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U.S. Department of Energy (FE-34)
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July 27, 2018

RE: Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports

To whom it may concern,

We appreciate the opportunity to comment on Department of Energy/Fossil Energy's *Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports* (2018 LNG Export Study). As affected landowners for over 13 years now in the Jordan Cove and associated Pacific Connector Gas Pipeline proposed projects, we are writing to express our concern for some of the generalizations and assumptions that are forthcoming in this report and also to point out the uncertainties acknowledged by the authors. We also agree with the astute observations, comments and concerns expressed by Patricia Weber.

We understand that "DOE may use the 2018 LNG Export Study to inform its decisions in the pending non-FTA docket proceedings (listed above), in future non-FTA application proceedings, and for other purposes."[1] To that end, while the report does provide some useful information, it is incomplete and does not reflect specific scenarios that must be also weighed by DOE before determining whether a given LNG project is in the public interest. These unique factors cannot be dismissed.

Assumptions and Probabilities

As is always true in modeling, there is no crystal ball that can predict the future. Running 54 different scenarios is both an interesting and ambitious approach to try and better understand what might happen where U.S. LNG exports are concerned. We found the starting probabilities somewhat problematic given that 1) they are a best guess; 2) they are coming entirely from industry leaders who would likely have something to gain in developing LNG as a global commodity; 3) they have narrowed the "most likely" scenarios that are scrutinized in more detail to only those that result in "reference" or "high" demand for both U.S. and Rest of World (ROW) demand.

The most glaring of these predictions is that there is a mere 5% probability that the ROW would meet the 450ppm of CO2e as set forth in the Paris Climate Agreement.

The lowest natural gas demand is obtained from a scenario in which the IEA assumes

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

> that every country adopts policies sufficient to keep global greenhouse gas concentrations under 450 ppm CO2e. **To achieve this concentration, it is necessary to phase out all fossil fuel use including natural gas over the course of the next century**.[2] (emphasis added)
> <…>
> NERA experts have followed the development of international agreements on climate change for many years, and we do not expect that future progress will be very much greater than in the past. Therefore, we assign a low probability to the WEO 450 ppm case, and the highest probability to the WEO Current Policies case that assumes no additional actions to limit emissions in the ROW. Specifically, we assumed that the high natural gas demand case is about twice as likely (65% probability) as the Reference case (30% probability) and that the probability of the world adopting policies that would achieve the WEO 450 ppm CO2e target is just 5% (Table 2).[3]

Right or wrong we find this quite disturbing given that every country, except the United States, is committed to trying to keep accumulative CO2e emissions under 450 ppm which would limit temperature rise to 2 degrees Celsius above pre-industrial levels.

Similarly, the U.S. demand "low" assumption is given a 16% probability of being met and none of the "likely outcomes" include low U.S. demands.

> For the low demand case, termed the Renewables Mandate case, we assume an aggressive national renewable energy policy that is in line with California's stringent RPS target. This mandate crowds out natural gas generation and natural gas demand in the electric sector. We estimate that by 2040, this mandate will displace 6 Tcf of natural gas in the electric sector.[4]

The final probability estimates used to run the analysis are shown in Table 3 and illustrate that the gas demand from the Rest of the World (ROW) and the United States combined is 211 Tcf as a high and 140 Tcf as a low. The low demand scenarios for both US and the ROW were given probabilities of 17% and 5% respectively.

Table 3: Final Probability Assignments and Central Supply/Demand Estimates (Tcf) for Each Case in 2040

		US Supply	US Demand	ROW Supply	ROW Demand
	Case	AEO 2017, HOGR	Robust Economic Growth		WEO
High	Estimate	49	39		172
	Probability	30%	17%		50%
	Case	AEO 2017, Reference	AEO 2017, Reference	IEO 2017, Reference	IEO 2017, Reference
Reference	Estimate	39	33	139	145
	Probability	55%	66%	80%	45%
	Case	AEO 2017, LOGR	Renewables Mandate	Low Supply	WEO 2016, 450 ppm
Low	Estimate	28	27	90	113
	Probability	15%	17%	20%	5%

[2] 2018 LNG Export Study at page 41
[3] Ibid at 41-42
[4] 2018 LNG Export Study at page 40

As indicated in Table 3, the four main assumptions used were U.S. Supply, U.S. Demand, Rest of the World (ROW) Supply and ROW demand. ROW is defined as everyone outside of North America. It is not clear then where Mexico and Canada fit in and how much of the U.S. Macroeconomic benefits should go to the U.S. versus elsewhere in North America. The implication in the report is that the benefits would all go to the United States. However, the report does acknowledge on page 34:

> On a practical level, there are also other important uncertainties about the ownership of LNG plants and how the LNG contracts will be formulated. These have important consequences on how much revenue can be earned by the U.S. and hence overall macroeconomic effects. 34

With footnote 34 further explaining:

> In the NewERA model, it is possible to represent these variations in domestic versus foreign ownership of assets and capture export revenues to better understand the issues. However, this study does not investigate these issues.

This is an important distinction when foreign companies, such as Pembina Pipeline, is not only the owner of the proposed Jordan Cove Energy Project and Pacific Connector Gas Pipeline, but in addition the natural gas supply can be 100% Canadian-sourced—which would directly compete with U.S.-sourced gas interested and the bottom line of the economic projects coming out of the 2018 LNG export study. Clearly if all of North America is not listed in the Rest of the World categories, then any of the macroeconomic benefits would be shared with these countries and not all fall to the United States, as the report suggests. We assume from the language in to the report that the economic benefits projected are determined using U.S.-sourced gas only.

Final Probabilities influenced 'most likely' outcomes and Macroeconomics analysis

Basing the modeling on the final predictions of probabilities resulted in a much narrow range of statistically probably outcomes. Any changes in the probabilities, would have resulted in a different set of outcomes. When each of the 54 possible outcomes were run, the study found:

> Based on the final probabilities, 40 scenarios have less than 2% chance of occurring; while the chance of occurring for rest of the other 14 scenarios is greater than 2%. There are only 2 scenarios that have probability of greater than 10% (see Table 21). For example, the scenario that combines Ref U.S. supply, Ref U.S. demand, Ref international supply, and High international demand (Ref_Ref_Ref_High) assigned relatively high probabilities for likely case assumptions resulting in the scenario probability of 14.5% (rounds to 15%).

The Macroeconomics analysis was limited to seven of the 'most likely' scenarios which are highlighted in Table 9.

Table 9: Macroeconomic Scenarios[50]

Scenario Name	U.S. Supply	U.S. Demand	ROW Supply	ROW Demand	LNG Exports (Bcf/day)	Cumulative Probability
Ref_Ref_Ref_Ref	**Ref**	**Ref**	**Ref**	**Ref**	**12.9**	**33%**
Ref_Ref_Low_Ref	**Ref**	**Ref**	**Low**	**Ref**	**29.6**	**76%**
Ref_Ref_Low_High	Ref	Ref	Low	High	45.7	96%
Ref_Ref_Ref_High	**Ref**	**Ref**	**Ref**	**High**	**24.0**	**68%**
High_Ref_Ref_Ref	**High**	**Ref**	**Ref**	**Ref**	**23.3**	**47%**
High_Ref_Low_Ref	High	Ref	Low	Ref	40.4	91%
High_Ref_Low_High	High	Ref	Low	High	52.8	99%
High_Ref_Ref_High	**High**	**Ref**	**Ref**	**High**	**30.7**	**87%**
Low_Ref_Ref_Ref	Low	Ref	Ref	Ref	0.1	5%
Low_Ref_Low_Ref	**Low**	**Ref**	**Low**	**Ref**	**9.9**	**16%**
Low_Ref_Low_High	**Low**	**Ref**	**Low**	**High**	**23.4**	**48%**
Low_Ref_Ref_High	Low	Ref	Ref	High	8.2	11%

The narrowing of the study to only 14 scenarios that had a greater than 2% chance of occurring and the seven macroeconomic analysis--dictated by assigning probabilities from peer-reviews of industry-connected individuals and NERA—resulted in both U.S demand and ROW demand falling in the "reference" or "high" levels. While this may end up the realty and future we face, we do not see evidence that the 2018 LNG Export Study takes into account the downside economic risks from climate instability for impacts such as increasing extreme climate disasters, health costs, national security issues, and impacts of ecosystem disruption. These impacts are often expressed as the social cost of carbon and social cost of methane. If, as the authors have predicted, we sail past the 450ppm and have no policies or regulations that steer us back toward climate stability at 350 ppm of CO2e in the atmosphere, then it is inaccurate to exclude all of the externalities associated with an increase in human-caused CO2e and the outcome of this study is flawed.

As an example, Table 8 shows the projected income to the United States economy under eight of the most likely scenarios. "The range of the highest LNG export revenues across different U.S. natural gas supply assumptions is from $71 billion to $129 billion in 2040."[5]

[5] 2018 Macroeconomic Study at page 60.

Table 8: LNG Exports (Bcf/d) and LNG Export Revenues for a Subset of the More Likely Scenarios in 2040

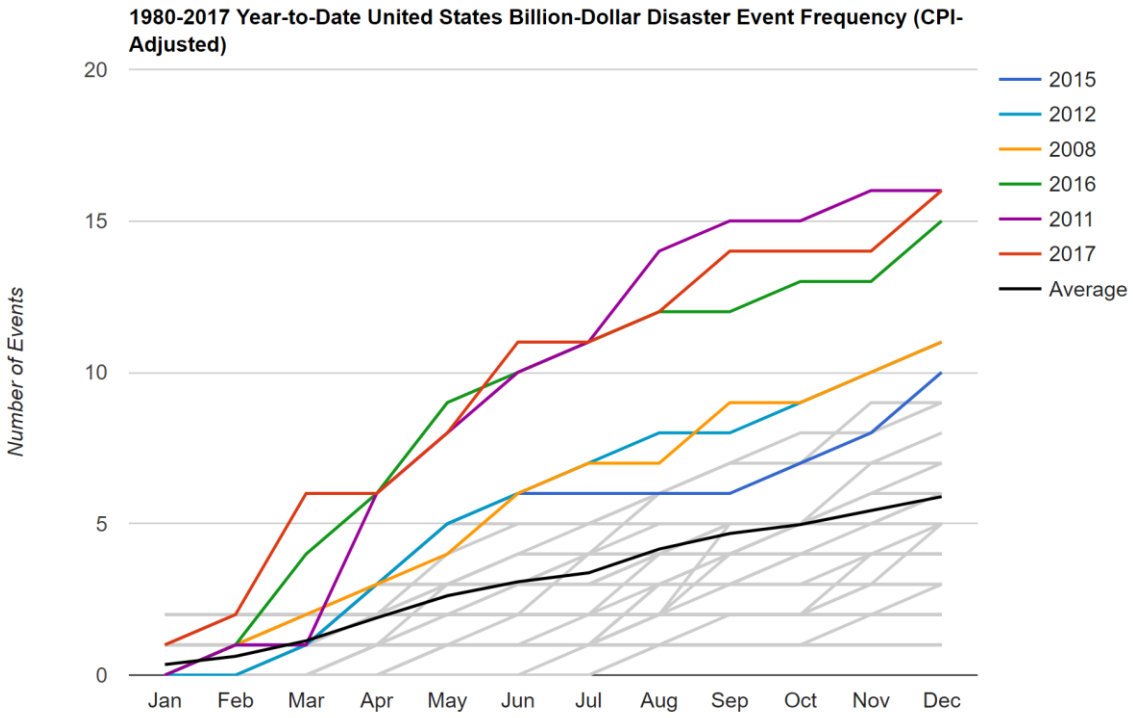
Scenario	LNG Exports (Bcf/day)	LNG Export Revenues (2016$ Billion)
Low_Ref_Ref_Ref	0.1	4
Low_Ref_Low_Ref	9.9	5
Low_Ref_Low_High	23.4	129
Ref_Ref_Ref_Ref	12.9	38
Ref_Ref_Ref_High	24.0	75
Ref_Ref_Low_Ref	29.6	94
High_Ref_Ref_Ref	23.3	52
High_Ref_Ref_High	30.7	71

In comparison, extreme weather disasters in the United States, defined as over a billion dollar events, in 2017 were the highest ever costing $306 billion dollars. Currently in Oregon we are experiencing a repeat of major fires that are harming businesses, like Oregon Shakespeare Festival, and having a negative effect on the economy of Southern Oregon currently. These fires in our increasingly hot and dry summers are not predicted to decrease if CO2e levels continue to rise. Data collected in the United States show a steady climb in extreme weather events triggering $1 billion dollars or more of damage rising from **21** events in the 1980s, **38** in the 1990s to **92** this past decade (2007-2016).

> During 2017, the U.S. experienced a historic year of weather and climate disasters. In total, the U.S. was impacted by 16 separate billion-dollar disaster events tying 2011 for the record number of billion-dollar disasters for an entire calendar year. In fact, 2017 arguably has more events than 2011 given that our analysis traditionally counts all U.S. billion-dollar wildfires, as regional-scale, seasonal events, not as multiple isolated events.
>
> More notable than the high frequency of these events is the cumulative cost, which **exceeds $300 billion in 2017** — a new U.S. annual record. The cumulative damage of these 16 U.S. events during 2017 is $306.2 billion, which shatters the previous U.S. annual record cost of $214.8 billion (CPI-adjusted), established in 2005 due to the impacts of Hurricanes Dennis, Katrina, Rita and Wilma.[6]

Overall, the 16 disaster events in 2017 claimed the lives of 362 people. The chart below shows the number of billion-dollar or greater disasters from 1980 through 2017. The annual average over the entire time span is 5.8 events (CPI-adjusted) and the annual average for 2013-2017 is 11.6 events (CPI-adjusted).

[6] NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions/



Event statistics are added according to the date on which they ended.

The bottom line is that when calculating GDP of LNG exports of U.S.-sourced gas, the model must also make sure that the full accounting of GHG emissions associated with extraction, transportation, liquefaction, regasification and final combustion of the natural gas is used. Many other industry materials categorizes LNG as 'clean' and a better choice than other fossil fuels, but siting only that gas has roughly half the CO2e emissions of coal when combusted, for example, is only part of the story. The report should clarify what emissions are being calculated and whether a cost of these emissions has been included in the results. This accurate accounting in dollars cost to the economy needs to be incorporating into this an future studies on economic impacts of natural gas and LNG in particular.

The Study reaffirms that Positive and Negative results still exist

Similar to the *2015 Macroeconomic Impact of Increasing U.S. LNG Export* study, the 2018 LNG Export study is still predicting winners and losers if the U.S. pushes LNG Exports. Interestingly there is quite a difference in whether the LNG Exports come from International demand—which is predicted to raise the prices of Natural gas around the world—or if it comes from U.S. pushing lower priced natural gas into the world market-resulting in keeping world prices lower. The report points out that "U.S. LNG exports have positive effects on some segments of the U.S. economy and negative effects on others."[7]

The positive effects are directed to natural gas producers and associated labor/support industries and potentially the limited number of investors in these companies. "On the negative side, producing incremental natural gas volumes to support natural gas exports will increase the marginal cost of

[7] 2018 LNG Export Study at page 64.

supplying natural gas and therefore raise domestic natural gas prices and increase the value of natural gas in general."[8]

Further, the macroeconomic analysis looks at a limited number of factors to determine 'benefit' to the U.S. economy.

> The macroeconomic effects of each scenario can be measured by different metrics. We used metrics such as the wellbeing of the average U.S. consumer, total household income from all sources, economy-wide investment, output effects on key manufacturing sectors, and gross domestic product (GDP) to characterize the effects on the economy of the scenarios. The scenario results provide a range of outcomes that reflect uncertainties in the international and U.S. natural gas markets."[9]

What is less clear is whether the NERA model also measured the likely increase of costs to the average American due to increased health impacts, extreme events, national security issues all related to climate instability.

An additional negative associated with LNG exports, that gets glossed over by industry, is the reliance on eminent domain for pipeline construction to get these volumes of natural gas to LNG liquefaction facilities. While this is mostly concerning to FERC, the fact that the end product has nothing to do with pubic use, is problematic and has become an increasing concern to those of us that fall on the path of a proposed route exclusively to serve an LNG facility. With 'no destination" clauses, the LNG is a tradable commodity as soon as it leaves the port, providing no assurance that it is connected to "energy security" of our allies or anyone else. Instead there is a very slippery slope currently, that assumes private gas industry corporations don't have to obtain voluntary easements from willing landowners, but instead can uniquely use eminent domain to secure right of ways.

This particularly becomes problematic with the statement on page 68

> An important implication of this result is that if the market is allowed to determine exports, changes in global markets that bring forth increased LNG exports will also lead to an increase in overall economic activity leading to higher GDP. In addition, Figure 17 illustrates that any restrictions on LNG exports would forgo the additional GDP to be gained by allowing exports to respond to market conditions. (emp. added)

Conversely, there is a clear indication from the 2018 LNG Export Study that there is likely a limit to the amount of LNG that would leave the U.S. as exports.

> To summarize, our analysis finds that by the year 2040 there is a 16% chance that U.S. LNG exports will be below 9.0 Bcf/d and a 16% chance that they will be above 30.7 Bcf/d; or to put it differently, there is about a 68% probability that U.S. LNG exports will be between 9.0 and 30.7 Bcf/d in 2040.
>
> <…>

[8] ibid
[9] Ibid at page 65

> As of February 26, 2018, DOE has received applications for a total of 55.04Bcf/d of LNG exports to Non-FTA countries. Again, there is virtually no chance that this level of LNG exports could be reached before 2040, and only a 2% chance that this level could be reached or exceeded by 2040.

The implication is the authors are suggesting the assistant Secretary of Fossil Energy approve all 55.04 Bcf/d LNG export projects for non-FTA export. We disagree. This opens up not only the possibility over building, but it assumes that every project of the 55.04 bcf/d in the queue has merit and would help reach the natural gas industry goal of supplying whatever ROW demand might materialize whenever that might come to pass. As landowners who have already been held in limbo for more than 13 years on the speculation of various energy companies hoping for any market to develop we see this to be completely unacceptable and a violation of our 5th amendment rights. If a private corporation wants to play by the same rules as every other private enterprise seeking to sell commodities to a foreign buyer, then pipeline companies will need to figure out how to partner with landowners and provide fair compensation similar to those that landowners who willingly give gas leases are given.

Additionally, given the 68% probability that U.S. LNG exports will be between 9.0 and 30.7 Bcf/d in 2040, the Department of Energy has an obligation to look closely at individual proposed projects, including where the gas is sourced, to determine whether or not projects are consistent with the public interest and not merely assume that all LNG projects are equal.

Although we feel that this latest 2018 LNG Export Study provides some useful information, it is incomplete in offering a full analysis on economic costs and benefits because 1) it does not distinguish between benefits to the United States, Canada and Mexico; 2) it does not internalize all of the externalities associated with harmful environmental impacts associated with unconventional extraction and full lifecycle GHG emissions; 3) it bases the findings on probabilities that are skewed toward an outcome beneficial to industry and select winners, and ignores much larger harms that can occur if the world fails to target the 450 ppm CO2e level of the Paris Agreement.

Thank you for allowing us to comment on this report. We sincerely hope that the Department of Energy will take these comments into consideration when deciding what projects seeking non-FTA authorization are deemed in the public interest.

Sincerely,

Deb Evans and Ron Schaaf
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Opening

DOE may use the 2018 LNG Export Study to inform its decisions in the pending non-FTA docket proceedings (listed above), in future non-FTA application proceedings, and for other purposes.

Report indicates a limited market for U.S-sourced gas as LNG and does not calculate how Canadian-sourced gas would compete with and influence the U.S. Economy.