New U.S. Policy to Reduce Carbon Emissions from the Power Sector

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In June, the United States Environmental Protection Agency (EPA) issued proposed greenhouse gas regulations called the *Clean Power Plan*. Because of opposition in the U.S. Congress to enacting legislation to limit greenhouse gas emissions, EPA used its existing regulatory authority under the Clean Air Act to put forth this proposal. The EPA expects the plan will decrease carbon dioxide emissions from the power sector 30 percent below 2005 levels by 2030. The plan is an important step forward, although it is likely that significantly larger emissions cuts could be achieved cost-effectively over the same period. In any case, the proposed plan is worth close attention because it includes a number of design elements that could be very useful in China, particularly the concept of energy efficiency as a resource and the practice of improving the dispatch of power plants to reduce emissions.

Under the proposal, EPA will establish binding state-specific emissions reduction targets. Each state will be allowed flexibility in developing plans to meet the target; EPA will be responsible for reviewing and approving (or disapproving) the state plans. EPA encourages states to base their efforts on existing state planning procedures. Most states already practice some form of integrated resource planning for electricity supply that seeks to find the least-cost resource mix (including energy efficiency) and considers the costs associated with various emissions.

The state targets are set in terms of carbon emissions intensity (i.e., pounds of carbon emissions per MWh) and EPA developed a methodology that allows a variety of control measures to count toward intensity reductions. In other words, EPA allows several approaches that states can use to meet their targets. Each state will be able to put together a cost-effective (or least-cost) mix of resources including:

1. **End-use energy efficiency:** The proposal encourages states to reduce power sector emissions by investing in end-use energy efficiency as a substitute for thermal power plants and explicitly recognizes energy efficiency investments as effectively producing carbon-free kilowatt-hours. State plans can use verified savings achieved through state power sector energy efficiency programs (which, in most states, are administered by electric utilities and overseen by state regulatory agencies). This is very similar to China's energy efficiency power plant (EPP) concept — although EPA takes the concept a step forward by integrating EPPs into a detailed and transparent carbon-reduction power plan. EPA expects all states to be able to implement energy efficiency programs that achieve annual energy savings of at least 1.5 percent of annual sales. Several states already far exceed this target.

2. **Renewable energy**: New investments in renewable energy can count toward state targets. EPA calculated that the percentage of generation supplied by renewables in each state could be ramped up, although wind and solar still supply less than 15 percent of electricity in EPA's 2030 scenario. Hydro generation can also count toward state targets, although EPA does not expect any major new construction, due primarily to the lack of availability of hydro sites.[1]

3. **Redispatch (changes to annual running hours across the fleet of power plants)**: This option reflects programs that dispatch gas plants more often and coal plants correspondingly less often. Available wind and solar resources are assumed to be given priority over thermal resources. EPA's plan calls for raising the average capacity factor of natural gas plants from 44 to 46 percent in 2012 to 70 percent in 2030.[2]

4. **Heat-rate improvements:** This category refers to efficiency increases *within* existing thermal power plants. EPA projects an average of 6 percent improvement across all plants.

5. **Nuclear energy:** Nuclear generation can also count toward the state targets, although EPA does not expect any significant new construction in this category through 2050 because of the high costs of nuclear plant construction. EPA allows states some limited credit for keeping existing plants in operation.

As a method for calculating overall emission reduction targets for each state, EPA developed estimates for the contribution of each of these "building blocks." The contribution from each of the above sources will vary significantly across states. For the country as a whole, EPA expects the first three sources — energy efficiency, renewables, and redispatch — to play the largest roles. The contribution of heat-rate improvements at existing plants is expected to be somewhat smaller, and extending the lives of existing nuclear energy plants will offer the least incremental contribution, according to EPA's forecast.

EPA calculates that the benefits of the plan will far exceed its costs, from a whole-society point of view. Costs will include investments in new renewable capacity and energy efficiency measures; benefits will include the climate and health effects of emission reductions, as well as the economic benefits of energy savings. Importantly, EPA calculates benefits not just from reduced carbon emissions (avoided climate change) but also from associated reductions in conventional pollutants (including reduced emissions of ozone precursors, fine particles, and mercury). These conventional emissions reductions are not the main focus of the program — but the benefits (particularly in terms of human health) are substantial and including them in the calculation of benefits (as well as considering them in program design) is good practice. In fact, the EPA calculations imply that, even in the absence of any benefits stemming from climate change mitigation, the value of the public health benefits from air quality improvement alone (in

[1] Hydroelectric generation in the United States has remained constant for the past 20 years.

[2] EPA concludes that individual natural gas plants are capable of operating with utilization rates as high as 87-92 percent. See U.S. Environmental Protection Agency (2014). *Technical Support Document (TSD) for Carbon Pollution Guidelines for Existing Power Plants: Emission Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units* (EPA-HQ-OAR-2013-0602). Washington, DC: Office of Air and Radiation. Available at http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-ghg-abatement-measures.pdf.

the sense of total benefits exceeding total costs) would justify the proposed policy. Table 1 summarizes the cost-benefit calculation associated with one of the EPA's main scenarios.[3]

Table 1 Cost-Benefit Analysis of Clean Power Plan Scenario

Climate benefits	$30 billion
Air pollution benefits (public health)	$27 to $63 billion
Total compliance costs	$8.8 billion
Net benefits	$49 to $84 billion

Total compliance costs reflect the total costs of implementing the proposed policy. Specifically, the compliance costs include the cost of redispatching away from coal toward gas and the cost of new renewable capacity. Compliance costs also include the cost of energy efficiency (both the costs borne by the program administrators and the program participants). However, the EPA's calculations show that energy efficiency is much less expensive than other power sector resources and other emission-reduction options. According to independent analysis, the Clean Power Plan may produce slightly higher electricity rates in the near term, but consumers will enjoy lower average electricity bills and the economy will experience positive net benefits.[4]

EPA's proposal encourages states to consider linking with other states to develop regional (multi-state) programs. Interstate cooperation on energy efficiency and renewable energy programs can reduce administrative costs. States may join together in regional cap-and-trade schemes in order to meet targets. One example is the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade scheme that covers nine states in the Northeastern U.S. Under RGGI, emissions allowances are auctioned and the revenue is largely recycled into energy efficiency programs – an approach often referred to as "cap-and-invest."[5]

The timeline for the proposed rule is as follows:

- Until mid-October 2014: Detailed plan is open for public comment;
- June 2015: The rule will be finalized and released;
- June 30, 2016: State compliance plans must be submitted to EPA; and
- 2030: EPA's emission rate targets must be met.

[3] See Table 2 of U.S. Environmental Protection Agency Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 FR 34829 (2014). Available at https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

[4] Hibbard, P. (2014). *EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers,* Washington, DC: The Analysis Group. Available at http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Analysis_Group_EPA_Clean_Power_Plan_Report.pdf.

[5] The majority of RGGI revenues have been used to support energy efficiency programs. Some revenues have also supported low-income customer assistance and renewable energy.

What's Missing from EPA's Proposal?

EPA's proposed plan is well-designed. However, EPA did not establish its targets for states in a way that would maximize net social benefits. In other words, EPA would almost certainly be justified in increasing the carbon emissions reduction target for each state. The following would improve EPA's proposed plan:

- **Higher targets for energy efficiency programs**: As noted above, several leading states have already demonstrated that it is possible to achieve annual energy savings that are significantly greater than those envisaged in the proposed rule – and there is significant scope to push beyond even the achievements of those states by, for example, targeting more comprehensive energy retrofits in households and facilities.[6] Energy efficiency programs are typically much less expensive than meeting demand through supply-side options (i.e., new power plants) and they reduce average customer bills. They also have significant air quality benefits in addition to reducing carbon emissions.
- **Stricter building energy codes:** Tightened codes for buildings would complement utility administered energy efficiency program. Again, energy efficiency is cost-effective and saves money for consumers and businesses.
- **Demand response programs**: These can reduce greenhouse emissions, reduce peak electricity prices, and lower NO_X, and $PM_{2.5}$ emissions.
- **Measures to reduce transmission and distribution line losses**: Line losses in the U.S. average 6 to 8 percent and can run as high as 20 percent at peak times. Reduced line losses avoid the need to operate high-emitting peak generation, and like improved building codes, offer simultaneous greenhouse gas, NO_X, and $PM_{2.5}$ emissions reduction benefits.

Conclusion and Ideas for China

Although the proposed rule has some shortcomings, it includes several design features that are worth consideration by China's policymakers.[7] Three are emphasized here.

End-use energy efficiency as a resource to be integrated into power sector planning: China would benefit from a power sector planning process that more directly compares demand-side and supply-side resource options, and incorporates consideration of their total social costs and benefits. Several leading states in the U.S. have decades of experience with such integrated resource planning – and the EPA proposal is designed to build on their experience. The twin concepts of integrated resource planning and energy efficiency as a resource can be particularly useful in helping China (and its local governments) design cost-effective power sector plans that simultaneously address carbon emissions and air quality goals. China already has experience with these concepts in the form of efficiency power plants, although these have yet to be well-integrated into power sector planning and are still not widely accepted in China as effective and low-cost measures to combat air pollution.

[6] See, for example, http://www.raponline.org/featured-work/tapping-efficiency-in-homes.

[7] The recommendations for China in this section are discussed in more detail in Regulatory Assistance Project (2013). *Recommendations for Power Sector Policy in China*. Beijing, China: Regulatory Assistance Project. Available at http://www.raponline.org/document/download/id/6869.

Comprehensive, detailed, and transparent cost-benefit analysis: The calculations include not only climate mitigation impacts but also the co-benefits associated with air quality effects on public health. In public documents available online, EPA describes at length the cost-benefit methodology, as well as the thinking behind its approach and its methods for developing targets. EPA also describes in detail its power sector projections under various scenarios. Greater transparency and data availability in China will strengthen economic, regulatory, and policy analysis for not only controlling greenhouse gas emissions but also in other key policy issues, such as distributed generation, creating effective demand response programs, and grid integration of renewables.

Recognize the potentially primary role of improving power plant dispatch in reducing emissions: This is a particularly important area for China, which is an international outlier in terms of generator dispatch. The philosophy underlying the EPA proposal – indeed underlying dispatch in most countries around the globe – is that generators should be dispatched according to their variable costs, ideally including environmental costs, so that the system operator calls upon generators with the lowest operating cost (including the cost of emissions) first. In a nutshell, EPA's proposal will strengthen the consideration of emissions costs in dispatch decisions. China has a very different approach to dispatch, with the government annually assigning the system operator a roughly equal target number of operating hours for each coal-fired generator. As a result, the overall performance of the Chinese power system has suffered significantly in terms of cost, environmental performance, carbon emissions, and distorted investment decisions. Improving dispatch practices would be a good way to reduce carbon emissions and improve air quality in China, avoiding the need to pursue much more expensive, environmentally damaging, and carbon-intensive solutions such as coal-to-gas facilities and coal-fired plants in Western provinces.