WILL CUTTING CARBON KILL COAL?

Only if the industry fails to adapt, explains CMU engineering professor

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Daniel Marsula/Post-Gazette

Forecasts of coal's demise have been wrong for more than 700 years, ever since King Edward I of England famously proclaimed, "Be it known to all within the sound of my voice, whosoever shall be found guilty of burning coal shall suffer the loss of his head."

Now, new cries of a "war on coal" have emerged in the wake of the U.S. Environmental Protection Agency's proposed rules requiring existing power plants to cut emissions of carbon dioxide by an average of 30 percent by 2030 — a significant step to control the major pollutant linked to global climate change.

That action followed another EPA rule proposed last fall that would limit CO2 emissions from new coal-fired power plants to roughly the same level as natural gas-burning plants. Effectively, that would require new coal plants to install a technology called carbon capture and storage, or CCS, to reduce CO2 emissions by roughly 40 percent to 45 percent.

That proposal also drew strong criticism and attempts in Congress to weaken or rescind the rule. Opponents assert that CCS technology is unproven, far too costly and that it would "kill coal." Others disagree, citing experience with CCS in other industries and a variety of power-plant applications, including several large projects nearing completion.

While controversy over the draft EPA regulations won't subside anytime soon, one thing just about everyone agrees on is the need for technology innovations that reduce greenhouse-gas emissions at lower cost. The U.S. Department of Energy is actively pursuing such innovations with research programs on CCS and advanced energy technologies, as are other nations.

A key question is whether EPA rules for new and existing power plants will hinder or help these efforts to keep coal viable in a carbon-constrained world. Past experience shows that well-crafted rules can actually help. Here's why.

For insight, it is instructive to look at the history of EPA standards for other power-plant air pollutants.

At Carnegie Mellon University, we have studied that history and the technological response to environmental regulations. We've also studied and analyzed CO2 capture and storage systems and advanced energy technologies.

By examining U.S. research funding and patenting activity over the past century, we found that not until national policy required large reductions in power-plant emissions did inventive activity to reduce those emissions swing into high gear.

The accompanying graph illustrates this for sulfur dioxide controls. Much of the 10-fold spike in patenting activity that followed the 1970 Clean Air Act was directed at improving SO2 "scrubbers" needed to comply with stringent federal and state-level standards.

Like "CO2 scrubbers" today, technology to capture and remove SO2 from power plant flue gases was new to the industry and not yet deployed at large coal-burning plants when EPA standards were first promulgated in 1971. These early SO2 capture units often operated poorly, leading one major utility to run full-page ads declaring scrubbers "unacceptable for electric utility use."

But ensuing improvements in technology design and operator training overcame those initial problems and, as their deployment and reliability grew, their cost declined sharply.

By the mid-1990s, the inflation-adjusted cost of SO2 capture equipment was half its cost two decades earlier. That facilitated the sale of scrubber

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technology to Europe and (more recently) China. Today, the coal and utility industries properly boast of achieving big cuts in air pollution using "clean coal technology" while at the same time tripling U.S. coal use.

While sustained research and development was essential to achieving those improvements, the key to technology innovation was the "demand pull" of emission regulations, which established commercial markets for this environmental technology. Why else would technology developers and vendors invest large sums to improve SO2 scrubbers if there was no market for them?

So, too, with carbon capture and storage technology.

While CCS is arguably more advanced today than SO2 scrubbers were 40 years ago, it is also much more expensive and complex, and it's just beginning to be deployed at power plants in large-scale demonstration projects subsidized by national governments. Its future viability, however, depends on continued R&D to drive down costs, plus a market demand that can only be established by requirements or strong economic incentives to reduce carbon emissions significantly.

Can such requirements sustain rather than stifle the use of coal?

Let's look north.

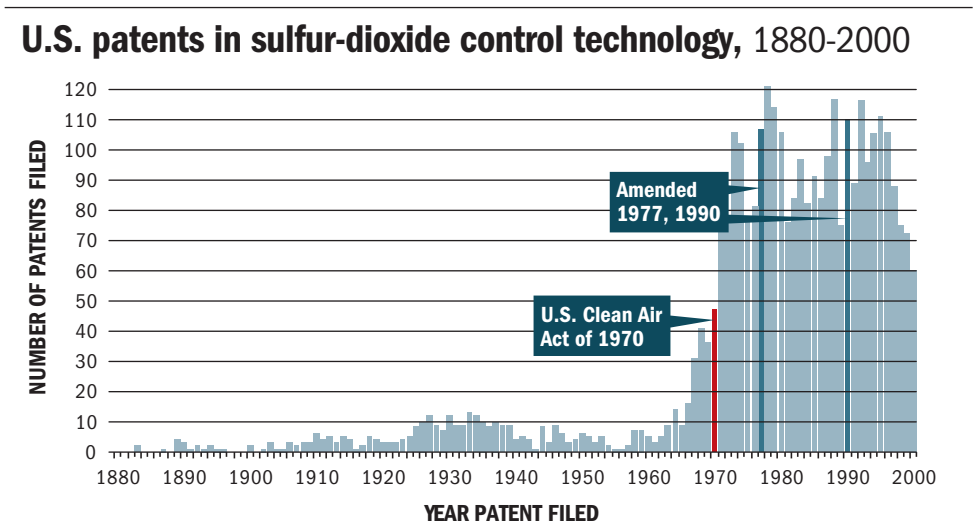
Two years ago, Canada adopted CO2 standards for coal plants more stringent than the EPA's. Rather than convert to natural gas, SaskPower, located across the border from North Dakota, chose to refurbish one of its plants with carbon capture and storage capability.

Two months ago, the company's Boundary Dam plant became the first coal-fired unit to deploy CCS at a commercial scale. The 110-megawatt facility is now capturing 90 percent of its CO2, then transporting it via pipeline to a depleted oil field where it is used to extract additional oil. It then remains sequestered deep underground, keeping over a million tons of CO2 out of the atmosphere each year.

Revenue from selling the CO2, plus aid from the Canadian government, were critical to this first-of-a-kind project. Based on the Boundary Dam experience, SaskPower expects its next CCS project will cost about 30 percent less — the first step down the learning curve that we've seen for SO2 scrubbers and other technologies.

U.S. projects also show that coal can be a low-carbon energy source. In Mississippi, a 582-megawatt advanced technology power plant starting up next year will capture and sequester nearly 4 million tons of CO2 annually. In Texas, construction is underway on a 240-megawatt coal plant that will capture 90 percent of its CO2, emitting far less carbon than a modern gas-burning plant. Three more advanced technology projects under DOE's demonstration program are slated to follow.

CCS potentially can reduce emissions from existing power plants as well, especially if combined with major upgrades that alone can reduce CO2 emissions by roughly 20 percent through improved efficiency. Co-firing with natural gas or biomass are among other options offering CO2 reductions.



Source: E.S. Rubin, Carnegie Mellon Post-Gazette

Of course, the viability of any of these measures depends heavily on its cost. Even without carbon regulations, competition from natural gas and the needs of an aging coal fleet has led to the closing of some coal plants, with more expected. Nor are any new coal plants likely to be built anytime soon in the face of low demand growth for electricity and the promise of abundant natural gas from fracking. With the added cost of carbon constraints and competition from other low-carbon energy sources, U.S. coal use is expected to decline in coming years.

But history shows that forecasts of future energy prices are reliably wrong, so it's foolish to believe that coal can't compete in a carbon-constrained world. Indeed, studies find that in the United States and globally, coal with carbon capture and storage is critical to avoiding severe climate change impacts at minimum cost.

Admittedly, that low-carbon future is still years away. In the interim, markets for CCS and other clean coal technologies will take time to materialize, and public support will be needed to further their development. This includes funding for R&D, tax credits, innovative financing methods and modifications to proposed EPA rules to allow greater flexibility in compliance.

So, will carbon cuts kill coal? Not likely.

Evidence suggests that technology innovations "pulled" by policy requirements and catalyzed by sustained investments in clean-energy technology can indeed allow domestic coal resources to be utilized economically while achieving long-term cuts in carbon emissions. U.S. leadership in this arena also would spur other nations to follow and open new markets for U.S. businesses.

Looking back decades from now, predictions of coal's demise will again have been proven wrong.

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