

Answering Questions about Liquefied Natural Gas (LNG) A Fact Sheet by Americans Against Fracking, April 2014

What is LNG? Liquefied Natural Gas (LNG) is methane in the form of a bubbling, super-cold liquid. (By contrast, Compressed Natural Gas is highly pressurized methane vapor.) Chilling natural gas to its liquid state shrinks its volume by a factor of 600 and allows for its transportation to places where pipelines do not run. LNG is the form that natural gas takes when it is exported overseas on tanker ships. To a lesser extent, LNG is used as vehicle fuel in, for example, long-haul trucks.

How is LNG made? Through a cryogenic process called “liquefaction,” methane is turned to liquid at - 259 degrees F. An LNG export terminal typically requires its own power plant to generate the immense energy so required to achieve this ultra-low temperature.

How are low temperatures maintained during storage and transport? Contained in Thermos bottle-like tanks, LNG stays cold through insulation, refrigeration, and evaporative cooling. As the liquid methane inside slowly warms up, some of it vaporizes. This gas is vented to maintain the remaining liquid at - 259 degrees F and to prevent explosions. That is, LNG tanks leak methane gas *by design*. Smaller tanks sweat methane directly into the atmosphere. Some larger tanks are engineered to capture the boiled-off gas and reuse it, but this not a leak-proof process.

What happens after LNG arrives at its destination? Before it is used or sent down a pipeline, LNG must be re-vaporized in a regasification terminal. Regasification is also energy intensive, requires massive infrastructure, and includes periodic methane flaring to control pressure.

Is LNG safe? If LNG spills into water, it explodes. If LNG spills on the ground, it turns into rapidly expanding clouds of vaporizing methane that can asphyxiate by displacing oxygen and flash-freeze human flesh.¹ If ignited at the source, these vapors become flaming “pool fires” that burn hotter than other fuels and cannot be extinguished.² Drifting in the wind, an ignitable vapor cloud can threaten large populations. Highly volatile LNG cannot be odorized, so there is no warning of a leak. The ongoing prohibition on LNG facilities in New York State was the result of a deadly explosion in 1973 that blew apart an empty LNG tank in Staten Island and killed 40 people.³

Is LNG climate friendly? Refrigeration, venting, leaks, and flaring make LNG 30 percent more energy intensive than conventional natural gas. The carbon footprint of LNG is at least as bad as coal and, when used as vehicle fuel, worse than diesel.⁴

¹ U.S. Dept. of Transportation, Federal Transit Administration, *Summary Assessment of the Safety, Health, Environmental and System Risks of Alternative Fuel*, April 1999, http://ntl.bts.gov/lib/000/400/422/20021101_alt_fuel.pdf.

² Congressional Research Service, *Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress*, 9 Sept. 2003, http://www.energy.ca.gov/lng/documents/CRS_RPT_LNG_INFRA_SECURITY.PDF.

³ K. Paulsen, “40 Years Ago: Staten Island LNG Explosion Killed 40 Workers,” *Staten Island Advance*, 10 Feb. 2013. http://www.silive.com/news/index.ssf/2013/02/40_years_ago_today_staten_isla.html.

⁴ P. Jaramillo et al., “Comparative Life-Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation,” *Env. Science & Tech.* 41 (2007): 6290-6296, <http://pubs.acs.org/doi/abs/10.1021/es063031o>; A.R. Brandt et al., “Methane Leaks from North American Natural Gas Systems,” *Science* 342 (Feb. 2014): 733-35. <https://www.sciencemag.org/content/343/6172/733.summary>.

Do LNG facilities create toxic pollution? LNG plants discharge wastewater laced with mercury and toxic hydrocarbons.⁵ And before the gas is liquefied, it must be purged of freezable benzene. In New Brunswick in fall 2013, 7,500 migrating songbirds were killed in a single night while flying over an LNG facility that was flaring off gas.⁶ In San Diego, LNG vehicle fuel has contributed to smog.⁷ In Australia, LNG plants are responsible for nitrogen dioxide emissions that exceed safe limits.⁸

How is LNG connected to fracking? LNG facilities encourage fracking by creating storage for the glut of gas that fracking has created, by enabling its export, and by driving up prices and profit margins.⁹ The gas industry views fracking and LNG as intimately related.¹⁰ LNG is fracked gas made liquid.

Is LNG a security threat? LNG tanks and ships are terrorist targets, with Al-Qaeda showing specific interest. In its 2008 report, *Liquefied Natural Gas (LNG) Infrastructure Security*, the Congressional Research Service warned, “LNG infrastructure is inherently hazardous and potentially attractive to terrorists....Local officials...have challenged numerous LNG infrastructure proposals on the grounds that they may represent an unacceptable risk to the public.” If an LNG tanker ship lost ten percent of its cargo and the resulting three million gallon spill of LNG ignited, the flaming vapor cloud created could extend for three miles—and burn human flesh a mile beyond that. LNG ships and terminals require security zones, gunboat escorts, and intense surveillance.¹¹

What are the alternatives? Erecting LNG export terminals—each one of which costs billions of dollars—will further entrench long-term, world-wide dependency on fossil fuels during a time of climate crisis. Instead, we should invest in infrastructure for renewable energy, which offers both energy independence and security. Mark Jacobson at Stanford University, with colleagues at Cornell, has provided us such a blueprint in the form of a plan to derive all of the nation’s energy from wind, water, and sunlight while creating sustainable jobs and energy price stability.¹²

⁵ International Finance Corporation, “Environmental, Health, and Safety Guidelines for Liquefied Natural Gas (LNG) Facilities,” 30 April 2007, <http://www.ifc.org/wps/wcm/connect/87e7a48048855295ac04fe6a6515bb18/Final%2B-%2BLNG.pdf?MOD=AJPERES&id=1323161924903>.

⁶ CBC News, “7,500 Song Birds Killed at Canaport Gas Plant in Saint John,” 18 Sept. 2013. <http://www.cbc.ca/news/canada/new-brunswick/7-500-songbirds-killed-at-canaport-gas-plant-in-saint-john-1.1857615>.

⁷ ABC News, “Pollution Fears Aired Over Curtis Island LNG Plant Approval,” 8 Oct. 2013, <http://www.abc.net.au/news/2013-10-08/pollution-fears-aired-over-curtis-island-lng-plant-approval/5008422>; O.R. Soto, “Gas From Afar Pollutes Here, Critics Say – County Officials Concerned that Use of LNG Will Lead to More Smog in Region,” *San Diego Union-Tribune*, 13 Jan. 2011. <http://www.utsandiego.com/news/2011/jan/13/gas-from-afar-pollutes-here-critics-say/all/?print>.

⁸ E. Gramenz, “Pollution Fears Aired Over Curtis Island LNG Plant Approval,” ABC News, 8 Oct. 2013. <http://www.abc.net.au/news/2013-10-08/pollution-fears-aired-over-curtis-island-lng-plant-approval/5008422>.

⁹ N. Klein, “Why US Fracking Companies are Licking Their Lips Over Ukraine,” *The Guardian*, 10 April 2014. <http://www.theguardian.com/commentisfree/2014/apr/10/us-fracking-companies-climate-change-crisis-shock-doctrine>.

¹⁰ D. Kashi, “Fracking Gas Boom in US: ‘How New England Seeks US LNG Exports to Help Lower Natural Gas Prices,’” *International Business Times*, 1 Oct. 2013. <http://www.ibtimes.com/fracking-gas-boom-us-how-england-seeks-us-lng-exports-help-lower-natural-gas-prices-1413186>.

¹¹ Council on Foreign Relations, “Liquefied Natural Gas: A Potential Terrorist Target?” 27 Feb. 2006. <http://www.cfr.org/natural-gas/liquefied-natural-gas-potential-terrorist-target/p9810>; CRS Report for Congress, *Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress*, 9 Sept. 2003. <https://www.hsdl.org/?view&did=486464>; Sierra Club, Oregon Chapter, “Stop Liquefied Natural Gas.” <http://oregon.sierraclub.org/goals/lng.asp>; U.S. Government Accountability Office, “Maritime Security: Public Safety Consequences of a Terrorist Attack on a Tanker Carrying Liquefied Natural Gas Need Clarification,” GAO-07-316, 22 Feb. 2007. <http://www.gao.gov/products/GAO-07-316>.

¹² M.Z. Jacobson et al., “The Solutions Project.” <http://thesolutionsproject.org>.