

Exporting US coal to Asia could drop emissions 21 percent

August 19 2014

Under the right scenario, exporting U.S. coal to power plants in South Korea could lead to a 21 percent drop in greenhouse gas emissions compared to burning the fossil fuel at plants in the United States, according to a new Duke University-led study.

"Despite the large amount of emissions produced by shipping the [coal](#) such a long distance, our analysis shows that the total emissions would drop because of the superior energy efficiency of South Korea's newer coal-fired power plants," said Dalia Patiño-Echeverri, assistant professor of energy systems and public policy at Duke.

For the reduction to occur, U.S. plants would need to replace the exported coal with natural gas. And in South Korea, the imported coal must replace other coal as the power source. However, if imported U.S. coal were to replace natural gas or nuclear generation in Korea, the emissions produced per unit of electricity generated would increase, Patiño-Echeverri said.

"This significant difference in results highlights the importance of analyzing domestic energy policies in the context of the global systems they affect," Patiño-Echeverri said.

Stricter emissions requirements on coal-fired power plants, together with low [natural gas](#) prices, have contributed to a recent decline in the use of coal for electricity generation in the United States, she said. Faced with a shrinking domestic market, many coal companies are taking advantage

of a growing export market. U.S. coal exports hit an all-time high in 2012, fueled largely by demand in Asia. U.S. coal exports to Asian countries have tripled since 2009.

Patiño-Echeverri and her colleagues published their findings this month in the peer-reviewed journal *Environmental Science & Technology*.

To conduct their analysis, they performed lifecycle air-emissions and economic assessments of two scenarios: a business-as-usual scenario in which the coal continues to be burned domestically for power generation at [power plants](#) in the U.S. Northwest after they have been retrofitted to meet EPA emissions standards, and an export scenario in which the coal is shipped to South Korea. For the export scenario, they focused on the Morrow Pacific Project being planned in Oregon by Ambre Energy. Under the project, Ambre would ship 8.8 million tons of Powder River Basin coal each year to Asian markets using rails, river barges and ocean vessels.

In the export scenario, emissions of "equivalent carbon dioxide"—a scientific measure of the coal emissions' total global warming potential over a 100-year period—dropped 21 percent.

Other harmful emissions, including sulfur dioxide, nitrogen oxide and particulate matter, dropped similarly.

"In addition to these benefits, our analysis shows that the export scenario would generate more than \$25 billion in direct and indirect economic activity in the United States," Patiño-Echeverri said. "It would also directly or indirectly create nearly \$6 billion in total employee compensation, \$742 million in new tax revenues, and roughly \$4.7 billion in profits for all sectors involved."

Promising though these results are, "it's too early to give the export

scenario an unequivocal green light," she said.

Further studies are needed to assess the export scenario's full environmental impacts, including water use, land use, the loss or degradation of vital fish and wildlife habitats, and risks associated with extraction and wastewater disposal of U.S. shale gas deposits. And there's still some fine tuning to do on the economic end.

Patiño-Echeverri said the team's projections are limited in precision due to the fact that the Morrow Pacific Project is in a permitting stage, and many of its operational and financial details are still unknown. As more specific information about the project is released, calculations can be updated to present a clearer picture of the impacts the project may have on the U.S. energy system and global environmental conditions.

"It's important to note that this is just one scenario. The export of coal to different markets, under different conditions, might yield very different results," Patiño-Echeverri said. "Our work does not provide a carte blanche for all energy export projects, but it does give us a framework for comparing their impacts and making smarter economic and environmental policy decisions."

Support for the study came from the Center for Climate and Energy Decision Making (SES-0949710), which is funded by the National Science Foundation.

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She conducted the study with Barrett Bohnengel, a 2013 master's degree graduate of both Duke and the University of North Carolina at Chapel Hill, and Joule Bergerson, assistant professor of chemical and petroleum engineering at the University of Calgary.

More information: "Environmental Implications of United States Coal Exports: A comparative Life Cycle Assessment of Future Power System Scenarios," by Barrett Bohnengel, Dalia Patiño-Echeverri and Joule Bergerson. *Environmental Science & Technology*, July 15, 2014. pubs.acs.org/doi/abs/10.1021/es5015828

Provided by Duke University

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