

# Coal-to-gas transition alters Pennsylvania water consumption

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Extraction of coal and natural gas and power generation from both fuels contributed to a yearly 2.6 to 8.4 percent increase in water consumption in Pennsylvania during the early stages of the coal-to-gas transition from 2009-12.

However, impacts varied across the state as some areas experienced no change or large decreases in water consumption, according to a new working paper examining the water implications of Pennsylvania's energy extraction and [generation](#) choices.

Co-authored by researchers at Duke University's Nicholas Institute for Environmental Policy Solutions, the University of Calgary, and the Belfer Center for Science and International Affairs at Harvard University, the study estimates monthly water consumption associated with fuel extraction and [power generation](#) within Pennsylvania watersheds using available data from 2009 to 2012.

It also provides the first comprehensive representation of changing water consumption patterns associated with the state's coal-to-gas transition at the sub-basin level. The sub-basins in this study average 3,100 square kilometers, a much finer scale than the entire Susquehanna River Basin in Pennsylvania which is 71,000 square kilometers.

"We found that while more water is being consumed in Pennsylvania for [natural gas](#) energy extraction and production—roughly equivalent to water use in a town the size of 61,000 – coal is being used less, so less

water is being used for its extraction and generation," said Lauren Patterson, a policy associate at the Nicholas Institute and the study's lead author. "These findings show how examining both energy extraction and generation sectors, as well as zooming down to a scale even smaller than the state level, can aid decision-makers in defining consumption impacts as a result of the coal-to-gas transition."

The paper combines publically available location data from the Pennsylvania Department of Environmental Protection, FracFocus, the Mine Safety and Health Administration and the U.S. Energy Information Administration to estimate water consumption related to both energy extraction and electricity generation at a finer scale than previous studies.

The study found that water consumption varied widely depending on the presence of natural gas resources and power generating infrastructure. During the four-year period, water consumption increased 67 percent for natural gas generation, particularly around the metropolitan region of Philadelphia and Pittsburg, while water used for hydraulic fracturing increased over time in southwest and northeast Pennsylvania.

Water consumed by coal power, on the other hand, decreased 13 percent in the four years. And in some areas of the state, increased water use from hydraulic fracturing was offset by the decrease in water consumption for power generation as plants switched from coal to natural gas.

"Our work provides a case study demonstrating the importance of accounting for the linkages between different production sectors to understand the impacts of technology developments on the environment," said Laura Diaz Anadon, of the Belfer Center for Science and International Affairs at the Harvard Kennedy School and the University College London's Department of Science, Technology,

Engineering and Public Policy. "The difficulty we had estimating the magnitude of [water consumption](#) changes in Pennsylvania for the fuel extraction and conversion industries in the recent past also provides an indication of how hard, but necessary, it is to do this prospectively."

**More information:** L.A. Patterson, S.M, Jordaan, and L.D. Anadon. 2016. "A Spatiotemporal Exploration of Water Consumption Changes Resulting from the Coal-to-Gas Transition in Pennsylvania." Nicholas Institute Working Paper 16-01. Durham, NC: Duke University. [nicholasinstitute.duke.edu/wat...-coal-gas-transition](https://nicholasinstitute.duke.edu/wat...-coal-gas-transition)

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