A BRIDGE TO NOWHERE

THE CLIMATE, HUMAN RIGHTS, & FINANCIAL RISKS OF LIQUEFIED NATURAL GAS EXPORT

A $HORTING THE CLIMATE PAPER

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I. EXTREME FOSSIL FUELS, EXTREME RISK

The Paris Climate Agreement, in which the international community committed to "[hold] the increase in the global average temperature to well below 2°C … and [pursue] efforts to limit the temperature increase to 1.5°C,"[1] is on track to enter into force by the end of 2016.[2] The financial sector has voiced support for the fight against climate change and the transition to a low-carbon economy.[3] That support is welcome, and the most urgent step banks must take is clear: stop driving climate change by financing extreme fossil fuels.

Rainforest Action Network, Sierra Club, BankTrack, and Oil Change International's 2016 report, *Shorting the Climate*, analyzed 25 major North American and European banks' exposure to the most carbon-intensive, financially risky, and environmentally destructive fossil fuel subsectors.[4] Between 2013 and 2015, those banks financed $42.39 billion for companies active in coal mining, $154 billion for top operators of coal power plants, $307 billion for the top owners of the world's untapped "extreme oil" (tar sands, Arctic, and ultra-deepwater oil) reserves, and $283 billion for companies involved with liquefied natural gas (LNG) export terminals in North America. *Shorting the Climate* also analyzed these banks' policies on lending and underwriting for these sectors, finding that, with the partial exception of coal mining, major global banks have no plans to get out of extreme fossil fuels.

If the world's governments follow through on the Paris Climate Agreement and successfully limit climate change to 1.5 or even 2 degrees Celsius, coal and extreme oil and gas projects become worthless investments, or stranded assets.[5] In fact, these investments are good bets only in a world of runaway climate change. In other words, investment in extreme fossil fuel extraction and infrastructure creates a dilemma: either the international community succeeds in limiting emissions, and fossil fuel projects become stranded assets; or the world fails to rein in global warming, and we face climate chaos.[6]

These investments are good bets only in a world of runaway climate change.

In financial terms, "short-selling," or shorting, is a transaction through which an investor profits if an asset declines in value. After Paris, financing extreme fossil fuels is tantamount to shorting the climate.

Sometimes labeled a "bridge" to renewable energy, natural gas in the form of LNG in fact locks in usage of a fossil fuel that studies suggest is worse for the climate than coal, while crowding out renewable energy investment and delaying the shift to a clean energy economy. This report examines the implications of continued financing of a particular extreme fossil fuel subsector by detailing the social, environmental, and financial risks posed by North American LNG export terminal buildout.

II. THE LNG PROCESS

Liquefied natural gas is a cooled, compressed form of gas that can be transported overseas. In the beginning of the process, natural gas is extracted, refined to essentially pure methane, and fed into the LNG terminal through distribution pipes. Once the gas is cooled and dehydrated, the liquefaction process can begin. Each liquefaction train in a terminal — of

which there are typically several — is comprised of a network of tubes that compress and cool the gas as it travels through, until the end product is a liquid at about -260 degrees Fahrenheit and 1/600th of its original volume.[7] The LNG then moves from storage tanks at the facility onto barges with storage tanks that keep the liquefied gas cold. A typical ship for exporting LNG is around 1,000 feet long — the length of nearly three football fields.[8] At the importing locale's regasification terminal, the liquefied gas is heated back into a gaseous vapor, by which time it is ready to be stored or distributed.

Currently there are 66 proposed or existing LNG export terminals in North America.[9] The Federal Energy Regulatory Commission (FERC) is the U.S. agency in charge of permitting infrastructure, evaluating environmental impacts, and ensuring that there is a demonstrated public need for LNG infrastructure.[10]

The LNG export terminals planned in the United States are poised to get feed gas from the Marcellus and Utica plays in the Appalachian region, as well as the Eagle Ford Shale and Permian Basin in Texas, and the Haynesville Shale crossing Texas and Louisiana. Gas in these areas is primarily produced through hydraulic fracturing (see section V).[11] On the other end, Asian Pacific countries make up the largest share of global LNG imports. In 2015 LNG exported from the United States went to Japan and Taiwan;[12] Japan alone has 34 percent of the global LNG import market share.[13] Though the LNG import market remains centered in Asia, the share of demand from this region is falling as newer markets emerge in the Middle East, and China's appetite for LNG is proving not as large as many hoped it would be.[14] Many see exporting LNG to Europe as key recourse for relieving the gas oversupply in North America; yet, gas demand from the region has declined in recent years, and European LNG import terminals are currently utilized at rates lower than 18 percent.[15] The International Energy Agency (IEA) predicts that the global gas glut will continue through 2021 — though in that same time period, global LNG capacity is projected to grow by 45 percent. This mismatch means that, according to the IEA, "markets will struggle to absorb the increase" of new LNG capacity coming online.[16]

The gas industry in the United States has already faced unmet expectations and financial losses around LNG import terminals. LNG terminals are not new — Cove Point, in Maryland, first came online to receive imports in 1972.[17] The LNG import trend caught on in the early 2000s, and by August of 2005 there were 50 LNG import terminals in North America in various stages of the permitting process. When unconventional gas plays came online, there was less of a need to import gas in order to satisfy U.S. demand, shifting the fate of these enormous infrastructure projects. LNG imports dropped from their 2007 peak.[18] Large facilities in the United States, such as Sabine Pass in Louisiana and Cove Point, sat idle until recent years, when the companies applied for governmental permits to convert their import terminals into export facilities.[19] In 2012, the Spanish company Engas SA was in the midst of constructing an LNG terminal when it decided to mothball the project as soon as it was built.[20] As of August 2016 — 11 years after 50 applications were in the works for import terminals — there are only 20 existing or approved import terminals in North America, and at least seven are applying to convert into export facilities.[21] Companies and the banks behind them had invested billions in these import terminals, and by the time the tide started to turn, many found themselves in too deep to get out.

Australia is in the midst of a similar overbuild, but with LNG export terminals. Too many producers jumped to build export terminals when unconventional gas sources came online, only to find their projects continuously exceeding cost projections, their profits threatened, and their companies at large facing credit downgrades.[22] In August 2016, the oil and gas company Santos Ltd. took a $1.05 billion writedown on its LNG export terminal project in Queensland, Australia, due to low LNG prices and rising construction costs. This translated to a $1.1 billion loss for the company in the first half of the year.[23] The manufacturing and metals company Alcoa has raised concerns to the U.S. Department of Energy (DOE) that it is dangerous to view Australia's experience with LNG as anything other than a cautionary tale, as "there, the focus on exports is doing long-term damage to a diversified economic base." Alcoa Energy, along with The Dow Chemical Company, has opposed the U.S. federal government's rampant approvals for LNG export terminals, citing the damage that would be caused to domestic industry.[24]

While North American LNG export is projected to grow, low oil prices and the potential for oversupply of export capacity are serious threats to the industry. There is an enormous discrepancy between export capacity coming online in North America and forecasted shipments; Wood Mackenzie estimates that as much as half of the United States' LNG export capacity could go unused through 2020.[25] Moreover, increased competition threatens the dozens of investors that have already put significant funds into planning projects. In the Rio Grande Valley in Texas, for instance, where three terminals are currently proposed, analysts predict that only one project will actually break ground.[26]

There is an enormous discrepancy between export capacity coming online in North America and forecasted shipments.

The effects that LNG export will have on domestic natural gas prices in the United States are also a cause for concern. A 2014 study by the U.S. Energy Information Administration (EIA) found that increased LNG export could raise consumer costs for natural gas by 8 percent and electricity bills by up to 3 percent.[27] The Industrial Energy Consumers of America and American Public Gas Association oppose LNG export for these reasons.[28]

Shifting market conditions and the likelihood of overbuild make LNG export buildout an inherently risky endeavor for the companies themselves and the banks behind them. The financial risk becomes even greater when factoring in how efforts to curb greenhouse gas emissions will impact industry plans: the Carbon Tracker Institute found that $283 billion worth of potential LNG projects will be unnecessary through 2025 in a low demand scenario that keeps the world to a carbon budget compatible with 2 degrees.[29]

III. ECOSYSTEM IMPACTS

Like any fossil fuel production or refining process, gas liquefaction poses a significant danger to the environment through pollution of air and water and destruction of natural habitats. In a review of Cheniere Energy's planned Corpus Christi LNG export terminal, the

Environmental Protection Agency found "a number of potential adverse impacts to aquatic resources, air quality, environmental justice populations, and wetlands."[30] The terminal has since been approved by FERC, after its estimated impacts were outlined in detail. While companies like Cheniere can claim that these impacts are not significant, the apparent truth remains that these terminals will disturb a large amount of land and water and emit a significant amount of pollution.

Most potential LNG export terminals in the United States would be built on or near wetlands around the Gulf of Mexico, harming natural landscapes and threatening wildlife. Wetlands provide a crucial storm barrier for communities along the coast. Several protected species live in the Gulf, including 28 protected marine mammals and five threatened or endangered sea turtles.[31] While Cheniere will take some steps to minimize impacts, the Corpus Christi project's environmental assessment notes that construction and operation of the terminal will still "result in the permanent loss and conversion of disturbed coastal grasses and scrub/shrub habitats which would result in the permanent relocation of wildlife and an increase in stress, injury, and/or mortality."[32] LNG ships could strike and kill marine animals, which are drawn to these types of channels for heat and to the adjacent shallow habitats for foraging and shelter. Sea turtles, notes Texas Parks and Wildlife, "may become cold-stunned" as a result of the Corpus Christi LNG project — an already frequent occurrence in the increasingly industrialized waters.[33] Moreover, many projects require excavation and dredging of waterways for the enormous ships to pass through, a process which inevitably disturbs marine areas, especially nurseries.

IV. HUMAN RIGHTS IMPACTS

In considering the impacts that the proposed LNG buildout could have on air and water, and thus public health, a good deal can be inferred from facilities like the Cheniere Energy's two export projects whose pollution levels have already been approved. Sabine Pass LNG, in Southwest Louisiana, will be one of the biggest polluters in the whole region once it is fully running. Nitrogen oxides (NOx), which cause respiratory diseases such as emphysema and bronchitis, are just one major pollutant this terminal will produce. If it runs at capacity, it will emit more harmful NOx than any other regulated stationary source in all of Southwest Louisiana, increasing the amount of this pollution from regulated point sources for the entire five-parish region by 27 percent. It would also be the biggest source of carbon monoxide (CO) in the five parishes, releasing about twice as much as the current biggest regulated CO polluter. Carbon monoxide is a toxic air pollutant that takes part in the formation of urban smog, and Sabine Pass LNG running at full steam would increase the regulated point-source CO for all of Southwest Louisiana by 39 percent.[34] This terminal, like others, also emits major amounts of volatile organic compounds, which are harmful chemicals that can contribute to smog formation;[35] particulate matter, which worsens asthma and is linked to heart and lung problems;[36] and sulfur dioxide, which causes respiratory harm and reduces visibility by creating atmospheric haze.[37]

In addition to the unsettling public health impacts, LNG export buildout also creates economic shifts that disfavor local industries and can negatively impact people's livelihoods. If built, the three proposed LNG terminals in Texas's Rio Grande Valley could significantly impact the local fishing, shrimping, and eco-tourism industries. Nearby South Padre Island, a well-known destination for sport fishing, bird-watching, and enjoying pristine beaches, would have its beauty and economy compromised by the addition of flaring towers hundreds of feet tall, the release of millions of gallons of effluent water, and the brown haze that could come with the thousands of tons of air pollution.[38] Nature tourism alone in the Rio Grande Valley leads to 6,600 part- and full-time jobs.[39] An LNG terminal, on the other hand, creates mostly temporary construction jobs and typically only a few hundred permanent jobs. The proposed Rio Grande LNG would only create about 200 lasting jobs,[40] while its effects would put an unknown number of livelihoods in jeopardy. Property values are also affected; as Sabine Pass coastal resident Isom Ramsey said of his home in Louisiana, "Maybe about 10 to 15 years ago, this was an ideal spot to bring your family." Now, Cheniere's LNG plant, the size of an NFL football stadium, dominates the coastal landscape.[41]

LNG export terminals also compromise the safety of local communities, posing risk of explosion. This is not just theoretical; in 1944, an LNG plant fire in Cleveland killed 128 people. In 2004, an LNG blast in Algeria killed 27.[42] And in 2014, an explosion and fire from an LNG storage tank in Plymouth, Washington, forced hundreds to evacuate a two-mile zone around the facility. The leak formed a dangerous cloud of gas vapors, and a captain with the region's fire district noted that under slightly different conditions, there could have been an explosion deadly to anyone up to three-quarters of a mile away.[43] The potential for major leaks of gas from any part of the facility also poses health risks. The 2015-2016 Aliso Canyon gas leak in California — the first singular leak whose methane emissions could be seen from space[44] — left residents with nausea, skin and respiratory irritations, and rashes, as well as unresolved concerns over potential long-term effects.[45]

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80 percent of the proposed or existing LNG export terminals in the U.S. are sited in the Gulf of Mexico.[46] Industry's proposed massive buildout of LNG infrastructure is only the latest chapter in a long history of the Gulf Coast serving as a fossil fuel sacrifice zone. 51 percent of U.S. natural gas processing plant capacity and more than 45 percent of U.S. petroleum refining capacity is sited on the Gulf Coast, and 17 percent of U.S. crude oil production occurs offshore in the Gulf of Mexico.[47] The Gulf of Mexico has long been the seat of the United States' environmental justice movement because of the disproportionate exposure low-income communities of color have to harmful chemical and fossil fuel infrastructure and pollution.[48] Recent impacts from extraction include the 2010 BP Deepwater Horizon disaster, the worst oil spill in U.S. history, which saw 11 workers killed, some 134 million gallons of crude oil leaked, and 1.4 million gallons of chemical dispersant used to break up the spill.[49] Gulf communities are also on the front lines of fossil fuel-driven climate change, which is increasing the frequency and intensity of disasters like the

southern Louisiana floods of August 2016 — the worst U.S. natural disaster since Superstorm Sandy[50] — and 2005's Hurricanes Katrina and Rita, which also highlighted race- and class-based environmental injustices in the region.[51] Global warming-driven sea levels will accelerate coastal erosion, with southeastern Louisiana already seeing the loss of one football field's worth of wetlands every hour.[52] And as extraction and climate impacts grow in the Gulf Coast, so does grassroots resistance to the fossil fuel industry grow in size and intensity.[53]

V. HYDRAULIC FRACTURING AND LNG

LNG is intricately connected with the controversial extraction process of hydraulic fracturing. Hydraulic fracturing involves injecting a mixture of water and chemicals at high pressure into rock in order to fracture it, forcing the release of oil or gas.[54] When combined with horizontal drilling of oil and gas wells, hydraulic fracturing makes it possible to stimulate previously inaccessible reservoirs of tight oil or shale gas.[55] This practice became economically feasible around 2007, and production from hydraulically fractured wells skyrocketed.[56] While in 2000 hydraulically fractured wells accounted for 2 percent of national oil production, by 2015 hydraulically fractured wells made up 50 percent of the country's oil production.[57] On the gas side, hydraulically fractured wells made up less than 7 percent of U.S. gas production in 2000. By 2015, that percentage was up to 67 percent, with hydraulically fractured wells producing over 53 billion cubic feet per day of gas.[58]

Hydraulic fracturing comes with significant environmental and climate impacts. Natural gas primarily consists of methane, an extremely potent greenhouse gas. As detailed further in section VII, fugitive methane emissions along the natural gas production cycle — primarily from flaring, venting, and leaking gas — contribute to climate change. Hydraulic fracturing is also water intensive: the hydraulic fracturing of a single well can require up to 23 million liters of water.[59] With 38 percent of the world's shale resources in arid or highly water-stressed regions, the practice is a cause for serious concern.[60]

The spread of hydraulic fracturing is closely connected with the spike in applications to build LNG export terminals in the United States. With the rise of natural gas production due to hydraulic fracturing technologies, the United States experienced a decrease in domestic natural gas prices, and thus a glut of gas on the market.[61] With a still-increasing flood of shale gas into the market, natural gas prices in the United States reached a 17-year low in February 2016. This was the same month the first export of LNG from the lower 48 states left the country, heading for the newly expanded Panama Canal.[62] The EIA forecasts that natural gas production will rise by 2.9 percent in 2016 over the previous year, partly due to proposed LNG export.[63] In 2014 projections, the EIA found that about three quarters of increased natural gas production for LNG exports would be from shale.[64] That is, hydraulically fractured gas and LNG for export are connected by circular reasoning: a glut of cheap hydraulically fracked gas produced in economically unfavorable conditions is fueling a race to build out more LNG export terminals, while exporting LNG at these terminals provides an incentive for further hydraulic fracturing, with the potential to worsen the market's glut.

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Given that an abundance of hydraulically fractured gas is so integral to their business plans, companies planning to build LNG export terminals, as well as the financial institutions behind these projects, must consider the risks posed by the anti-fracking movement. Hydraulic fracturing is a highly controversial practice, and as use of the practice has grown, so has a worldwide movement of individuals, organizations, and governments in opposition. In addition to land rights issues, water usage and contamination, and local health concerns, the anti-fracking movement has highlighted the climate impacts of hydraulic fracturing. New investment and infrastructure in hydraulic fracturing means locking the global economy into continued use of fossil fuels. Meanwhile, a new study by Oil Change International and 14 other organizations found that the potential oil, gas, and coal resources that are already developed overshoot likely chances of keeping global warming under 2 degrees — meaning no new gas, unconventional or otherwise, can be extracted if the world is serious about maintaining reasonable chances for a climate-stable future.[65]

As an effect of the intense opposition to the practice, hydraulic fracturing has been banned or placed on a moratorium in the United States by counties such as Boulder, Colorado, and states such as New York.[66] The German government has outlawed hydraulic fracturing across the country.[67] In these bans, governments have cited health impacts, groundwater contamination, and lack of sufficient regulation as reasons for ending the practice.

Opposition to hydraulic fracturing poses an existential threat to the LNG export industry. Without rampant production of hydraulically fractured natural gas there is no demonstrable need for the exports, and as the movement in opposition to the practice strengthens and regulation increases, the terminals lose their primary feed gas source. Anti-hydraulic fracturing sentiment abroad can also threaten the profitability of North American LNG export terminals. France, another country that has banned the practice, is considering a ban on importing LNG from the United States because a large percentage of the gas will be shale gas produced by hydraulic fracturing.[68] Policies like this could mean U.S. shale would lose valuable import markets; in 2015 France's LNG imports made up 1.8 percent of the world's total, while Europe as a whole imported 15 percent of the world's exported LNG.[69] Where consumers don't want hydraulically fractured gas produced on their own land, they are also unlikely to want to purchase that same type of gas produced somewhere else.

VI. PIPELINE BUILDOUT AND LNG

Hydraulically fractured or otherwise, for natural gas to travel from the extraction site to a coastal terminal for liquefaction and export necessitates a maze of pipelines. This includes gathering pipelines that aggregate gas from wells, transmission pipelines that transport gas across long distances, and distribution pipelines that move gas into the terminal itself.[70] LNG export terminal buildout also engenders pipeline construction on the other end, where the imported gas must be piped to gas-fired power plants and consumers.

Many of the LNG export terminal applications on FERC's desk also involve plans to build new pipelines to service these terminals. For instance, Cheniere Energy is building a pipeline that would travel 23 miles to connect its LNG export terminal in Corpus Christi, Texas to other intrastate and interstate pipelines.[71] The application to build the Rio Grande LNG export terminal in Brownsville, Texas includes a proposal to construct two parallel pipelines 137 miles long to bring gas into the terminal, with three compressor stations along the way.[72]

New pipelines and increased usage of existing pipelines to support LNG export pose safety concerns across the impacted areas. Between 2010 and 2015, over 12.8 billion cubic feet of natural gas was released in the United States in nearly 700 gathering and transmission pipeline incidents.[73] In addition to the climate impacts of leaking methane, explained further below, aging infrastructure makes the system prone to explosions; 46 percent of natural gas transmission pipelines in the U.S. were built in the 1950s and '60s.[74] An explosion from a Kinder Morgan pipeline in Texas in August 2015 sent two locals to the hospital and forced the evacuation of 150 homes.[75] In April 2016, an underground pipeline exploded in Pennsylvania, sending a massive fireball into the air that seared the surrounding land and badly burned one man.[76]

Parallel to the movement against hydraulic fracturing, public opposition to pipeline construction is formidable. These projects can incite resistance for crossing tribal or private land, threatening local drinking water resources, and contributing to the global climate crisis. Opposition to the Keystone XL pipeline ultimately resulted in President Obama's rejection of the permit on climate grounds in November 2015.[77] In the summer of 2016, tribal protests against the Dakota Access Pipeline from North Dakota to Iowa have attracted nationwide attention and delayed construction on the $3.8 billion oil pipeline.[78] Analysis by Oil Change International found that further tar sands extraction is only plausible with new pipeline buildout, and yet "public support for climate action, and therefore opposition to export pipelines for the tar sands, has directly impacted the viability of expansion plans in the land-locked tar sands."[79]

An explosion from a Kinder Morgan pipeline in Texas in August 2015 sent two locals to the hospital and forced the evacuation of 150 homes.

The fervor is no less fierce when it is natural gas traveling through the pipeline; Spectra Energy's gas pipeline construction plans have sparked protests throughout the Northeastern United States. Activists have gone so far as to lock and glue themselves together in order to

block construction, while the city of Boston is appealing the decision of federal courts to allow Spectra to build the West Roxbury Lateral gas pipeline.[80]

This opposition, combined with recent instruction from the White House Council on Environmental Quality that FERC should analyze climate impacts of proposed pipelines, should come as a serious concern for an industry reliant on a growing network of pipelines.[81] Pipelines are an integral piece of the LNG export puzzle, as demonstrated by the Downeast LNG project planned for exporting gas out of Robbinston, Maine. This proposed project was shelved in August 2016 because of cancellation or lack of progress on the pipelines that would bring gas to the terminal. As Bloomberg Markets reported, "The suspension of the project also comes as pipeline developers in New England face opposition from environmentalists and plunging gas prices undermine the economics of their projects."[82]

One of the pipelines whose cancellation was key to the Downeast LNG terminal's demise was Kinder Morgan's Northeast Energy Direct natural gas pipeline, which would have been a link in the transfer of hydraulically fractured gas from Pennsylvania to the Northeastern coast for export.[83] The company faced intense public scrutiny and protest for these plans, where citizens were concerned with land clearing, eminent domain, compressor stations, and more. Activists staged multiple protests against the project, and when it was ultimately shelved, Massachusetts Senator Elizabeth Warren stated that the pipeline was unnecessary for the state's energy needs.[84]

The Jordan Cove LNG export project planned for Coos Bay, Oregon, is another whose fate was sealed by pipeline problems. In March 2016, FERC rejected an application from Veresen Inc. and Williams Partners to build the Jordan Cove LNG Export Terminal and the Pacific Connector Pipeline, respectively. The agency cited the pipeline company's inability to reach easement agreements with landowners, declaring that there was not a sufficient public need for the pipeline. This is what doomed the export terminal itself, because without a pipeline to feed in gas, there would be no demonstrable benefit of building the LNG export terminal.[85]

VII. CLIMATE RISKS OF LNG

For years, government and industry leaders in the U.S. have touted the climate benefits of natural gas as an energy source. The reason for these claims is that when it is burned for energy, methane — the main component of natural gas — releases half as much climate-warming carbon dioxide as does coal. Yet usage of less carbon-heavy fossil fuels still keeps the world on a dangerous warming trajectory; even foregoing coal, the world's currently operating oil and gas reserves would overshoot a 1.5 degree Celsius climate budget.[86]

Moreover, if natural gas leaks into the air without being burned, methane itself is an even more powerful greenhouse gas than carbon dioxide. When any small amount of methane escapes from rock explosions at a fracking well, an imperfectly sealed drill pipe, a leaky pipeline, or anywhere else along its way to a power plant, the gas traps much more heat in the atmosphere than carbon dioxide does, and it does so much more quickly. Over a 20-year timeframe, which is appropriate given the impending threat of climate change in the near-term,

methane is 84 to 87 times more potent than carbon dioxide in terms of damage to the climate.[87]

This means that natural gas becomes even worse for the climate than coal when there is a small amount of leakage anywhere along the natural gas pathway. Using the 20-year timeframe, it takes only 2.4 to 3.2 percent leakage to erase any climate benefits of generating electricity from natural gas over coal.[88] And while it is understandably difficult to exactly measure how much of the invisible, odorless gas escapes along the entire process, an academic review of the best available scientific data found that up to 5 percent of the gas probably leaks out before it is burned.[89]

Recent examples show the danger of unleashing this potent greenhouse gas as well as the difficulty in plugging leaks; the aforementioned Aliso Canyon in California became the biggest leak in U.S. history when it was finally plugged after four months, but by that time it had already released the equivalent of greenhouse gas emissions from 572,000 cars.[90] Methane leakage has recently come into the spotlight as a key problem to solve in order to address climate change; in May 2016, the Obama administration put forth new regulations to limit fugitive methane emissions from oil and gas production, the first of its kind.[91]

The break-even estimates over which natural gas is worse for the climate than coal are based on domestic gas use, so they do not even take into account the extra energy intensity — and therefore extra climate impact — of the liquefaction, ocean transport, and regasification processes necessary for exported LNG to be used as a fuel abroad. These processes take a large amount of energy, and because of this, LNG is the most carbon-intensive form of natural gas. The DOE found that when shipping LNG from New Orleans to Europe, these extra steps nearly double the carbon intensity of energy produced from natural gas.[92] The same government study found that when LNG travels this distance, it takes just 1.9 percent of the gas escaping to make it worse than coal power for the climate. Shipping LNG to Asia is even more energy intensive; just 1.4 percent leakage makes LNG worse than coal. These numbers use the 20-year warming timeframe, but even with a very conservative approach comparing the difference over 100 years, it takes only about 5 percent leakage for exported LNG to cause more climate damage than coal. Some studies calculate that this leakage amount is already occurring.[93]

Using the 20-year timeframe, it takes only 2.4 to 3.2 percent leakage to erase any climate benefits of generating electricity from natural gas over coal.

Scientists continue to study the difficult-to-measure methane leakage issue, but perhaps even more concerning is the potential for the construction of LNG terminals to lock the world into fossil fuel usage for the long term, delaying truly clean energy, instead of acting as a so-called “bridge” to renewables. As Jeff Currie, global head of commodities research at Goldman Sachs, said, "the economic viability of a lot of the renewables are getting killed because we have too much gas in the world right now."[94] Similarly, Achim Steiner, former head of the United

Nations Environmental Programme, voiced a warning that the switch from coal to natural gas could turn out to be "a liability" to global efforts to stem climate change, noting, "if it turns into a 20- to 30-year delay to making the transition towards real low-carbon and zero-emission energy matrixes then I think it could actually become a distraction and in that sense slow down our efforts."[95] The International Energy Agency also found in 2011 that widespread global adoption of gas "could muscle out low-carbon fuels," and would still result in the earth's temperatures rising 3.5 degrees Celsius.

VIII. FINANCIAL SECTOR EXPOSURE TO LNG

LNG Export League Table: January 1, 2013 – September 30, 2016

Rank	Company	Exposure
1	JPMorgan Chase	$45.08 Billion
2	Bank of America	$40.13 Billion
3	Barclays	$40.10 Billion
4	Citigroup	$37.94 Billion
5	Morgan Stanley	$29.98 Billion
6	Mitsubishi UFJ Financial	$23.35 Billion
7	HSBC	$23.03 Billion
8	Wells Fargo	$20.77 Billion
9	Deutsche Bank	$19.99 Billion
10	BNP Paribas	$19.36 Billion
11	Goldman Sachs	$17.11 Billion
12	RBS	$16.66 Billion
13	Mizuho Financial	$16.01 Billion
14	Scotiabank	$12.98 Billion
15	RBC	$12.03 Billion
16	Credit Suisse	$10.70 Billion
17	Société Générale	$9.79 Billion
18	Crédit Agricole	$7.81 Billion
19	Sumitomo Mitsui Financial	$7.75 Billion
20	UBS	$6.90 Billion
21	TD Bank	$4.89 Billion
22	Lloyds Bank	$4.02 Billion
23	Santander	$3.66 Billion
24	U.S. Bank	$3.33 Billion
25	ING	$3.08 Billion

Rank	Company	Exposure
26	BBVA	$2.96 Billion
27	Intesa Sanpaolo	$2.74 Billion
28	DNB ASA	$2.39 Billion
29	Bank of Montreal	$2.23 Billion
30	SunTrust Robinson Humphrey	$2.11 Billion
31	Natixis	$2.10 Billion
32	Standard Chartered Bank	$1.80 Billion
33	CIBC	$1.54 Billion
34	ICBC	$1.29 Billion
35	CIMB	$1.28 Billion
36	Commerzbank	$1.28 Billion
37	Commonwealth Bank	$1.14 Billion
38	UniCredit	$1.02 Billion
39	ABN AMRO Bank	$0.94 Billion
40	Maybank	$0.92 Billion
41	Export-Import Bank of Korea	$0.6 Billion
42	PNC Financial	$0.55 Billion
43	Axis Bank	$0.49 Billion
44	Danske Bank	$0.45 Billion
45	KeyBanc Capital Markets	$0.45 Billion
46	KBC Bank	$0.42 Billion
47	Crédit Mutuel	$0.40 Billion
48	Westpac	$0.40 Billion
49	AmInvestment Bank	$0.36 Billion
50	ANZ	$0.36 Billion

Note: This league table compiles each bank's total involvement in corporate lending and underwriting transactions (debt and equity issuance) with the 42 companies from the table below whose financial information is accessible in the Bloomberg database.

Companies with Over 0.5 Billion Cubic Feet per Day (Bcfd) of Attributable LNG Export Capacity in Proposed or Existing Terminals in North America

Rank	Company	Bcfd
1	Cheniere Energy, Inc.	7.04
2	ExxonMobil Corporation	5.61
3	Venture Global LNG	4.81
4	Canada Stewart Energy Group Ltd.	4.04
5	Tellurian Investments	4.00
6	Woodside Petroleum Ltd.	3.86
7	Steelhead LNG Corporation	3.77
8	Orca LNG Ltd.	3.68
9	NextDecade LLC	3.60
10	Freeport-McMoRan, Inc.	3.22
11	Sempra Energy	3.16
12	Kitsault Energy Ltd.	3.11
13	Rockyview Resources, Inc.	3.02
14	Royal Dutch Shell, plc	2.93
15	State-owned Assets Supervision and Administration Commission of the State Council (People's Republic of China)	2.88
16	Freeport LNG Development LP	2.86
17	Petroliam Nasional Bhd	2.74
18	Energy Transfer Family	2.20
19	Hiranandani Developers Pvt Ltd	2.07
20	Veresen Inc.	2.00
21	G2 LNG LLC	1.84
22	New Times Energy Ltd.	1.84
23	Fairwood Peninsula Energy Corporation	1.80
24	Barca LNG LLC	1.60
25	Eos LNG LLC	1.60

Rank	Company	Bcfd
26	Southern California Telephone Company	1.60
27	Liquefied Natural Gas Ltd.	1.58
28	Qatar Petroleum	1.47
29	Spectra Energy Corporation	1.46
30	Pieridae Energy Canada Ltd.	1.33
31	Inpex Corporation	1.17
32	Mitsubishi Corporation	1.14
33	Kinder Morgan	1.10
34	Cambridge Energy Group Ltd.	1.07
35	ConocoPhillips Company	0.97
36	Exelon Corporation	0.94
37	Parallax Energy LLC	0.94
38	Freestone Capital LLC	0.90
39	Breyer Capital LLC	0.90
40	Haisla Nation	0.83
41	Dominion Resources, Inc.	0.82
42	Korea Gas Corporation	0.74
43	Chevron Corporation	0.64
44	State of Alaska	0.64
45	Mitsui & Co., Inc.	0.58
46	ENGIE	0.58
47	WesPac Midstream LLC	0.56
48	Texas LNG LLC	0.55
49	BP plc	0.51

IX. CONCLUSIONS AND RECOMMENDATIONS

LNG export terminals are capital-intensive, financially risky, and environmentally destructive. Financial institutions that provide loans to construct these projects, as well as underwriting or general corporate loans for companies engaged in building LNG terminals, share responsibility for the impacts of these facilities. These are impacts that span people and ecosystems across the continent: communities around the terminal site, communities at the point of extraction, and communities along pipeline routes. By financing practices that are incompatible with a climate-stable future, banks are positioning their businesses in opposition to the global agreement to address the climate crisis, which was signed by President Obama in September of 2016.[96]

Thus, we call on banks to adopt a firm public policy that prohibits financing for LNG export projects, as well as for companies engaged in export terminal construction or operation.

Such a policy would protect banks from the financial risks of doubling down on LNG export in a shifting market, as well as the reputational risk of backing projects so disastrous for local communities and ecosystems. Additionally, staying away from LNG export finance would ensure that banks refrain from financing companies and projects that pose existential risks to coastal communities threatened by sea level rise from climate change.

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