

Obama climate plan will hit coal hard

New loan guarantees for spurring development of technologies to control carbon emissions are not likely to help utilities cut their CO₂ output in the short term.

Among the actions President Obama is taking to address climate change, none is more controversial than his move to reduce carbon dioxide emissions from the nation's fossil-fuel-powered electricity-generating plants. Few options are available for US utilities to substantially reduce the CO₂ that spews from existing coal plants, by far the nation's largest power source.

In a 25 June memorandum, Obama directed the Environmental Protection Agency to formulate a CO₂ reduction standard for existing fossil-fuel plants, although he set no overall reduction target. The EPA was instructed to prepare a draft standard by 1 June 2014 and a final standard one year later. States would be required to submit implementation plans by mid 2016.

In early July the Department of Energy released a draft solicitation for proposals for projects aimed at developing new technologies to avoid, reduce, or sequester air pollutants and greenhouse gas emissions. The agency will provide up to \$8 billion in loan guarantees for the projects. The specific

technologies eligible for loans will be finalized after a period of public comment, but they will include those that can improve the thermal efficiency of coal burning, possibly by recovering waste heat, combining heat and power generation, and generating electricity at smaller, more efficient plants. Carbon capture systems and novel alternative approaches to mitigating CO₂ emissions also will be considered for loans.

"Any serious effort to protect our kids from the worst effects of climate change must include developing, demonstrating, and deploying technologies to use our fossil resources as cleanly as possible," Energy secretary Ernest Moniz told reporters. "As we develop the transformational technologies of the very low-carbon future of tomorrow, we also have to innovate around today's energy systems."

A two-track process

Power plants produce 2.2 billion metric tons of CO₂ annually, roughly one-third of total US greenhouse gas emissions from all sources. Emissions limits will

fall most heavily on the nation's 585 coal-fueled plants, which, on average, spew twice as much CO₂ per unit of electricity as natural gas plants do. Some older coal plants emit up to 2500 pounds (1134 kilograms) per megawatt hour, but some newer units add as little as 1400 pounds per megawatt hour, says a source with the Edison Electric Institute (EEI), which represents US electric utilities.

In April 2012 the EPA released a draft emission standard of 1000 pounds per megawatt hour for future fossil-fueled plants. But after receiving more than 2 million comments, the agency decided to reevaluate that limit. In his memorandum, Obama ordered the new draft standard to be issued by September and made final "soon afterward." He also said that the standards for existing plants will be developed through a different process that will directly involve the states and should use market-based approaches such as a cap-and-trade system.

Plant owners have announced plans to eliminate 50 gigawatts of the total 313-GW US coal-powered generating capacity by 2025, according to the American Coalition for Clean Coal Electricity. The group blames existing EPA regulations on air pollutants other than CO₂ for all but 9 GW of that capacity loss.

Aging plants, environmental regulations, and economic factors—mainly the recent abundance of inexpensive natural gas—all figure in the closures, according to the EEI source, who asked not to be identified. "Our members have to look 30 to 50 years into the future for what the market will require for them to have capacity-wise. They also have to make educated guesses for what the regulations will look like."

At the margins

Some options that coal plant operators have for marginally reducing CO₂ emissions include efficiency improvements in the combustion process, reduction of auxiliary loads from other equipment such as pumps and blowers, and co-combustion with less carbon-intensive fuels such as biomass, says Bryan Hannegan, associate director of the National Renewable Energy Laboratory. But those and other measures, including control-system improvements, could reduce



Existing fossil-fueled power plants will have their carbon dioxide emissions limited under a directive issued by President Obama.

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CO₂ emissions by 5–6% at best, according to several sources.

Hannegan, a former chief of staff at the White House Council on Environmental Quality, also notes that implementing the improvements will depend on factors such as the level at which the new emissions standard is set, the condition of the plant and whether actions have already been taken to comply with previous EPA rules, and the resulting economics of the plant with the new compliance expenditures.

More substantial emissions reductions could be achieved by installing supercritical and ultra-supercritical boilers (the latter operate at 760 °C or higher and pressures of around 35 megapascals). Ultra-supercritical units can achieve thermal efficiencies as high as 48%, far better than the 33% average efficiency of the current US coal fleet. Supercritical boilers are used for all large-capacity boiler operations in most European and Asian countries, according to the National Energy Technology Laboratory. More than 400 supercritical boiler plants are in operation worldwide. But US companies, which generally operate older plants, have been slower to adopt the technology.

Supercritical and ultra-supercritical boilers require expensive stainless steel or high-nickel alloys. Installing the boilers in an existing facility would usually require a complete plant rebuild, says the EEI source. Plant operators, moreover, would be unlikely to install a new boiler with a 40-year lifetime in a plant with a much shorter remaining lifetime, notes Jeffrey Phillips, senior program manager for the advanced generation program at the Electric Power Research Institute.

Plant modifications can also trigger a regulatory process known as new source performance review. That process could result in an older coal plant suddenly being subject to emissions regulations on pollutants such as nitrogen oxides, sulfur dioxides, particulates, and mercury. Utilities want to avoid that outcome at all costs, the EEI source explains.

Rachel Cleetus, a senior scientist at the Union of Concerned Scientists, says other ways of cutting CO₂ emissions include converting coal plants to natural gas and operating older, less efficient plants less often. The Union of Concerned Scientists, the Natural Resources Defense Council, and other environ-

mental groups advocate that states be given the flexibility to let utilities average their CO₂ emissions across the range of plants they operate. That is the approach Congress took in the 1990s to cut emissions of sulfur dioxide, the pollutant from coal burning that caused acid rain.

Ultimately, the opportunity for the greatest reduction in CO₂ emissions will come from carbon capture and storage. Moniz and others say commercial CCS systems may become available in the mid 2020s, although some installations that capture CO₂ for use in enhanced oil recovery could be in place before the end of the decade. And, says Phillips, it's likely that any use of CCS will be for new plants rather than existing ones. "The challenge is that it is going to cost the power-plant owner on the order of \$50 to \$75 a ton to put in all the capture and storage equipment," he says. "And oh, by the way, you have to monitor the CO₂ in the ground for another 50 years after you stop storing. Most power-plant owners are saying, 'I could do that, or I could vent it to the atmosphere and it wouldn't cost me anything.'"

David Kramer



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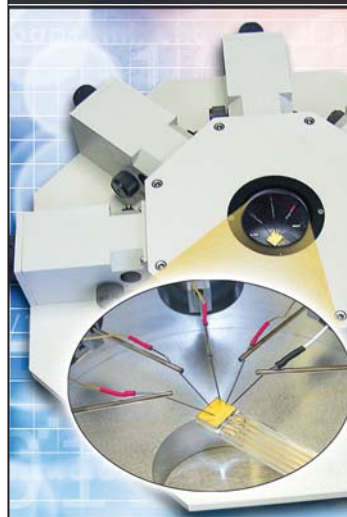
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