The Climate Impacts of Liquefied Natural Gas

Excerpted from "Liquid Natural Gas: A Roadblock to a Clean Energy Future," published by Greenpeace, September 2004.

LNG uniquely increases the emissions of CO_2 into the atmosphere. The composition of natural gas emissions are identical whether it has been converted to LNG or burned straight from gas. However, the processes necessary to convert and transport LNG are energy intensive. As shown in Table 1, the process of converting natural gas into a liquid, transporting it across the Pacific Ocean, and then returning it to its gaseous form, known collectively as the "LNG supply chain," requires an increased natural gas consumption of 18-22 percent.[1] An additional 11 to 18 percent increase in CO_2 emissions is likely to occur because of high CO_2 content in the raw source gas being converted to LNG and exported to California or Mexico.[2] The CO_2 in the source gas may be vented to atmosphere during processing.

The combined impact of venting CO_2 during processing and the energy penalty of the LNG supply chain would increase CO_2 emissions by roughly 20 to 40 percent over California's current emissions from domestic sources of natural gas (see Table 1). This increase significantly closes the gap between coal and natural gas with respect to global warming gases.

Table 1. Transportation of liquid natural gas to California would significantly increase greenhouse gas emissions

Process Step	Additional Gas Use (Percent)
Domestic Natural Gas	Basecase
Liquification	9 – 10
Transport	7 – 9
Regasification	2 – 3
Carbon Dioxide in Gas	0 – 18
Total Additional Gas Consumed	**18 – 40**

Source: Powers Engineering 2004, June 1, 2004 Global LNG Summit presentation.

The coal industry claims that LNG increases gas consumption by 30 percent[3] over natural gas for the liquefaction and regasification alone which is nearly three times the Powers Engineering estimate. The discrepancy stems from the age and thus efficiency of the LNG infrastructure. The Powers Engineering study assumes the most efficient

[1]. B. Powers, July 6, 2004 PowerPoint presentation to CalEPA, Sacramento.
2. Both the Gorgon gas field (NW Australia, source of ChevronTexaco LNG) and the Tangguh gas field (Indonesia, source of Sempra/Shell LNG) are high in CO_2.
[3] Coal Industry: Utility Fax Alert #681, July 9, 2004.

technology available, while the coal industry used the current condition of plants when conducting its study.

The net result of the increase in global warming emissions is that natural gas power plants burning high CO_2 natural gas that has been shipped as LNG to California would have a global warming impact that falls in-between coal and domestic natural gas (see Table 2). In other words, LNG power plants will only reduce global warming pollution by about half as much as domestically produced natural gas versus current electricity from coal. Given the tremendous worldwide reserves of natural gas that could be shipped to California for decades, the emissions are significant.

Table 2. Liquid natural gas power plants

Power Plant Type	Global Warming Gas Pollution
Natural gas – low CO_2 domestic gas	400 g/Kwh
Liquid Natural Gas	480 g/Kwh
Liquid Natural Gas – high CO_2 (a)	560 g/Kwh
Coal – Advanced IGCC	660 g/Kwh (b)
Coal – pulverized coal	770 to 830 g/Kwh (c)

Source: http://www.ieagreen.org.uk/sr1p.htm

(a) Assumes a 40 percent increase in CO2 emissions, see above.

(b) Three demonstration integrated gasification combined cycle (IGCC) plants exist in the U.S. Gasification plants turn coal into gas, and are touted as the next generation of coal-burning power plants, but have not been embraced by industry. Assumes a 50 percent thermal efficiency.

(c) Half of U.S. electricity is generated from pulverized coal. Assumes 40 – 43 percent efficiency.

Because of the comparable emissions of both LNG and coal power plants, renewable energy and conservation investments are much more effective in slowing global warming and produce a multitude of co-benefits. California's natural gas demand can be reduced by 2,300 mmcfd through conservation and renewable energy measures, avoiding the emission of 100 billion pounds of CO_2 per year. This would reduce California's natural gas consumption by a third, and the equivalent of removing more than 10 million passenger cars per year from the road.[4]

[4] Environmental Protection Agency (assumes auto emissions of 10,000 pounds of CO_2 per year).