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Natural Gas for Electricity

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-PSIEE Highlights

Although the U.S. currently has the ability to generate up to 40 percent of its electricity from natural gas, the U.S. typically uses only about 20 percent of that capacity ? most of the country?s electricity is produced from coal.

?We have a lot of gas capacity that we don?t use very often. But at the same time, the price of natural gas really drives the prices in electricity markets,? Seth Blumsack, assistant professor of energy and mineral engineering explains. Since the coal and nuclear demand is pretty stable, natural gas is the wild card, used to fill the fluctuating demand that coal and nuclear can?t meet. However, current regulations and simple economics make it clear that natural gas use is likely to rise.

?The future of the electricity system and reliability of markets, are all of a sudden hinged on natural gas,? Blumsack reports. As the U.S. looks to add more renewable sources to its energy portfolio the reality is that electricity can?t be stored in large volumes at an economical cost. In order to balance the natural variability in wind and solar power, resources are needed on the grid to offset those fluctuations. Since gas-fired power plants can ramp up and down relatively quickly, natural gas is an obvious complement to wind and solar power.

At the same time, the federal government is increasing the number of environmental constraints on coal emissions, which may cause large amounts of coal-fired generation to shut down. The nuclear power sector is hampered by high construction costs, declining electricity prices and perceptions over safety issues. Natural gas is the only real alternative for the ?base load? power plants need to maintain the reliability of the electric system.

Blumsack, who calls himself an energy systems economist, researches the large-scale systems and networks that provide us with energy. He studies factors such as economic impact, environmental issues, and risk associated with energy technologies. Most of Blumsack?s research is related to the electricity industry and that?s what first led him to look at natural gas and the impact of the Marcellus shale drilling.

?The types of projects that really interest me are on the economics and decision-making side,? Blumsack said. Along those lines, he has worked on studies showing the economics and workforce impacts of natural gas production throughout Pennsylvania. Currently, he is part of a team working with the Department of Energy (DOE) National Energy Technology Lab to determine the feasibility of using CO_2 for enhanced natural gas recovery in depleted Marcellus wells. He is primarily interested in the economics of capturing CO_2 from large industrial sources, such as cement plants, and using the gas to stimulate deep shale wells where production has tailed off.

Blumsack is also working with the DOE Mid-Atlantic Clean Energy Application Center to explore how natural gas production, especially in the Marcellus shale region, might affect the economics of combined heat and power (CHP), an energy efficiency technology used primarily in commercial and industrial applications. CHP, he explained, is when waste heat is captured during the burning of a fuel source and used for another application. For example, when Penn State replaces their coal plant with a gas-fired system, they will be able to generate steam and electricity from the same location.

Blumsack is also working on a project tied to increased drilling for natural gas in Pennsylvania. Because of increased production from the Marcellus wells, the existing gas pipelines are at capacity leaving no room to ship gas from shallower conventional wells that have been in the area for decades. Blumsack is working with a company in Clearfield County to analyze the economic feasibility of capturing the gas from those conventional wells and distributing it locally through ?natural gas micro-grids.? Creating a market for this gas means avoiding potential environmental problems associated with old wells improperly capped and abandoned. In addition, if the gas could be delivered at competitive prices, a local energy source would be a significant asset to small towns in the county trying to draw industry. If the economics of the gas micro-grid model seem favorable, Blumsack hopes that it could become a model for other communities in Pennsylvania and elsewhere.

Most of Blumsack?s research is related to natural gas use within the electricity industry. ?I was originally interested in [shale gas] solely because I was interested in the electricity industry,? Blumsack said. ?Since then my involvement in it and my interest in it has grown beyond just its applications to the power industry.? Other applications include using natural gas as a fuel instead of coal, oil, or electricity in various residential and commercial facilities, or as a feedstock in

industry to make products such as chemicals, plastics, or tires. Since much of the research associated with natural gas has developed only in the last couple of years, Blumsack expects the number of projects he has in this area to continue to increase.

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