

# Is replacing coal with natural gas actually good for the climate?

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Credit: Grant Wilson/public domain

Just ten years ago, around half of all electricity generation in the U.S. was powered by coal. Today, that number has dropped to one third. Over that same time period, electricity generation powered by natural gas has jumped from around 20% to 33%. This trend is expected to continue, with natural gas becoming the primary way that Americans get their electricity. And while we know that natural gas emits less carbon dioxide than coal, that doesn't mean that other emissions related to the production natural gas, such as methane, aren't just as damaging to the environment. In fact, a large body of work over the

last 5 years highlights that natural gas' methane emissions can limit the climate benefits replacing coal with natural gas.

To add to the understanding of whether or not natural gas really is better for the environment than [coal](#), researchers from Carnegie Mellon University's department of Engineering and Public Policy have conducted a new evaluation of natural gas' methane emissions and the comparative climate benefits of using natural gas instead of coal for electricity generation.

"The results indicate that new natural gas combined cycle plants could have lower climate impacts than new coal plants, as long as methane leakage rates are not extremely high," says EPP Ph.D. student DeVynne Farquharson, the paper's lead author.

Farquharson, along with co-authors EPP's Associate Professor Paulina Jaramillo, Research Scientist Kelly Klima, and Post-doctoral Fellow Derrick Carlson, and CEE's Assistant Professor Constantine Samaras and Ph.D. student Greg Schivley, modeled the life cycle of carbon dioxide and methane emissions from a new pulverized coal plant, a new natural gas combined cycle plant, and a new ultra-supercritical pulverized coal plant, with and without carbon capture sequestration (CCS). Using this model, the team measured the climate impacts of each over a 100-year span, while also evaluating the effects of a variety of methane leakage rates, ranging from 1% to 5% of natural gas produced.

While previous studies have been conducted on the pros and cons of natural gas, "Beyond global warming potential: a comparative application of climate impact metrics for the life cycle assessment of coal and natural gas based electricity," published in the August issue of the *Journal of Industrial Ecology*, differs from previous work in that it uses four different climate metrics in its evaluation of coal and natural gas emissions: global warming

potential, cumulative radiative forcing, technology warming potential, and global temperature change potential.

"Without CCS, all metrics indicate that natural gas combined cycle plants with methane leakage rates below 8.5% have a lower climate impact than pulverized coal plants or ultra-supercritical pulverized coal plants over 100 years," Farquharson explains. "However, with the inclusion of CCS, pulverized coal plants and ultra-supercritical pulverized coal plants would have lower climate impacts than natural gas plants with CCS if methane leakage rates exceed 2% of the natural gas the plant uses."

But just because natural gas isn't as bad as coal, that doesn't make it "good."

"Our results suggest that a new natural gas plant would likely have lower climate impacts than a new coal plant, even after we account for methane leakage from the natural gas sector," says Farquharson. "However, deep decarbonization of the power sector would likely require a radical shift from fossil fuels, including natural gas."

It's coal vs. natural gas in the fight for "Least Negative Impact" on the climate.

**More information:** Farquharson, D., Jaramillo, P., Schivley, G., Klima, K., Carlson, D. and Samaras, C. (2016), Beyond Global Warming Potential: A Comparative Application of Climate Impact Metrics for the Life Cycle Assessment of Coal and Natural Gas Based Electricity. *Journal of Industrial Ecology*. [DOI: 10.1111/jiec.12475](https://doi.org/10.1111/jiec.12475)

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