

Environmental Benefits of U.S. LNG

Update to the Life-Cycle Analysis of GHG Emissions for U.S. LNG Exports

OVERVIEW

The American energy revolution allowed the U.S. to transition away from coal to cleaner natural gas while reducing emissions to generational lows. Thanks in part to the growth of U.S. energy exports over the past few years, natural gas continues to expand as a global energy source, providing 22 percent of the world's energy demand in 2018. However, global coal demand is still increasing in many countries. China continues to invest in existing and new coal mines, accounting for two-thirds of global investment on new coal supply, while India recently hit their highest coal production level in March 2020.¹

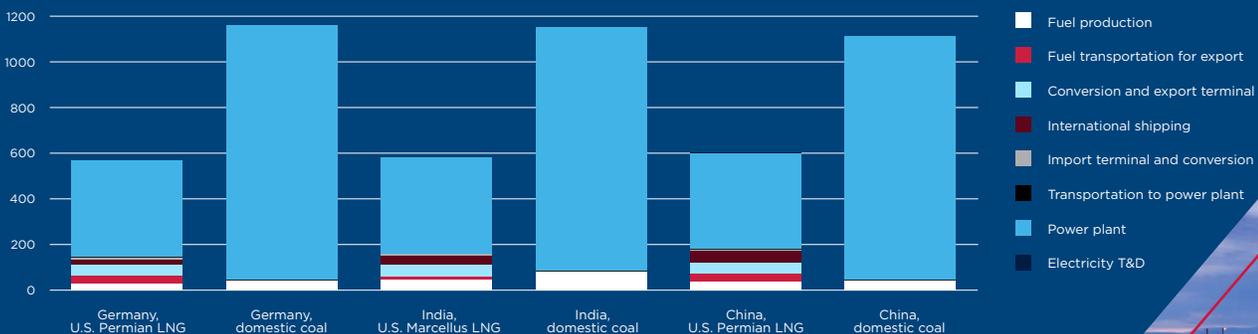
U.S. LNG exports represent an opportunity for other nations to transition away from coal to a cleaner fuel, a critical step toward reducing emissions and addressing the global challenge of climate change. This study by ICF examines the environmental benefits of switching from coal to natural gas by estimating greenhouse gas emissions from the use of U.S. LNG for electricity generation for a few select regions around the world and comparing GHG emissions from the LNG-to-power supply chain to those from coal-to-power.

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NATURAL GAS AND COAL FIRED LCA EMISSIONS

CO₂e kg/MWh delivered to consumer



SOURCES:

¹ <https://www.iea.org/reports/world-energy-investment-2020/fuel-supply#abstract>



PERCENTAGE DECREASE IN EMISSIONS FROM THE USE OF U.S. LNG VERSUS U.S. AND DOMESTIC COAL

In China:

49%

fewer

emissions than U.S. coal and 48 percent fewer emissions than Chinese coal

In Germany:

53%

fewer

emissions than U.S. coal and 51 percent fewer emissions than German coal

In India:

48%

fewer

emissions than U.S. coal and 48 percent fewer emissions than Indian coal

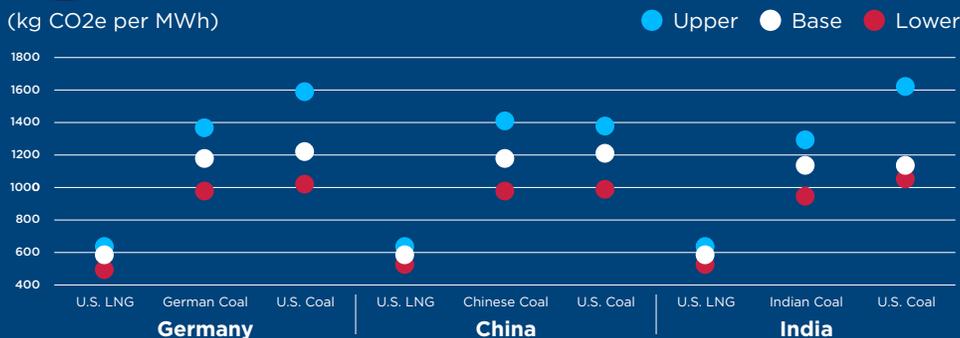
1/10

Export/import terminal operations and transportation each account for about 1/10 of total GHG supply chain emissions of U.S. LNG



COMPARISON OF GHG LCAS FOR POWER MARKET

(kg CO₂e per MWh)



STUDY CONCLUSIONS

The ICF study, which looked at cases in Germany, China and India, found that using U.S. LNG or imported pipelined gas for electricity generation produces on average 50.5 percent lower GHG emissions than electricity from coal in all base case scenarios studied — this includes carbon emissions from the fuel combustion itself, as well as carbon dioxide, methane, nitrous oxide and other GHGs emitted during the construction and operation of all related fuel supply chain and power plant infrastructure. This provides a clear picture of life-cycle emissions for natural gas-powered electricity and demonstrates the importance of natural gas for achieving global emissions reductions particularly in Europe and Asia, where many countries have not yet transitioned power generation away from coal. In China, coal still makes up 66 percent of power generation — in India, it's 74 percent, and also in Germany it also remains stubbornly high — nearly 30 percent.^{2,3} Coal generation in the U.S. has fallen from roughly 50 percent in 2005 to 24 percent in 2019, while natural gas generation has increased from 19 percent to nearly 40 percent in the same period.⁴ Transitioning to natural gas is a viable, affordable and realistic path for countries to continue meeting growing energy needs while slashing emissions and reducing the risks of climate change.

The study also found transportation and shipping distance have the least impact on emissions levels in the supply chain, demonstrating that the export journey for US LNG has a limited environmental impact.

SOURCES:

² <https://www.iea.org/reports/world-energy-outlook-2019>

³ https://www.energy-charts.de/energy_pie.htm?year=2019

⁴ <https://www.eia.gov/electricity/data/eia923/>



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METHODOLOGY:

Emissions estimates were calculated for each segment of the supply chain, and all estimates include fugitive and vented emissions during operations and emissions from combustion products, construction material, and transportation. Scenarios were based on fuel source origins, different global warming potentials for methane, and different efficiencies for power plants, export/import terminals, and transportation. Fuel source origins include natural gas produced in U.S. (Marcellus and Permian), Australia, and Mozambique; natural gas pipelined from Russia; and German, Chinese, and Indian coal, along with coal imported from the U.S.

Estimates for the LCA of LNG were roughly 6% lower than the NETL 2014 study which found that US LNG was 44% to 28% lower, due to changes in methodology and use of more recent data. Updates to NETL methodology include new estimates for upstream and pipelines emissions based on methane releases from new wells and gathering systems, higher gas well productivities, and updated efficiency rates for large liquefaction plants.