Ditching coal in the US is saving lives, helping crops

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A lot of the discussions about switching sources of electricity focus on costs, specifically whether going renewable will cost more than fossil fuels. But the costs of fossil fuels go well beyond simply the costs of supplying the fuel. Fossil fuels create costs by harming human health and the environment—these costs aren’t priced into electricity produced. Instead, they wind up being paid by society at large—and that’s before pricing in the inevitable costs of climate change.

In fact, in the United States, the rationale for Obama-era climate rules included the idea that the regulations would save money by avoiding these costs. That claim was controversial, however, and the Trump administration’s rollback of these rules also claimed to provide economic benefits.

What’s been lacking is a clear measure of the impact of pollution from fossil fuels. In an attempt to rectify that, Jennifer Burney of the University of California, San Diego, took advantage of a natural experiment that the US has been undertaking: shuttering older coal plants and replacing them with natural gas, which produce far less pollution. Using data

from a decade of vanishing coal plants, Burney found that tens of thousands of deaths had been avoided by replacing coal plants. As an added bonus, the productivity of nearby farms increased as well.

Tracking the unmeasurable

Burning fossil fuels produces a huge variety of pollutants. There's carbon dioxide, which alters the climate, and sulfates that form aerosols and lead to acid rain. Ozone can form from some of the other pollutants released, and particulate matter causes additional health risks. Finally, coal contains mercury and other metals that can have a variety of toxic effects. For some of these, we have good estimates of the health effects, and generating facilities are required to track their release of pollutants. But other pollutants aren't tracked at all, leaving gaps that make it difficult to estimate the contributions of individual power plants.

So rather than figuring out what's being produced while a plant operates, Burney decided to track what changes when a plant shuts down. The plants' locations are well documented and could be correlated with data on human health and agricultural productivity that are broken down by county, which provides a sense of the local impacts. Satellite data could also track the presence of materials like aerosols and ozone in the regions affected by plant closures.

Working with data from the decade 2005-2016, Burney identified when plants (almost entirely coal) shut down and when new ones (both coal and natural gas) came online. She then tracked changes to the measures of human and agricultural well-being from the surrounding area. While there are undoubtedly other factors that influenced these measures in each area, these should largely average out over the hundreds of plants that changed status over this period. It's also not clear how widespread to expect the effects to be relative to the

location of the plant. Burney did both a conservative measure, checking for impacts within 25km of the power plant, and a more expansive one that examined a 200km radius.

One of the interesting things she found was that the opening of new plants wasn't correlated with any statistically significant changes. She suggests that this is likely the result of the fact that the newer plants adopt the latest pollution-control technology and therefore have a lower impact on the surrounding communities. This might indicate that, in the decades to come, we'll see diminishing returns as coal plants close.

Big losses

But for the plants that closed in the decade she examined, the results were dramatic. The decommissioning of coal plants was associated with drops in ozone and aerosols formed by sulfur dioxide and nitrogen dioxide. For the latter two chemicals, the decrease faded as a simple matter of distance from the closed plant. (Ozone dynamics were a bit more complicated.)

Burney found that "these lower aerosol and ozone concentrations conferred near-immediate benefits to health and crop productivity." All cause mortality in the counties closest to the closed plant dropped by a percent, with the elderly being the largest beneficiaries. All told, the data suggests that about 27,000 premature deaths were avoided between 2005 and 2016. The confidence intervals are wide, ranging from 2,700 to 50,000, but the numbers go up if a wider radius around the plant is used. The effects on crops were even more dramatic. Nearby corn and soybean yields went up by over five percent; wheat yields rose by four percent.

Translating those numbers to apply to the remaining coal plants, Burney found that even for the conservative 25km estimate, they caused about 330,000 premature deaths and a loss of 10 billion bushels of crops over the decade she

studied. For reference, she notes that the crop loss is roughly equivalent to a half-year’s production; it’s also equivalent to five percent of the total US harvests over that decade.

The news isn’t all good when it comes to climate, though. The aerosols produced by these plants reflect sunlight and have a net cooling effect that outweighs the often black particulate matter they also produce. But as they close, the reflective aerosols they produce rapidly decline, leading to a shift from a net cooling to a net warming, at least locally. Collectively, the closure of hundreds of plants could lead to a localized warming.

As noted above, the results of plants closing may change as the poor economics of coal will eventually start hitting some of the newer plants that have more effective pollution controls. Which implies that the payoffs from closing plants will gradually decline. But Burney also notes that her analysis doesn’t include things like lost productivity and medical costs; it simply looks at mortality. If those costs are considered, then the payoffs from switching away from coal may remain considerable.

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