any explanation from Pangea as to *why* DOE/FE should use Pangea's opaque private modeling instead of the more transparent predictions made by the neutral EIA, DOE/FE should use the publicly created forecasts.

It is difficult to understand the contours of the four scenarios modeled by Pangea's Black and Veatch Report. Pangea describes two export scenarios with and two without its own project. The "base case" Pangea uses is described as including exports from two already approved terminals that "add up to 2.5 Bcf/d of natural gas demand to other demand for natural gas in the U.S. domestic market." App at 30. The "high LNG export cases" adds "2.8 Bcf/d of natural gas demand associated with additional LNG exports from the Gulf Coast region over and above the demand included in the base case." App at 31. Pangea also purports to model the effect of adding 1.2 bcf/d of demand attributable to the Pangea project to each of these scenarios. *Id.* at 30-31. After providing this description, however, Pangea refers to the price impacts that "result from the addition of the [Pangea] Project plus an additional 4.1 Bcf/d of export-related demand," *id.* at 32, without explaining the source of the 4.1 figure. Examination of the attached Black and Veatch report, including the charts on pages 18-19 therein, does not clarify the situation: the Black and Veatch report suggests that the baseline scenario includes exports in excess of the 2.5 bcf/d that Pangea states are included, and the Black and Veatch Report provides no insight into the provenance of the 4.1 bcf/d figure.

Because it is unclear what Black and Veatch has modeled, it is difficult to compare its price forecasts with EIA's. Using the charts provided in the Black and Veatch report, it appears that the difference between Black and Veatch's base case and the high LNG exports + Pangea project case is approximately 4 bcf/d. App. at appx. A 19. Black and Veatch's forecasts for these two cases include a 6% Henry Hub price difference for the 2018 to 2027 period (with prices for the two scenarios at \$5.93 and \$6.3 per MMBtu). App. at appx. A 4. EIA's reference case, in contrast, predicted a 10 to 13% increase in Henry Hub prices attributable to 6 bcf/d of exports (against a baseline case in which no

North American LNG exports occurred).²¹² For the 12 bcf/d scenarios, EIA's reference case predicts 14 to 26% increases in Henry Hub prices.²¹³

On the available record, it would be arbitrary and capricious for DOE/FE to adopt Black and Veatch's model over that used by EIA. Because Pangea has not provided the details of this model, it is impossible for DOE/FE or the public to understand or criticize its analysis or underlying assumptions. DOE/FE cannot supplant the open and transparent analysis of its impartial sister agency with this "black box" assertion provided by the applicant itself.

Pangea separately overstates domestic shale gas supply. Although Pangea selectively uses some information from EIA's 2012 Annual Energy Outlook, Pangea rests on superseded 2011 estimates of recoverable shale gas supplies. App. at 23-34. Pangea cites two 2011 reports that estimate 637 in the U.S. and 750 in the lower 48, respectively. *Id.* The more recent 2012 Annual Energy Outlook cuts the estimates of shale gas to 482 tcf.²¹⁴ Because EIA has explained that the price impacts of exports are highly dependent on gas recovery and, by extension, the size of the domestic gas supply (with Pangea in apparent agreement), all forecasts must reflect the most recent estimates of gas supplies. Similarly, price impacts will depend on domestic demand, and EIA's most recent estimates thereof must be used in predicting price impacts.

Pangea invokes gas price volatility to downplay the effect of gas price increases and to argue that exports will benefit gas markets. Neither argument should be accepted. First, Pangea asserts that the price increases that it predicts as a direct result of its proposed project are less than the variability domestic gas markets already experience on a regular basis. App. at 33. A useful analogy is to climate and the weather: although global warming will involve temperature increases that appear small when compared to average variability in day-to-day temperature, even small but steady increases in the global average will have severe consequences. Pangea's argument about variability is thus irrelevant, because it has no bearing on what the consequences of price increases will be; as we explain below, even small increases in gas prices adversely affect domestic industry and consumers.

Pangea also asserts that the demand provided by exports will provide a needed decrease in domestic gas price volatility. App. at 34. Pangea has neither shown that exports will reduce volatility or that the public interest would be meaningfully served by reducing volatility. On the first issue, Pangea argues that, in essence, increased production for export will stabilize domestic prices because, in the event of a supply shock or demand spike, domestic consumers can out-bid would-be importers and use

²¹² EIA Export Study at table B1.

²¹³ *Id.*

²¹⁴ EIA, Annual Energy Outlook 2012, at 9, 13 (June 2012) (discussing this change), attached as Exhibit 86.

gas otherwise destined for export. A specific example Pangea contemplates is of a Fukushima-like event in the US that immediately and drastically increases the US need for gas. *Id.* Of course, Pangea ignores the converse possibility: once domestic gas supplies are connected to foreign markets, a shock elsewhere, such as the actual Fukushima event, would be felt in the previously-isolated domestic gas market. On the second issue, Pangea offers no argument as to why volatility in the present domestic gas market is at problematic levels; indeed, it appears that the boom in unconventional production has greatly stabilized domestic gas prices.

b. Changes in Domestic Power Production

Pangea's export proposal will further increase air pollution by increasing the amount of coal used for domestic electricity production. The EIA Export Study predicts that exports, by causing natural gas prices to rise, will drive more electricity generation to coal than to renewable energy. According to the EIA, the power sector will "primarily" respond to higher natural gas prices by shifting to coal-fired generation, and only secondarily to renewable sources.²¹⁵ Specifically, EIA predicts that 72 percent of the decrease in gas-fired electricity production will be replaced by coal-fired production, with increased liquid fuel consumption, increased renewable generation, and decreases in total consumption making up the remainder (8, 9, and 11 percent, respectively).²¹⁶

The shift from gas- to coal-fired electricity generation will increase emissions of both traditional air pollutants and greenhouse gases. Gas-fired power plants generate less than a third of the nitrogen oxides and one percent of the sulfur oxides that coal-fired plants generate.²¹⁷ Thus, the EIA Export Study demonstrates that exports will harm the local environment by causing the opposite shift here.²¹⁸

Coal-fired plants also release roughly twice the carbon dioxide combustion emissions as gas-fired plants, although, as discussed in the following section, some of this combustion advantage is offset by the greenhouse gas emissions resulting from gas

²¹⁵ EIA Export Study, *supra* n.29, at 6; *see also id.* at 17 ("[H]igher natural gas prices lead electric generators to burn more coal and less natural gas.").

²¹⁶ *Id.* at 18.

²¹⁷ EPA, Air Emissions, <http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html> (last visited Dec. 12, 2012), attached as Exhibit 87.

²¹⁸ The NERA report did not examine shifts within the domestic power sector in detail, and the NERA study authors acknowledge that EIA uses a more sophisticated model that is better able to predict electricity sector responses to gas prices. The NERA report explains that "EIA's NEMS model has a detailed bottom-up representation of the electricity sector, while the electricity sector in the NERA model is a nested CES function with limited technologies. This means that NEMS allows for switching from natural gas-based generation to other technology types easily, while the possibility of switching out of natural gas is more limited and controlled in the NERA model." NERA Study, *supra* n.32, at 207 (appx. D, figs. 176-78 and accompanying text). Thus, although the NERA study predicts a smaller electricity sector response to gas prices than did the EIA, *id.*, DOE/FE should rely on the more sophisticated EIA predictions.

production. Accordingly, the price increase and corresponding shift to coal-fired power generation risks increasing greenhouse gas pollution. The *EIA Export Study* concluded that under every scenario modeled, exports would produce a significant increase in domestic greenhouse gas emissions, as illustrated by the table below. As we explain in the following section, however, the comparative life-cycle emissions of natural gas and coal are uncertain. Before authorizing a fundamental change in domestic energy markets, DOE/FE should seek out or commission efforts to resolve this uncertainty.

Table 2: Cumulative CO₂ Emissions from 2015 to 2035 With Various Export Scenarios²¹⁹

Case	no added exports	low/slow	low/rapid	high/slow	high/rapid
Reference					
Cumulative carbon dioxide emissions	125,056	125,699	125,707	126,038	126,283
Change from baseline		643	651	982	1,227
Percentage change from baseline		0.5%	0.5%	0.8%	1.0%
High Shale EUR					
Cumulative carbon dioxide emissions	124,230	124,888	124,883	125,531	125,817
Change from baseline		658	653	1,301	1,587
Percentage change from baseline		0.5%	0.5%	1.0%	1.3%
Low Shale EUR					
Cumulative carbon dioxide emissions	125,162	125,606	125,556	125,497	125,670
Change from baseline		444	394	335	508
Percentage change from baseline		0.4%	0.3%	0.3%	0.4%
High Economic Growth					
Cumulative carbon dioxide emissions	131,675	131,862	132,016	131,957	132,095
Change from baseline		187	341	282	420
Percentage change from baseline		0.1%	0.3%	0.2%	0.3%

Source: U.S. Energy Information Administration, National Energy Modeling System, with emissions related to natural gas assumed to be consumed in the liquefaction process included.

The fact that gas exports will tend to favor coal as a fuel for domestic electrical generation has particularly important implications for national emissions control efforts. EPA has just released proposed carbon pollution standards for electricity generating units which set emissions levels based upon the performance of natural gas combined-cycle plants.²²⁰ EPA anticipates no notable compliance costs for the rule because it expects utilities to react to low gas prices, among other factors, by avoiding constructing expensive coal-fired plants.²²¹ If LNG exports move forward, however, gas prices will increase, making it more difficult and expensive to capture combustion-side carbon pollution reductions from fossil-fuel fired power plants. This interference with national

²¹⁹ From the *EIA Export Study*, *supra* n.29, at 19.

²²⁰ Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392 (Apr. 13, 2012).

²²¹ *See id.* at 22,430.

efforts to control global warming, which endangers public health and welfare,²²² is not in the public interest.

c. Effects on Global Greenhouse Gas Emissions

Although domestic substitution of coal for gas in response to exports will harm the public interest, DOE/FE must reject Pangea's unsupported assertion that the reverse holds true for countries that receive U.S. LNG. That is, Pangea argues that exports can provide an environmental benefit by helping receiving countries switch away from coal and oil as fossil fuels, reducing global greenhouse gas emissions. App. at 40. The available evidence indicates that such a benefit is unlikely. Pangea's argument is wrong for two reasons.

First, importing countries may not use LNG in place of coal or other dirty fuels. Pangea relies on a Brookings Institute report for the proposition that "natural gas in general" can displace carbon intensive fuels. App. at 40. The Brookings Institute, in turn, relies on data from the International Energy Agency (IEA). *Id.* But the IEA itself concludes that increased use of natural gas is unlikely to reduce global greenhouse gas emissions. The IEA's recent *Golden Rules for a Golden Age of Gas* report predicts that international trade in LNG and other measures to increase global availability of natural gas will lead many countries to use natural gas in place of wind, solar, or other renewables, displacing these more environmentally beneficial energy sources instead of displacing other fossil fuels, and that these countries may also increase their overall energy consumption beyond the level that would occur with exports.²²³ In the United States alone, the IEA expects the gas boom to result in a 10% reduction in renewables relative to a baseline world without increased gas use and trade.²²⁴ The IEA goes on to conclude that high levels of gas production and trade will produce "only a small net shift" in global greenhouse gas emissions, with atmospheric CO₂ levels stabilizing at over 650 ppm and global warming in excess of 3.5 degrees Celsius, "well above the widely accepted 2°C target."²²⁵ Thus, the IEA's modeling directly refutes Pangea's unsupported assertion that LNG exports are unlikely to "lead to increased carbon dioxide emissions due to displacement of nuclear and renewable energy." App. at 40. Another recent study, prepared by the Joint Institute for Strategic Energy Analysis (JISEA), also modeled power sector futures resulting from increasing U.S. reliance on natural gas.²²⁶ That

²²² See Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

²²³ International Energy Agency, *Golden Rules for a Golden Age of Gas*, Ch. 2 p. 91 (2012), available at http://www.iea.org/publications/freepublications/publication/WEO2012_GoldenRulesReport.pdf, attached as Exhibit 88.

²²⁴ *Id.* at 80.

²²⁵ *Id.*

²²⁶ Jeffrey Logan et al., Joint Inst. for Strategic Analysis, *Natural Gas and the Transformation of the U.S. Energy Sector* (2012) ("JISEA report"), available at <http://www.nrel.gov/docs/fy13osti/55538.pdf>, attached as Exhibit 89

study likewise found that, under baseline assumptions for future electricity demand and policy measures, “natural gas and coal swap positions compared to their historical levels,” with wind energy growing at a rate that represents “a significant reduction from deployment in recent years;” as a result, CO₂ emissions “do not begin to transition to a trajectory that many scientists believe is necessary to avoid dangerous impacts from climate change.”²²⁷

Second, even where importing countries do substitute gas for coal or fuel oil, this substitution is likely to cause little, if any, reduction in global greenhouse gas emissions. This is because LNG has life-cycle emissions that are significantly higher than other sources of natural gas. Liquefying natural gas is an energy intensive process. Additional energy is then consumed in the transportation of the gas, with attendant greenhouse gas emissions. Finally, the LNG must be regasified at the import terminal, often through the use of heat generated by the burning of yet more natural gas. These operations drastically increase the lifecycle greenhouse gas emissions of LNG, adding between 13.85 and 51.7 pounds of CO₂e per MMBtu.²²⁸

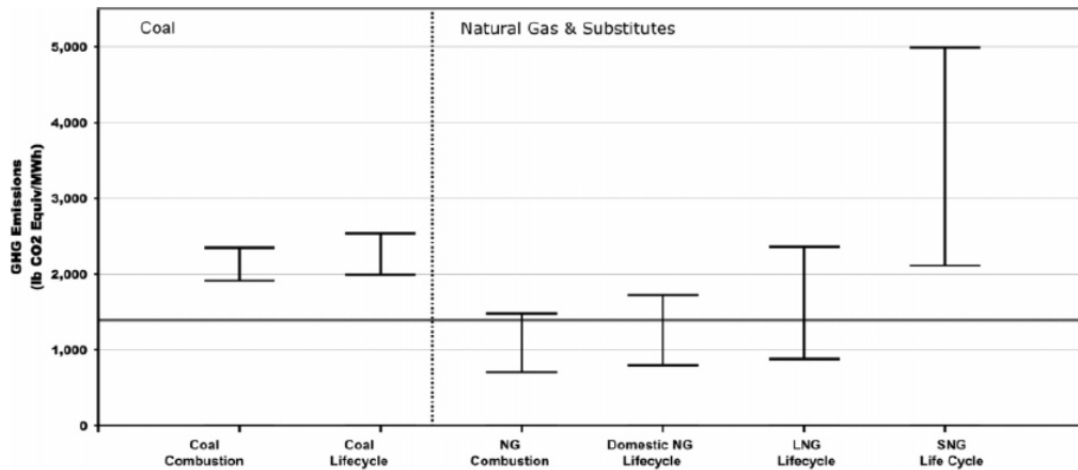
Emissions from liquefaction, transportation and gasification mean that the greenhouse gas emissions associated with LNG are significantly higher than those associated with domestic natural gas. For perspective, natural gas *combustion* emits roughly 120 pounds of CO₂e per MMBtu.²²⁹ Using the above conservative figures, the process of liquefying, transporting, and regasifying LNG accordingly emits 19% to 23% of the CO₂e emitted by natural gas combustion itself—a substantial increase. Jaramillo 2007 concluded that this increase could bring LNG’s lifecycle greenhouse gas emissions into parity with coal:

²²⁷ *Id.* at 98.

²²⁸ Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, Comparative Life-Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation, 41 *Environ. Sci. Technol.* 6,290 (2007) (“Jaramillo 2007”), available at http://www.ce.cmu.edu/~gdrg/readings/2007/09/13/Jaramillo_ComparativeLCACoalNG.pdf, attached as Exhibit 90. The cited estimate for the greenhouse gas emissions of liquefaction, transport, and regasification are derived by adding figures for these phases recorded in Figure 6S, p. 9 the supporting information for this article, which is available at http://pubs.acs.org/doi/suppl/10.1021/es063031o/suppl_file/es063031osi20070516_042542.pdf, and is attached as Exhibit 91 (“Jaramillo Supporting Information”). An earlier, related report with some additional information is Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews, *Comparative Life Cycle Carbon Emissions of LNG Versus Coal and Gas for Electricity Generation* (2005), available at http://www.ce.cmu.edu/~gdrg/readings/2005/10/12/Jaramillo_LifeCycleCarbonEmissionsFromLNG.pdf, and attached as Exhibit 92.

²²⁹ See, e.g., Jaramillo Supporting Info, *supra* n.228, at 9.

Figure 2: Life-Cycle Emissions of LNG, Natural Gas, and Coal in Electricity Generation²³⁰



Moreover, Jaramillo’s analysis understates LNG’s lifecycle greenhouse gas emissions, because this analysis does not reflect recent studies that have raised estimates for emissions associated with natural gas production. The Jaramillo studies were conducted prior to the shale gas boom. Some studies have found shale gas production’s methane emissions to be drastically higher than those of conventional gas production. Moreover, in April 2011 (well after the Jaramillo studies were published), EPA released improved methodologies for estimating fugitive methane emissions from all natural gas systems (unconventional and otherwise), which lead to higher estimates.²³¹

These recent studies estimate that aggregate domestic natural gas production releases at least 44 pounds of CO₂e per MMBtu. A report from the Worldwatch Institute and Deutsche Bank summarizes much of the recent work.²³² Specifically, the Worldwatch Report synthesizes three other reports that used “bottom-up” methodologies to estimate natural gas production emissions, prepared by Dr. Robert Howarth et al., of Cornell,²³³ Mohan Jiang et al. of Carnegie-Mellon,²³⁴ and Timothy Skone of NETL.²³⁵ The Worldwatch Report separately derived a “top-down” estimate, which produced a result

²³⁰ From Jaramillo 2007, *supra* n.228, at 6,295. “SNG,” in the figure, refers to synthetic natural gas made from coal.

²³¹ EPA, *Inventory of U.S. Greenhouse Gas Emissions And Sinks: 1990 – 2009*, U.S. EPA, EPA 430-R-11-005, attached as Exhibit 93. The executive summary to this document is attached as Exhibit 94.

²³² Mark Fulton et al., *Comparing Life-Cycle Greenhouse Gas Emissions from Natural Gas and Coal* (Aug. 25, 2011) (“Worldwatch Report”), attached as Exhibit 95.

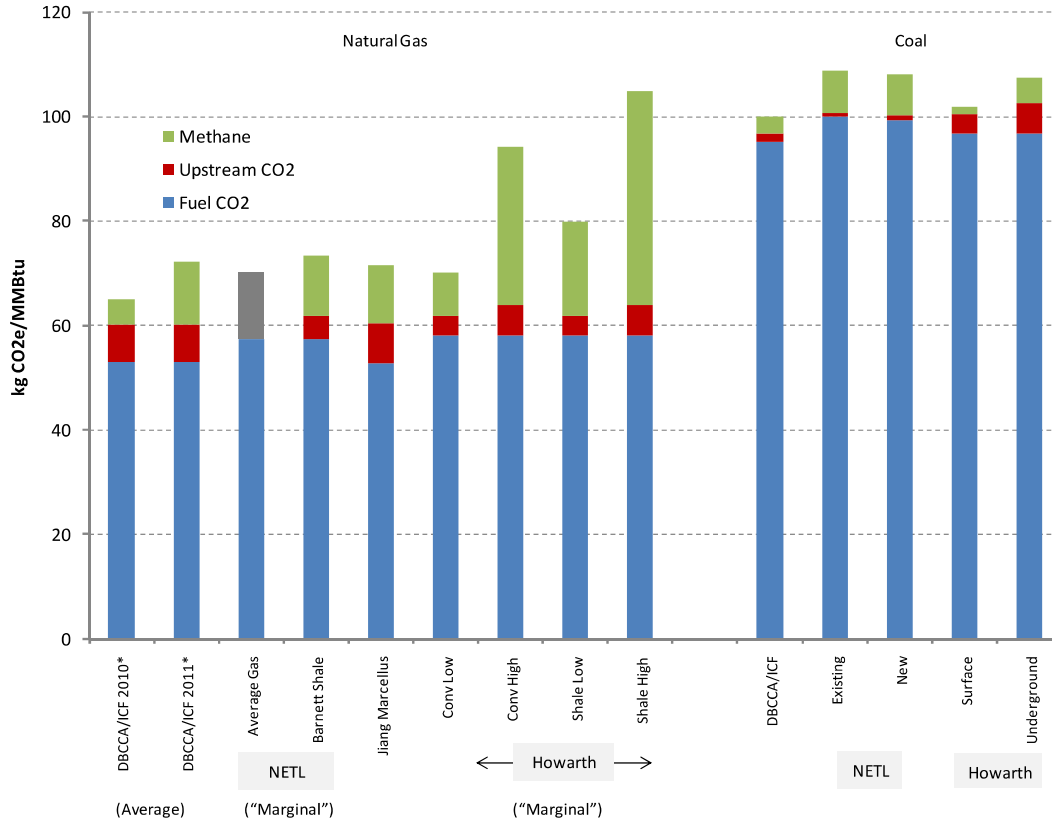
²³³ Robert W. Howarth et al., *Methane and the greenhouse-gas footprint of natural gas from shale formations*, *Climatic Change* (Mar. 2011), attached as Exhibit 96.

²³⁴ Mohan Jiang et al., *Life cycle greenhouse gas emissions of Marcellus shale gas*, *Environ. Res. Letters* 6 (Aug. 2011), attached as Exhibit 97.

²³⁵ Timothy J. Skone, *Life Cycle Greenhouse Gas Analysis of Natural Gas Extraction and Delivery in the United States*, Presentation to Cornell (May 12, 2011), attached as Exhibit 98. NETL has also published a fuller version of this analysis. See also Timothy J. Skone, *Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production* (Oct. 24, 2011), attached as Exhibit 99.

similar to the NETL estimate.²³⁶ These various assessments are summarized in the following chart.

Figure 3: Comparison of Recent Life-Cycle Assessments²³⁷



Source: DBCCA Analysis 2011; NETL 2011; Jiang 2011; Howarth 2011. Note: NETL Average Gas study includes bar shaded grey due to inability to segregate upstream CO2 and methane values, which were both accounted for in the study. See page 10 for more information. *2011 EPA methodology compared to 2010.

As this figure demonstrates, although the 2011 studies differ, most of them estimate production greenhouse gas emissions (combined methane and “upstream CO₂”) in a similar range. Synthesizing these studies, the Worldwatch Report estimated normalized life-cycle GHG emissions from domestic natural gas production (*i.e.*, excluding liquefaction, transport, and gasification of LNG) at approximately 20.1 kilograms, or over 44 pounds, of CO₂e/MMBtu,²³⁸ although, as the above figure shows, some studies estimate that production emissions are significantly higher. Two recent studies provide further evidence that unconventional gas production has high lifecycle emissions: one in line with the Worldwatch synthesis, finding that production adds approximately 23kg of CO₂e/MMbtu,²³⁹ and another finding drastically higher emissions.²⁴⁰

²³⁶ Worldwatch Report, *supra* n.232, at 9.

²³⁷ *Id.* at 3.

²³⁸ *Id.* at 15 Ex. 8.

²³⁹ JISEA Report, *supra* n.226 (also expressing this figure as 78g CO₂e/kWh).

Jaramillo used production emission estimates that are much lower than those produced by the more recent studies, and using the recent and higher figures appears to erode what little climate advantage Jaramillo found LNG to have over coal. Specifically, Jaramillo used estimates of 15.3 to 20.1 pounds CO₂e/ MMBtu, *i.e.*, estimates that were at least 24 pounds lower than the 2011 studies'.²⁴¹ Jaramillo estimated total life-cycle emissions for LNG at 149.6 to 192.3 lbs CO₂e/MMBtu.²⁴² Simply increasing these life-cycle estimates by 24 lbs CO₂e represents a 12% to 16% increase in total emissions. This increase substantially erodes any climate advantage LNG-fired electricity generation may have over coal-fired generation.

To predict the effects of LNG exports, Worldwatch and Jaramillo's numbers must be increased even further because they consider the average of current U.S. production, but production induced by exports (like future increases in production generally) will include a higher proportion of unconventional gas than the current production mix, and these unconventional sources are likely to have higher greenhouse gas emissions. As noted above, the EIA Export Study predicts that extraction induced by exports will overwhelmingly be from shale gas sources.²⁴³ Several studies have found that shale gas has higher production emissions than conventional sources.²⁴⁴ Notably, EPA recently estimated methane emissions from a conventional well completion at only 0.80 tons, while completion of a hydraulically fractured well yielded 158.55 tons of methane.²⁴⁵ The possibility that unconventional production induced by exports could release substantial quantities of greenhouse gases highlights the need for a thorough study regarding the indirect and cumulative impacts of export prior to any DOE/FE authorization. Further study is similarly needed to combine the analysis of export on fuel switching domestically with life-cycle emissions of LNG exports. In light of the

²⁴⁰ J. Tollefson, *Methane leaks erode green credentials of natural gas*, *supra* n.93.

²⁴¹ Jaramillo Supporting Information, *supra* n.228, at 8.

²⁴² *Id.*

²⁴³ EIA Export Study, *supra* n.29, at 11.

²⁴⁴ Although JISEA recently found greenhouse gas emissions from unconventional production in the Barnett shale to be "similar to levels reported in the literature from conventional natural gas," JISEA, *supra* n.239, at 4, that study's estimates may be too low. First, the JISEA study used data from the Barnett Shale, which is located in an ozone nonattainment area where emissions are likely to be rigorously controlled. It is therefore possible that its results may not generalize well to production in other plays. Second, the study did not include emissions associated with liquids unloading, a practice that involves removal of liquids from the well and consequent release of greenhouse gases, based on the assumption that liquids unloading is not frequently practiced in unconventional production. A recent industry survey suggests that liquids unloading is in fact practiced in unconventional production, however, so it may be appropriate to add emissions from liquids unloading to JISEA's life-cycle emissions total. Adding emissions associated with liquids unloading would contribute an additional 6 to 28 grams of CO₂e/kWh, or even 100g under low-recovery conditions. JISEA, *supra* n.239, at 29 (citing Terri Shires & Miriam Lev-On, *Characterizing Pivotal Sources of Methane Emissions from Unconventional Natural Gas Production* 11-14 (2012), attached as Exhibit 100).

²⁴⁵ See 2011 TSD, *supra* n.90 at 4-7 (Table 4-2).

evidence presented above, it is unlikely that LNG export will reduce global greenhouse gas emissions.

d. Pangea's Project Will Harm U.S. Workers and the U.S. Economy

Pangea argues that its project will further the public interest by creating jobs and boosting the U.S. economy, but these benefits are both overstated and dwarfed by the economic harms increased gas prices will entail. The project will likely cause net economic harm even if environmental impacts are excluded from consideration. When environmental impacts (and their economic effects) are considered in addition to these purely economic harms, as they must be, it is clear that the project is contrary to the public interest.

Pangea and its experts do not acknowledge, much less discuss, the economic harms exports will cause. Domestic gas price increases that will result from exports will have far-reaching effects on the U.S. economy. Consumers will face higher total gas bills despite reducing their consumption of gas, resulting in decreases in real wage growth for the overwhelming majority of Americans who do not own (directly or indirectly) stock in gas producing companies.²⁴⁶ Energy intensive industries, such as much manufacturing, will suffer job losses in the tens to hundreds of thousands.²⁴⁷ As we explain in part III.B.3 above, DOE/FE cannot authorize exports without carefully studying these impacts. Even by crude estimation, however, these other job losses will be an order of magnitude greater than the job creation benefits Pangea asserts. This is true even if Pangea's exports are considered in isolation. Pangea's project would require 1.2 bcf/d of gas, 0.438 trillion cubic feet per year (tcf/y). Many of NERA's scenarios considered export-created demand of only 0.37 tcf/y by 2015.²⁴⁸ NERA predicts that even this minimal level of export would cause a net decrease in wage income equivalent to between 15,000 and 31,000 jobs annually.²⁴⁹ As we explain in our comments on the NERA study and elsewhere in this protest, the job losses that would result from this level of exports are likely actually higher, and more importantly, DOE/FE cannot consider Pangea's exports in isolation. Nonetheless, evidence already in the record demonstrates that Pangea's proposal would cause a net decrease in employment and economic well-being of most Americans.

Whereas NERA understates these impacts, Pangea ignores them entirely. Pangea uses an "input-output" analysis by the Perryman Group to estimate jobs "supported" by expenditures relating to construction and operation of the facility, without mentioning how many of these jobs would have existed without the project or the jobs that will be lost because of increased gas prices. We reiterate that the estimates of lost job-

²⁴⁶ EIA Export Study at 6, 14; NERA Study at 8-9.

²⁴⁷ Sierra Club, et al., Comment on NERA Study at 8, Ex. 5 (Synapse Report) at 5.

²⁴⁸ NERA Study at 38.

²⁴⁹ Synapse Report at 5.

equivalents derived from NERA's figures, on the other hand, are net losses, which account for offsetting wage growth and job equivalents created by operation of the terminals, induced production, and associated spending. Simply put, because LNG exports will have significant job creation and job destruction effects, the failure to consider counterfactual scenarios renders Pangea's Perryman Group analysis essentially useless in this context.

These discussions of aggregate job impacts ignore other harms that exports will entail. The additional gas production exports induce will disrupt communities, potentially imposing the "resource curse" that has plagued economies dependent on resource extraction and exports.²⁵⁰ Raw numbers of jobs or job-equivalents failure to capture the continuity or quality of jobs, but as we explain elsewhere, the gas production jobs that exports will create are typically short-term jobs, whereas the manufacturing and energy-intensive industry jobs it will eliminate are typically stable and long-term.²⁵¹

Finally, exports will have grave distributional effects, as they harm wage-earning households and reduce employment while providing benefit to the relatively few shareholders in gas industries.²⁵²

In summary, the NGA's "public interest" test requires DOE/FE to determine whether the country would be better off with Pangea's proposal than without it. The input-output based economic study Pangea offers ignores crucial aspects of this question, and therefore provides no basis for concluding that the country would be better off. Instead, other information in the record demonstrates that exports will transfer wealth from the many to the few. The net effect of this transfer will be a reduction in GDP,²⁵³ or at most, a "very small" increase.²⁵⁴ Thus, DOE/FE must reject Pangea's argument that exports will provide economic benefits.

4. DOE/FE Cannot Rationally Approve Pangea's Export Plan On the Record Before It

The NGA, and subsequent DOE delegation orders and regulations, charge DOE/FE with determining whether or not a gas export application is in the public interest. *See, e.g.* 15 U.S.C. § 717b(a). DOE/FE must make this decision on the record before it. This means that, regardless of DOE/FE's decision to presume, initially, that an application should be granted, this presumption does not, and cannot, absolve DOE/FE of its duty to make its *own* determination. *Panhandle Producers and Royalty Owners Ass'n*, 822 F.2d

²⁵⁰ Sierra Club Initial NERA Comments at 13-24.

²⁵¹ *Id.* at 20-21.

²⁵² *See, e.g.*, Sierra Club Initial NERA Comments at 10.

²⁵³ Sierra Club Initial NERA Comments at 10, citing Comments of Dr. Wallace Tyner (filed Jan. 14, 2013).

²⁵⁴ NERA Study at 8.

at 1110-11. Simply put, “the *agency* must examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made.” *Motor Vehicle Mfrs. Ass’n of the United States v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (emphasis supplied). DOE/FE cannot rationally find for Pangea on the record in this case.

As we have demonstrated, record support for Pangea’s claimed benefits is extraordinarily thin. Pangea has submitted economic benefit information derived from input-output modeling, but the underlying model does not show whether the economy would be better off without Pangea’s proposal than it would without it.

Sierra Club, on the other hand, has shown that the gas and electricity price increases associated with exports will add billions of dollars in costs to consumers. These costs will propagate through the economy, retarding growth. We have also shown that the economic benefits, if any, associated with gas production increases may actually do long-term damage to the U.S. economy by plunging large regions of the country into a boom-and-bust extractive cycle. Further, we have shown that gas extraction and export have major environmental (and, hence, additional economic) costs, which Pangea has failed to even acknowledge.

On this record, DOE/FE cannot approve export. Were it do so, it would be violating basic norms of agency record rulemaking, as well as its own rules. *See, e.g.*, 5 U.S.C. § 706; 10 C.F.R. § 590.404 (requiring DOE/FE to base its final opinion “solely on the official record of the proceeding” and to impose terms “as may be required by the public interest” after record review).

D. If DOE/FE Does Move Forward, It Must Impose Rigorous Monitoring Conditions

If DOE/FE nonetheless approves Pangea’s application, it must recognize its continuing duty to protect the public interest, as it explained in its *Sabine Pass* decision. This duty is of crucial importance in the context of LNG export, where circumstances are rapidly changing. DOE/FE therefore announced its intention to monitor environmental, economic, and other relevant considerations. *Sabine Pass* at 31-33. Such a monitoring provision must be imposed here, as well, but must be significantly expanded.

Specifically, although *Sabine Pass* announces an intention to monitor many different considerations, it most clearly states that the agency will act if there is a “reduction in the supply of natural gas needed to meet essential domestic needs.” *Id.* at 32. This consideration is undoubtedly of great importance, but it is not the only way in which changing circumstances could imperil the public interest.

On the contrary, as we have demonstrated at length in these comments, there is strong evidence that the public interest will be impaired by gas exports. These impairments include (1) regional and national economic dislocations and disruptions caused by

natural gas extraction, including by the industry's boom-and-bust cycle, (2) national increases in gas and electricity prices and resulting shifts to more polluting fuels, (3) and environmental impacts of many sorts. Any one of these categories of interests could be impaired by gas export. DOE/FE must therefore state that it will monitor each of these areas, providing specific monitoring terms and thresholds which will trigger agency actions of various types, ranging from further study through reductions in export volume or changes in timing to a revocation of DOE/FE's approval.²⁵⁵

If DOE/FE fails to include such provisions in any final approval, it will fail to fulfill its "continuing duty to protect the public interest," *id.* at 31, and so violate the Natural Gas Act. Because neither Pangea nor DOE/FE have described or proposed such terms, Sierra Club protests this application to the extent that DOE/FE fails to develop adequate monitoring terms of the sort we have described.

IV. Conclusion

Sierra Club therefore moves to intervene, offers the above comments, and protests Pangea's export proposal for the reasons described above. Pangea's application is not consistent with the public interest and must be denied.

Respectfully submitted,



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²⁵⁵ Providing a clear monitoring plan of this sort will also benefit Pangea, which will be better able to determine when and how DOE/FE may act, improving the company's ability to plan its actions and investments.

Exhibit 1 Anderson Dec
Exhibit 2 Smith Test
Exhibit 3 EPA Region 10 Scoping Comments Jordan Cove
Exhibit 4 EPA Region 3 Scoping Comments Cove Pt
Exhibit 5 EPA, Scoping Comments – The Oregon LNG Export Project and Washington Expansion Project
Exhibit 6 DOE LNG Apps
Exhibit 7 EIA Nat Gas Pubs
Exhibit 8 Robert Brooks
Exhibit 9 Deloitte Study
Exhibit 10 EIA Export Study
Exhibit 11 NERA Study
Exhibit 12 Sierra Club Initial NERA Comment
Exhibit 13 Sierra Club Reply NERA Comment
Exhibit 14 Tyner Comment
Exhibit 15 ORG NSPS RIA
Exhibit 16 Jerrett Long-Term Ozone
Exhibit 17 EPA Ozone Health Impacts
Exhibit 18 EPA NO2 Health Impacts
Exhibit 19 UN Black Carbon Report
Exhibit 20 CO Health Impacts
Exhibit 21 Oil & Gas EPA Tech Support Doc
Exhibit 22 EPA Climate Change Health Report
Exhibit 23 EPA SO2
Exhibit 24 EPA PM
Exhibit 25 EPA Visibility
Exhibit 26 EIA Modeling System Overview
Exhibit 27 Model Documentation
Exhibit 28 EIA Documentation of the Oil and Gas Supply Module
Exhibit 29 SEAB 90 Day Report
Exhibit 30 SEAB 90 Day Report – Initial
Exhibit 31 EPA, Oil and Natural Gas Sector
Exhibit 32 Petron
Exhibit 33 Jeff Tollefson, Nature, Methane leaks erode green credentials of natural gas (Jan. 2. 2013),
<http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123#/ref-link-5>
Exhibit 34 McKenzie
Exhibit 35 Fed Reg Notice
Exhibit 36 IPCC Report
Exhibit 37 Endangerment Finding
Exhibit 38 Armendariz Barnett Shale Report
Exhibit 39 Pinedale Anticline SEIS TSD
Exhibit 40 CO Visibility
Exhibit 41 TRC Data
Exhibit 42 Schnell
Exhibit 43 WY Governor Letter
Exhibit 44 WY DEQ Tech Support Doc

Exhibit 45 Sublette County Ozone
Exhibit 46 Koch USA Today WY Smog
Exhibit 47 Pinedale DEQ Ozone Advisories
Exhibit 48 DEQ Ozone Advisory Feb 28
Exhibit 49 Streater
Exhibit 50 AirExplorer
Exhibit 51 GASCO
Exhibit 52 CO Air Quality Control Commission Presentation
Exhibit 53 CO Commission Oil & Gas Stats
Exhibit 54 Four Corners
Exhibit 55 Myers
Exhibit 56 Rodriguez
Exhibit 57 Kembball-Cook
Exhibit 58 Vandenberg
Exhibit 59 EPA Hydrogen Sulfide Report
Exhibit 60 Skrtic
Exhibit 61 James Collins & David Lewis, Report to CARB, Hydrogen Sulfide: Evaluation of Current California Air
Exhibit 62 Gassed
Exhibit 63 Alvarez
Exhibit 64 TNC PA EIA
Exhibit 65 PA Impacts Leasing Additional Forest
Exhibit 66 Comments on NY RDSGEIS
Exhibit 67 Nicot – Draft Report
Exhibit 68 Nicot – Final Report
Exhibit 69 Weltman report
Exhibit 70 Diesel Comments
Exhibit 71 Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers
Exhibit 72 Osborn et al Report
Exhibit 73 Report to Congress
Exhibit 74 Pavillion Groundwater
Exhibit 75 USGS Pavilion Report
Exhibit 76 Myers Pavilion Sept
Exhibit 77 Tollefson Nature
Exhibit 78 Myers Pavilion April
Exhibit 79 Action Memo Dimock
Exhibit 80 EPA Completes Drinking Water Sampling in Dimock, PA
Exhibit 81 NRDC Petition
Exhibit 82 Ohio Quakes
Exhibit 83 Flynn WSJ
Exhibit 84 Class II Comments
Exhibit 85 Ellsworth Abstract
Exhibit 86 EIA 2012 Annual Energy Outlook
Exhibit 87 Air Emissions
Exhibit 88 Golden Rules for a Golden Age of Gas

Exhibit 89 Jeffrey Logan

Exhibit 90 Jaramillo 2007

Exhibit 91 Jaramillo Supporting Info

Exhibit 92 Jaramillo 2005

Exhibit 93 Inventory of U.S. Greenhouse Gas Emissions And Sinks

Exhibit 94 GHG Inventory Exec Summary

Exhibit 95 Fulton

Exhibit 96 Howarth

Exhibit 97 Jiang

Exhibit 98 Skone (May 2011)

Exhibit 99 Skone (Oct. 2011)

Exhibit 100 JISEA Natural Gas GHG LCA