Deb Evans and Ron Schaaf
Ashland, Oregon

Comments on Office of Fossil Energy of the US Department of Energy:
Effects of Increased Levels of LNG Exports on U.S. Energy Markets, Oct. 2014
(2014 EIA LNG Export Study)

Comments submitted online Feb 12, 2016

Attention:
Robert Smith
US Department of Energy, Office of Fossil Energy
Forrestal Building, Room 3E-042
1000 Independence Ave. SW
Washington, DC 20585
202-586-7241

Edward Myers or Cassandra Bernstein
US Department of Energy (GC-76)
Office of the Assistant General Counsel for Electricity and Fossil Energy
Forrestal Building
1000 Independence Ave. SW
Washington, DC 20585
202-586-3397 and 202-586-9793

Mr. Smith, Mr. Myers and Ms. Bernstein,

Thank you for this opportunity to comment on both the "Effects of Increased Levels of LNG Exports on U.S. Energy Markets" (2014 EIA LNG Export Study) and "The Macroeconomic Impact of increasing U.S. LNG Exports" (2015 LNG Export Study) each of which examine the cumulative impacts of liquefied natural gas (LNG) exports. Specifically, we will address our comments to the **2014 EIA LNG Export Study** in this letter and submit a second letter with comments on the 2015 LNG Export Study.

One of the difficulties as you are no doubt well aware is that modeling rarely is able to take on all the real life factors that can influence markets, policies and changing awareness. The 2014 EIA LNG Study was issued on October 2014 and falls short on several measures to accurately identify factors that have and will continue to influence LNG supply and projected demand.

Some of these shortcoming are acknowledged in the introduction:

> EIA recognizes that the ramp-up specified by DOE/FE for the scenarios analyzed in this report, under which total Lower 48 states LNG exports reach 12 Bcf/d in 2020, is extremely aggressive, indeed almost impossible, and that the ultimate LNG exports

> levels specified by DOE/FE are also very unlikely for some of the baselines. (*2014 EIA LNG Export Study, page 5*)

Like previous commenters, including our Oregon Senator Wyden, who objected to DOE/FE using the flawed 2012 Nera Study to determine "public interest" and guide DOE/FE's approval of LNG Export terminals, we also vehemently object to using this study to simplistically state that all LNG terminals are "in the public interest". With the approval of Lake Charles LNG in December 2015, FERC and DOE have now pushed an aggressive and what some would call foolish number of LNG terminals, totaling 12.82 bcf/d capacity.[1] Some of these still have not secured off-take contracts for their full capacity and all are affected by the oversupply of LNG combined with low oil and gas prices and lower than expected demand. At the same time signals by subsequent reports like the 2014 EIA LNG Export study are being used to make predictions and guidance for future LNG approvals when clearly they are based on extremely limited information and have led to past predictions that have not come true.

1) The 2014 EIA LNG Export Study does not take into account many key factors that are critical to making intelligent long term capital-intensive decisions that affect the long term consequences of LNG and public health and safety.

As a case in point, the 2014 EIA LNG Export report admits that the projections of the US LNG markets are very difficult to make:

> EIA recognizes that projections of energy markets over a 25-year period are highly uncertain and subject to many events that cannot be foreseen, such as supply disruptions, policy changes, and technological breakthroughs. This uncertainty is particularly true for projecting the effects of exporting significant LNG volumes from the United States because of the following factors:
>
> - Nems is not a world energy model and does not address the interaction between the potential for additional U.S natural gas exports and developments in world natural gas markets.
> - Global natural gas markets are not fully integrated, and their nature could change substantially in response to significant changes in natural gas trading patterns. Future opportunities to profitably export natural gas from the United States depend on the future of global natural gas markets, the inclusion of relevant terms in specific contracts to export natural gas, as well as on the assumptions in the various cases analyzed. *(2014 EIA LNG Export Study, page 10)*

In order to have any hope of predicting the benefits or risks of developing US LNG export, a careful analysis of world LNG resources and changing world dynamics must be factored in as the US LNG market doesn't operate in a vacuum. Factors like China's slowing economy[2], rapid expansion of worldwide LNG

[1] FERC Approved Export LNG Terminals PDF- https://www.ferc.gov/industries/gas/indus-act/lng/lng-approved.pdf
[2] China's Slowing Demand Burns Gas Giants, Oct. 5, 2015, Wall Street Journal http://www.wsj.com/articles/chinas-slowing-demand-burns-gas-giants-1444071604

export terminals[3], Japan's restarting of nuclear plants[4], falling oil prices, Iran sanctions being lifted, renewable energy costs dropping, energy efficiency policies enacted, the growing world awareness of the high social costs of GHG pollution—all must get weighed along with new constantly changing dynamics to determine both LNG supply and demand and whether there is an overall "public benefit" or positive increase in GDP when these are factored into the modeling.

The following real changes pose a huge risk to LNG.

Oversupply of LNG: Responding to projected demand and previously high price points of world LNG markets, a whole bunch of countries decided to get into the LNG market. As many of these come online over the next 3-5 years the glut of oversupply is expected to continue.

> Citi Research says that there will be 25 mtpa of oversupply by 2018. That supply overhang will balloon over the next decade if all proposed LNG export terminals actually get constructed. Citi Research says capacity could exceed demand by one-third by 2025. In an Oct. 5 article, The Wall Street Journal cites the Arrow Energy project in Australia, a joint venture between Royal Dutch Shell and PetroChina. The companies had to take a AUS$700 million impairment charge on the project due to a souring "economic environment," and the project lost AUS$1.5 billion in 2014. The companies are scrapping the terminal.[5]

Significant changes in previously predicted LNG "supply" and "demand" with current overproduction and predictions of ongoing oversupply have made it impossible to secure the long term off-take contracts needed to justify building capital intensive LNG export facilities putting companies, financial backers and communities in the path of these projects, like Arrow Energy project in Australia, at great risk of failure and abandonment. LNG export projects creating this kind of risk in highly unpredictable markets most certainly are NOT in the "public interest".

Crashed world LNG Prices: Two years ago the price differential between Henry Hub ($4.90 mmBtu) and Japan Spot market ($18.30 mmBtu)[6] was $13.40. In January 2016 the Henry Hub price was $2.28 and Japan landed spot market price for January was $7.10, a $4.82 difference. The gap has narrowed even before a drop of LNG has gone out of the United States making it all but impossible for companies who have not signed contracts to do so in this buyer's market. This further puts "public interest" claims as suspect.

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[3] World LNG Report - 2015 Edition http://www.igu.org/sites/default/files/node-page-field_file/IGU-World%20LNG%20Report-2015%20Edition.pdf

[4] Japan Nuclear Update - Takahama 3 is Third Japanese Reactor to Restart - Feb. 4, 2016 http://www.nei.org/News-Media/News/Japan-Nuclear-Update

[5] Stafford, J. (2015, October 7). LNG Bust Could Last For Years. Retrieved from oilprice.com: http://oilprice.com/Energy/Gas-Prices/LNG-Bust-Could-Last-For-Years.html

[6] Japan Jan average LNG spot price falls to $7.10/mmBtu.Feb 9, 2016. Reuter's Toyko. http://www.reuters.com/article/lng-japan-spot-idUSL3N15O0GX

Slowing China Economy and Japan's restarting of nuclear power:
Much capital has already been invested in LNG and a lot more is poised—all banking on continued growth in demand. China's recent economic slowdown and their starting to price GHG emissions country-wide in a cap and trade program in 2017 will continue to influence and somewhat dampen their need for LNG. Also, with the lifting of the Iran sanctions China has recently committed to a $600 billion dollar trade deal[7] over the next 10 years with Iran who sits on the largest gas reserves in the world further raising questions over where is the demand for U.S. LNG export markets. Last month, Japan started up their 3rd nuclear reactor and a 4th is slated to start this month. These combined with the sharp decrease in cost of wind and solar are making it questionable to whether LNG will become the go to "bridge". The 2014 EIA study did not look at any of these world market influences, but simply concluded that if there is demand, it would benefit the US gas industry creating a slight positive increase in overall GDP. So far hindsight is 20/20 and the predictions of higher demand to absorb LNG coming online over the next 5 years have been wrong. This points out a fundamental flaw with using limited models to try and predict future supply, demand and benefits.

Climate Change, COP 21 agreement in Paris and world recognition of the need to LOWER GHG emissions and to stay under 1.5 Celsius: At the end of the talks in Paris in December 2015, 195 countries signed an agreement to try and hold global warming to 1.5 degrees Celsius. With states, provinces and select countries like Germany and China leading the way, it is predicted that ¼ of the world economy will put a price on greenhouse gas emissions by the end of 2016. This combined with the sharp decrease in cost of wind and solar, the extension of the wind and solar tax credits and the recent Supreme Court decision approving "demand response" are making it increasingly questionable whether natural gas and LNG will be by passed as a "bridge fuel" to a renewable energy future. Using energy efficient technology like "demand response" to eliminate peak energy, neutralizes much of the increase in electrical demand and when coupled with falling wind and solar costs and tax credit extension, renewables can begin taking the place of retiring coal and gas plants right away, bringing down emissions and transitioning the US to a clean energy economy.[8] [9] [10]

2) The finding that 20 bcf/d of LNG exports add more to GPD overall than the 12 bcf/d of LNG export projects already approved by FERC/DOE and made in the absence of social cost of fossil fuel pollution leads to a false conclusion.

Social Costs of Greenhouse Gas (GHG) Pollution: In the Summary of Results section, the study states:

[7] China, Iran Agree to Expand Trade to $600 Billion in a Decade - January 23, 2016. http://www.bloomberg.com/news/articles/2016-01-23/china-iran-agree-to-expand-trade-to-600-billion-in-a-decade

[8] LNG and Renewable Power: Risk and Opportunities in a Changing World, January 15, 2016, The Brattle Group. http://www.brattle.com/system/publications/pdfs/000/005/249/original/LNG_and_Renewable_Power_-_Risk_and_Opportunity_in_a_Changing_World.pdf?1452804455

[9] How Congress And The Supreme Court Blew Up The Natural Gas 'Bridge' To Renewables. BY JOE ROMM JAN 29, 2016. http://thinkprogress.org/climate/2016/01/29/3743517/congress-natural-gas-renewables/

[10] What Just Happened in Solar Is a Bigger Deal Than Oil Exports. Tom Randall, December 17, 2015. http://www.bloomberg.com/news/articles/2015-12-17/what-just-happened-to-solar-and-wind-is-a-really-big-deal

Increased LNG Exports result in higher total primary energy use and energy-related CO2 emission in the United States. The 0.1% to 0.6% increase in total primary energy use and a -0.1% to 0.6% change in CO2 emissions relative to baseline over the 2015-40 period reflect both increased use of natural gas to fuel added liquefaction and fuel switching in the electric power sector that for some cases increases both fuel use and emissions intensity. *(2014 EIA LNG Export Study, page 12)*

The report refers to the Reference baseline CO2 emissions as being 143,353 million metric tons. According to the EPA's Chart on Social Costs of CO2 emissions (Table 1), the average social costs from 2015 to 2040 would be a low of $2.2 billion to a high of $21.8 billion per year (in 2007 dollars). An increase of .6% would be an additional $1.3 million to $13.1 million dollars more. **The Social Cost of CO2 emissions should be included in the study.**

TABLE 1 - Social Cost of CO2, 2015-2050 a (in 2007 Dollars per metric ton CO2)
Source: Technical Support Document (PDF, 21 pp, 1 MB): Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised July 2015)[11]

	Discount Rate and Statistic			
Year	**5% Average**	**3% Average**	**2.5% Average**	**3% 95th percentile**
2015	$11	$36	$56	$105
2020	$12	$42	$62	$123
2025	$14	$46	$68	$138
2030	$16	$50	$73	$152
2035	$18	$55	$78	$168
2040	$21	$60	$84	$183
2045	$23	$64	$89	$197
2050	$26	$69	$95	$212

a The SC-CO2 values are dollar-year and emissions-year specific.

The study also needs to include Life Cycle Analysis of methane fugitive emissions when determining the true GHG (CH4) emissions and attribute the full social cost of methane in the report. It is unclear from the report whether any fugitive methane emission, which can range widely but are reported in Science as 5.4% of total life cycle production,[12] are included in the analysis. Since Methane traps heat 36 times more effectively than CO2 over 100 years and 86 times more over 20 year span, fugitive emission, if included in this study, would add significantly to the social cost—increasing the above emissions and

[11] EPA Social Cost of Greenhouse Emissions, July 2015 -
[12] Methane Leakage from North American Natural Gas Systems: http://www.sciencemag.org/content/343/6172/733.summary

costs by another 4.6 times over 20 years and 1.9 times the GHG pollution and associated social costs over 100 years.

More recently, in EPA's *Regulatory Impact Analysis for Oil and Natural Gas Proposed NSPS*, published in August 2015, a chart for the social cost of Methane (See Table 4.3)[13] was included. Using those values, it is clear the social cost of fugitive methane in the full life cycle production of natural gas comes with a high social cost.

Table 4-3 Social Cost of Methane (SC-CH_4), 2012 – 2050[a] [in 2012$ per metric ton] (Source: Marten *et al.*, 2014[b])

Year	SC-CH_4			
	5 Percent Average	3 Percent Average	2.5 Percent Average	3 Percent 95th percentile
2012	$430	$1,000	$1,400	$2,800
2015	$490	$1,100	$1,500	$3,000
2020	$580	$1,300	$1,700	$3,500
2025	$700	$1,500	$1,900	$4,000
2030	$820	$1,700	$2,200	$4,500
2035	$970	$1,900	$2,500	$5,300
2040	$1,100	$2,200	$2,800	$5,900
2045	$1,300	$2,500	$3,000	$6,600
2050	$1,400	$2,700	$3,300	$7,200

[a] The values are emissions-year specific and are defined in real terms, i.e., adjusted for inflation using the GDP implicit price deflator.
[b] The estimates in this table have been adjusted to reflect the minor technical corrections to the SC-CO_2 estimates described above. See Corrigendum to Marten *et al.* (2014) for more details http://www.tandfonline.com/doi/abs/10.1080/14693062.2015.1070550.

Social Costs associated with CO2 and CH4 (methane) carry significant implications in determining the viability of LNG in today's world and should be included in this and future studies.

Some examples of these externalities that are NOT mentioned in this study but are the result of human caused fossil fuel pollution are the increasing number of extreme weather events[14] [15] that include drought, floods, fires and wind events. Storms like Sandy which cost the government $60 billion in emergency funds, the tropical storm that hit Northern California and Southern Oregon on Feb 6th, 2015 that dumped 3 inches of rain in 24 hours, toppled thousands of trees across a 100 mile swath and created landslides that closed Highway 66 where we live in Oregon are costly and life threatening. Fires have been raging in the wake of our hotter, longer summers in the West and drought threatens drinking water, agriculture and fisheries.

[13] Regulatory Impact Analysis for Oil and Natural Gas Proposed NSPS, page 4-14. http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf
[14] The Unsustainable Trend of Natural Hazard Losses in the United States, November 14, 2011. http://www.mdpi.com/2071-1050/3/11/2157
[15] U.S. Billion-dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases. Smith, Adam B. Katz., Richard. Natural Hazards. June 2013, Volume 67, Issue 2, pp 387-410, http://link.springer.com/article/10.1007%2Fs11069-013-0566-5

In this study, that narrowly focuses on the natural gas/LNG industry with its 10%+ loss incurred in the energy intensive process to liquefy the natural gas, it seems completely catastrophic to NOT be putting the real social costs on our continuing to use of fossil fuels. We are over 400ppm of CO2 equivalent already causing a 1 degree Celsius global temperature increase and science says we have to return to 350 ppm. We fail to see how we can reach these goals if the path Department of Energy has been advocating for over the past 10 years is increased use of natural gas.

3) **The study fails to address the vast difference in costs between greenfield and brownfield LNG projects and the risk to capital given the many uncertainties that face pushing LNG as the next energy currency**.

One concern that faces the LNG future and goes counter to the simplified look at GPD this study makes, is the risk taken when investing large sums of capital into an industry that may soon get passed up with a move toward renewable energy. The authors of the Brattle Group's *LNG and Renewable Power: Risk and Opportunity in a Changing World* analyzed the current and projected cost of gas-fired generation using LNG from North America versus the current projected cost of renewable power in markets outside of North America and deduced that in some places wind and solar are already competitive with LNG for electric generation.

> The increasing competition between renewable power and gas-fired generation using LNG should be considered carefully by participants in the global LNG markets. This competition increases the uncertainty in global gas demand and the future LNG requirements in markets now being targeted by North American LNG export developers," the report notes. "Both investors in LNG infrastructure and buyers of LNG under long-term contracts will want to consider these risks before making large and long-term commitments to buy or sell LNG.[16]

The variation of costs between projects must also be considered. In the Study, the Mid-Atlantic and South Atlantic regions were each assumed to host 1 Bcf/d of LNG export capacity, the Pacific region was assumed to host 2 Bcf/d, with all of the remaining Lower 48 states' export capacity hosted along the Gulf Coast in the West South Central Census division. It's not clear in the study what cost parameters were used for which location. In the 2015 World LNG Report there was a considerable range between capital cost of greenfield and brownfield with greenfield costs increasing at a much faster rate.

> Cost has been the main challenge facing LNG projects worldwide. Liquefaction projects have faced considerable cost escalation since 2000 – several projects reported cost overruns in the range of 30-50% after construction began. Unit costs for liquefaction plants (in real 2014 dollars) increased from an average $321/tonne from 2000-2006 to $851/tonne from 2007-2014. Greenfield projects have increased from $326/tonne to

[16] LNG and Renewable Power: Risk and Opportunities in a Changing World, January 15, 2016, The Brattle Group. http://www.brattle.com/system/publications/pdfs/000/005/249/original/LNG_and_Renewable_Power_-_Risk_and_Opportunity_in_a_Changing_World.pdf?1452804455

> $1,185/tonne, while brownfield projects have only increased to $516/tonne, up from $315/tonne.[17]

Recent U.S. Congress decision to extend wind and tax credits and the Supreme Court decision to allow "demand response" will continue to push renewable energy costs lower and have shortened the time in which renewable energy will surpass conventional fossil fuel energy.

> The numbers are really stunning. According to a recent report by the investment firm Lazard, the cost of electricity generation using wind power fell 61 percent from 2009 to 2015, while the cost of solar power fell 82 percent. These numbers — which are in line with other estimates — show progress at rates we normally only expect to see for information technology. And they put the cost of renewable energy into a range where it's competitive with fossil fuels.[18]

Another contributing factor that will help renewables grow and more quickly supplant natural gas as a "bridge fuel" to a clean energy economy is the recent Supreme Court decision.

> In a long-awaited decision sure to benefit our wallets and the planet, the U.S. Supreme Court today upheld the Federal Energy Regulatory Commission's (FERC) authority to design rules and incentives for electricity customers to get paid for reducing consumption during periods of high electricity demand. Known as "demand response," it's most often used when energy is expensive and the grid's limits are tested.[19]

The reason this is significant is that through the use of smart technology we will be able to flatten peak electrical energy costs and rather than replace retiring coal or gas-fired plants with new gas-fired plants as a "bridge" it is predicted that renewable power will compete directly with natural gas. The Brattle Group study shows solar, wind and hydro already is the least expensive option in some parts of the world. With increased production these costs will continue to decline, making renewables the least expensive energy option. Already in early 2016 roughly one quarter of the world's emissions now fall under some form of carbon pricing system.[20] With China introducing Cap and Trade country-wide in 2017, this number will only increase.[21] All of this shift in the world markets combined with the current oversupply in LNG, and current LNG export terminals in the US struggling to get long term contracts for 100% of their capacity suggest that a shift is already starting to occur. This raises serious questions around what happens if LNG markets dwindle instead of grow.

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[17] World LNG Report 2015, page 26. http://www.igu.org/sites/default/files/node-page-field_file/IGU-World%20LNG%20Report-2015%20Edition.pdf

[18] Wind, Sun and Fire, Paul Krugman, FEB. 1, 2016. New York Times. http://www.nytimes.com/2016/02/01/opinion/wind-sun-and-fire.html?emc=eta1

[19] U.S. Supreme Court Decision: Demand Response Forces Awaken, Allison Clements's Blog, January 25, 2016. http://switchboard.nrdc.org/blogs/aclements/us_supreme_court_decision_dema.html

[20] A 2016 Carbon Market Forecast. Kasey Krifka, The Climate Trust. https://www.climatetrust.org/a-2016-carbon-market-forecast/

[21] China to launch national cap-and-trade plan in 2017, US announces, Suzanne Goldenberg, Sept 24, 2015. The Guardian. http://www.theguardian.com/world/2015/sep/24/china-national-cap-and-trade-deal

Some, like The Solutions Project, have come up with plans to get to 100% renewable by 2050. They project that the plan for the United States would save a whopping $587 billion (1.5% GPD) in avoided mortality and illness Costs. The Plan pays for itself in as little as 1.5 years from air pollution and climate cost savings alone. If this were even remotely possible, it seems that the studies we should be conducting are ones that look at how we can attract capital to renewable energy and leave hydrofracturing and fossil fuels, with their high social cost, in the ground.

4) **What criteria should DOE/FE/FERC use in determining approval of additional export terminals when comparing the 29 contenders?**

One of the reasons for conducting this study and asking for comments was to determine who of the 29 pending applicants should get a shot at a very narrow LNG export market. Our response, for all the reasons stated above, emphatically is NO ONE ELSE! The risk and uncertainty created by significant and ongoing changes in energy markets, our cascading toward increasing climate chaos and the failure to incorporate real costs of GHG pollution caused by continued use of fossil fuel energy clearly shows that the narrow positive GDP margin currently shown in the study would be negated and that LNG Exports are most certainly NOT in the "public interest."

Should the DOE/FE decide against prevailing wisdom to curtail our finite and harmful fossil fuels resources and move to approve an additional 8 bcf/d of LNG capacity, taking us from the current 12 bcf/d still not fully contracted terminals to 20 bcf/d, it should be first and foremost based on demand. And only then, if there are willing buyers contracted for 100% of the capacity.

By doing this, you establish two things: that there is actual demand for US LNG and that it must be delivered through long term contracts at prices a company can build infrastructure and sell LNG for thus guaranteeing that the jobs and the economic benefit that this study suggests, would actually exist. Without contracts, as in the case of Jordan Cove/Pacific Connector where we live in Oregon, there is absolutely zero public benefit in granting approval.[22] These LNG terminals and their associated pipelines are far too damaging, dangerous, polluting and a financial risk putting valued natural resources, private property, health and safety and risk of abandoned and stranded assets in jeopardy. Instead money could be put into other more beneficial renewable energy sources for a real and direct "public benefit" right here at home. Terrain and earthquake, tsunami and rain induced risk to public safety and environmental destruction should also be taken into consideration if future LNG terminals are approved.

If, as is suggested, the world demand exists for LNG, then only those plants that secure 100% longer term contracts and can show financial strength and a good track record of following all state and federal permit/certificate orders should be considered. Another factor that should be taken into consideration both in determining whether a project or applicant meets the increased U.S. GDP benefits is whether the stakeholder company(s) is/are from the United States. If profits over the course of the project do not bring dollars into the United States economy, but rather are taken elsewhere, this limits the trade balance perceived to partially make these projects in the "public interest". When GDP dollars were

[22] Landowner letter filed with FERC, Dec 9, 2015.
http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20151210-5000

determined in the study, was any profit to companies projected to account for any portion of the overall GDP or trade balance?

On this note, we believe that DOE/FE has far out step its bounds in determining that "LNG exports" are in the "public interest" and that private companies should be granted eminent domain for private corporate gain when LNG exports as in the case of Jordan Cove and the gas being exported are most certainly NOT for "public use" as eminent domain is designed to serve. This shift from "public use" to "public interest" all based on modeling that has so far not predicted the correct climate change ravaged world and flies in the face of our 5th amendment constitutional rights.

If the true social costs and the full life cycle analysis were done on US LNG export, the 2014 EIA study would have shown additional cost which arguably would have produced a negative GDP rating. The flood gates should NOT have been, nor should they continue to be, opened allowing more cost-intensive and harmful climate chaos causing pollution. It is time we recognize that for the sake of future generations we cannot keep fowling our atmospheric nest. Only when we remove the existing fossil fuel subsidies and we charge the real social costs of fossil fuel pollution both burned and fugitive will we find that renewable energy is the obvious choice. The sooner we get to that realization and start building the new energy economy the better. Our recommendation is that DOE/FERC stop approving more LNG terminals starting now.

Thank you for this opportunity to comment on the study.

Sincerely,

Deb Evans and Ron Schaaf,
(as individuals)
and
Hair on Fire Oregon