RATE-BASED COMPLIANCE UNDER THE CLEAN POWER PLAN

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The Clean Power Plan gives states the option to comply via either a rate-based or a mass-based approach. Ten states currently operate mass-based greenhouse gas reduction programs, and many more participate in mass-based programs to reduce other pollutants (e.g., sulfur dioxide) that are administered by the U.S. Environmental Protection Agency. Various sources are available for background information on how mass-based trading works.

In contrast, there is little current working knowledge on implementing rate-based programs. This paper considers some key aspects of rate-based Clean Power Plan implementation options to inform stakeholders as they engage in state implementation plan design.

RATE-BASED COMPLIANCE OPTIONS UNDER THE CLEAN POWER PLAN

The Clean Power Plan defines rate-based greenhouse gas performance standards for electric generating units (EGUs). These standards are expressed in terms of pounds of carbon dioxide per megawatt-hour generated (lb CO_2/MWh). States can choose to enforce performance standards at each EGU in their jurisdiction—either using the Clean Power Plan rate targets for the two broad categories of EGUs or using EPA-approved alternate rate targets—or enforce a statewide average performance standard set in the Clean Power Plan.

The final standards are 1,305 lb CO_2/MWh for steam-generating units (mostly coal-fired EGUs) and 771 lb CO_2/MWh for the cleaner natural-gas, combined-cycle units (NGCC). Both standards represent a significant improvement over current performance. Observed emission rates vary because of unit-specific factors (e.g. age and how frequently it runs), but typical emission rates are around 2,000 lb CO_2/MWh at coal-fired EGUs and around 1,000 lb CO_2/MWh at NGCCs. Existing power plants, especially older plants, have few options for reducing their emission rate on-site. In light of this, EPA allows trading for compliance, and numerous states have expressed a desire to allow trading in their state plans.

EMISSION RATE CREDITS

States that choose to allow emissions trading, and decide that they prefer a rate-based Clean Power Plan approach, will need a mechanism to quantify performance against the Clean Power Plan standard. The Clean Power Plan allows for this through generation of an emission rate credit (ERC) which is equal to one MWh and could be submitted by an EGU to demonstrate compliance. All ERCs are to be administered *ex post*, that is after the generation or avoidance of electricity occurs and is verified. This provision ensures the environmental integrity of the ERC, and also adds robustness to ERCs which can boost confidence in trading markets.

States are granted the authority to issue ERCs, though the Clean Power Plan does give some limitations on which sources are eligible. Rather than examine all possible ERC-generating projects, this paper focuses on those that are included in the proposed federal implementation plan and draft model rules. These provisions are illustrative of how future state plans could be developed; however, they will not be finalized until the summer of 2016. Thus the exact details of ERC generation discussed here are subject to change.

The proposed federal plan would grant ERCs to several types of sources. Affected EGUs that perform better than the relevant Clean Power Plan standard (steam-generating unit or NGCC) would receive ERCs using a baseline-and-credit approach, where the Clean Power Plan standard for the EGU's type is the baseline. Non-emitting sources (new nuclear and metered renewables) would receive ERCs for all generation they produce in excess of their 2012 generation.

The proposed draft model rule for a rate-based approach would also give ERCs to energy efficiency projects for the avoidance of electricity consumption. EPA is additionally considering including low-emitting sources like combined heat and power (CHP) and waste heat to power (WHP) as eligible ERC sources under the model rule. The details of the crediting formula for these sources are complicated and not yet final, but CHP and WHP would essentially receive ERCs equal to the fossil generation they offset.

In the proposed draft model rule for a rate-based approach, EPA describes an additional crediting mechanism meant to incentivize NGCC units to operate above their historic levels. This is effectively a baseline-and-credit mechanism, where NGCCs' emissions performance is compared to that of steam-generating units. All generation from NGCCs would be given a fractional Gas-Shift ERC (GS-ERC), representing the shift from coal to gas generation taking place on the grid. The GS-ERCs are different than other ERCs in that each represents less than one MWh generation. EPA is proposing a formula to calculate how many GS-ERCs a MWh of NGCC generation would receive in each state. Also, a GS-ERC may not be used by an NGCC for compliance. Depending upon a NGCC's actual emissions rate, it could end up being both a seller of GS-ERCs and a buyer of ERCs.

WHY USE ERCS?

Using ERCs for compliance lowers the overall costs to EGUs and, consequently, the total costs of the program to society. These cost reductions are achieved by allowing the market to find opportunities for lower cost reductions. These reductions may or may not occur in the same territory served by the EGU, but ERCs provide a means of accounting for the reductions and ensuring that the Clean Power Plan objectives are met in aggregate at the national level.

The cost benefits of ERCs closely parallel the benefits of using carbon offsets for compliance in cap-and-trade programs. But ERCs will have a different impact in future Clean Power Plan markets because, unlike offsets, ERCs can only be generated by sources that compete in the same markets as EGUs. Thus, high-emitting EGUs will experience two separate kinds of additional cost. First, the cost of purchasing ERCs for Clean Power Plan compliance. Second, the opportunity cost arising from a loss of market share, either from increased energy efficiency or increased renewable generation that will come on-line to generate ERCs in that electricity market. The interaction between future ERC markets and electricity markets will vary from state to state, depending on the composition of the electricity fleet (the "supply stack"). Three simplified scenarios below highlight a few potential market dynamics.

1. **ERCs generated from low-emitting EGUs:** Fossil generation with an emissions rate better than the Clean Power Plan standard receives ERCs that can be sold since they would not be needed by the EGU for compliance. Sale of this asset would lower the generating cost of the low-emitting EGU and potentially displace higher cost, higher-emitting fossil generators, who must buy ERCs for compliance. High-emitting sources (i.e., EGUs whose emission rate is above the standard) pay for ERCs and potentially lose market share to low-emitting EGUs because the higher-emitting sources would be less price competitive.
2. **ERCs generated from non-emitting sources:** Similar to No. #1, non-emitting sources (i.e. renewables, hydro, or nuclear) earn ERCs that lower their costs and add additional generation to the regional electricity market. Since these sources often have lower operating costs than fossil-fired units, they can also lower the wholesale price of electricity at the same time that higher-emitting units face the additional cost of buying ERCs for compliance. Higher-emitting sources will face additional competition for market share and, depending on which is higher cost in a particular electricity market, either coal or natural gas generation could be displaced.
3. **ERCs from energy efficiency:** Because energy efficiency does not add generation to regional supply, ERCs from this source will have a different electricity market impact than No. #1 or No. #2 above. Energy efficiency lowers the overall

demand for electricity, reducing total electricity sales. The electricity market price will decrease to meet this lower demand, but the decline in output from EGUs will likely be smaller than the above scenarios because energy efficiency is not creating additional supply and competing in the same market (it is, in effect, shrinking the market). Fossil-fired EGUs will also have to purchase ERCs to be in compliance, but they do not face additional competitive pressure in generation.

ROOM FOR GROWTH

The above scenarios are best understood in the context of fixed demand for electricity. But what if demand is growing? The final Clean Power Plan defines an EGU's compliance obligation as:

$$ERCs = MWh \times (R_{CPP} - R_R)/(R_{CPP})$$

where MWh is the generation from the EGU, R_{CPP} is the rate limit for that EGU under the state's implementation plan and R_R is the EGU's reported rate.

This formula demonstrates how an EGU's demand for ERCs is directly proportional to its output. If an EGU has a performance rate below the Clean Power Plan target, then it will need to purchase more ERCs to maintain the compliance target if its generation increases. In other words, every MWh generated from a unit with an emission rate higher than the Clean Power Plan rate must be counterbalanced by clean generation or energy efficiency. These ERC-generating sources will be simultaneously competing with EGU generation in the electricity markets, though interstate electricity trading may alter which markets experience the most change.

In practice, the number of ERCs required to meet demand growth will depend upon the emission rate and economics of individual power plants as well as the economics of non-emitting sources. For example, in a state where extra electricity demand would come from an existing but rarely used coal plant with a high emissions rate, many ERCs would need to be purchased to stay in compliance. If, however, new electricity demand in a state is met by new renewable generation, then there could be surplus ERCs that could be sold to EGUs in other states that also have rate-based trading programs.

THE ROLE OF NEW POWER PLANTS

In many states, new fossil-fired power plants may be constructed to meet new electricity demand, but these would not be covered under the Clean Power Plan, which applies only to existing EGUs. Emissions from new power plants are regulated under separate EPA authority (Section 111(b) of the Clean Air Act) in a rule known as Carbon Pollution Standards for New, Modified, and Reconstructed Power Plants.

The Carbon Pollution Standards require new natural gas-fired power plants to achieve an emissions rate of 1,000 lb CO_2/MWh and new coal-fired power plants to achieve an emissions rate of 1,400 lb CO_2/MWh. For new NGCC plants, EPA identifies this rate as being within the observed range of recently constructed units. For coal-fired EGUs, EPA estimates this rate can be achieved with partial carbon capture technology, i.e., capturing 20 percent of emissions. Unlike the Clean Power Plan, the Carbon Pollution Standards do not allow trading or other market approaches for compliance.

While new NGCCs may be capable of meeting or exceeding their Carbon Pollutions Standards rate, there is no mechanism whereby new EGUs can generate ERCs to trade with existing EGUs. In fact, EPA requires provisions to prevent generation from new NGCCs to simply replace generation from existing NGCCs, a phenomenon known as leakage. But in a state with high electricity demand growth, new NGCCs could serve the new, additional generation while existing EGUs served the historical levels of demand. In that case, ERC trading between existing EGUs would proceed in the same way as described in the scenarios above.

DECOUPLING ECONOMIC GROWTH AND EMISSIONS GROWTH

The above discussion focuses on how constraints on emissions may impact growth in electricity demand and supply. This, however, ignores the important point that economic growth can be achieved without a corresponding growth in electricity sector emissions. First, the growth in demand can be met entirely through non-emitting electricity generation: renewables, hydro, and nuclear. The Clean Power Plan poses no restrictions on expansion of these sources, and in fact offers an incentive to do so. A rate-based implementation plan provides a straightforward means of incentivizing this by giving these new sources a tradable ERC that is expected to have increasing value on the market as Clean Power Plan goals tighten through 2030. Under this approach, ERCs can become an additional revenue stream to non-emitting assets which in turn reduces their cost and accelerates their deployment.

An expanded use of energy efficiency can also allow for economic growth without a corresponding growth in emissions. This is also directly incentivized under the Clean Power Plan through the potential to generate ERCs from energy efficiency investments. While energy efficiency has a valuable role in lowering emissions, and in protecting ratepayers by lowering bills, it poses economic challenges for utilities whose business model is based upon using electricity sales to cover the fixed and variable costs associated with electricity generation. The creation of ERCs under the Clean Power Plan can mitigate this problem to some extent by providing utilities with a revenue stream for energy efficiency projects they undertake. However, broader system changes like rate decoupling may allow energy efficiency to achieve its full potential and offset any growth in electricity demand coming from economic growth.

The details of how energy efficiency can be incentivized in both rate-based and mass-based compliance plans is the subject of a companion C2ES fact-sheet.

ADMINISTRATIVE CONSIDERATIONS

While this brief focused mostly on market impacts, administrative considerations and costs are also an important factor for states as they work to implement the Clean Power Plan. For many aspects of trading-ready implementation plans, there are no differences between a rate-based approach or a mass-based approach. For example, both options need a tracking system or registry, need to monitor EGU emissions, and need to determine compliance deadlines. The proposed draft model rules from EPA give provisions for all these design elements that states could choose to adopt.

A rate-based approach does require an important additional administrative framework—evaluation, measurement, and verification (EM&V) protocols for sources generating ERCs. Since ERCs from non-emitting generation and energy efficiency do not reduce the on-site emission rate of an EGU, they must be of utmost integrity to ensure the goals of the Clean Power Plan are being met. EPA included EM&V requirements in its proposed federal plan and draft model rules. For electricity generators the EM&V requirements are fairly straightforward—these must be connected to the grid in such a way to measure the amount of electricity they generate. For energy efficiency providers, however, the EM&V requirements are more detailed because they must quantify the electricity that would have been consumed had the energy efficiency project not taken place. These requirements are not yet final, and states could also develop their own EM&V requirements instead of adopting EPA's final language on this topic.

FUTURE REGULATORY ENVIRONMENT

The same Clean Air Act processes that triggered the Clean Power Plan will trigger analogous regulations on greenhouse gases from other sectors in coming years. Several states are also considering their own policies to reduce economy-wide emissions, separate from federal authority. Since the Clean Power Plan does not come into effect until 2022, and its targets never expire, these future (and unknown) regulatory actions will interact with the Clean Power Plan implementation plans being developed. That puts a burden on states to craft compatible plans now in order to avoid redesigning them in the future.

Rate-based Clean Power Plan implementation may be challenging to link with potential market-based greenhouse gas reduction policies in other sectors because the tradable unit, namely an ERC, is measured in units of electricity (MWh). In order to link Clean Power Plan implementation with a market-based program in another sector, a conversion will need to take place. This is possible, for example by converting electricity production (MWh) into the carbon content of the electricity produced (tons). EPA is considering a formula to convert between MWh and tons in the context of the Clean Power Plan's Clean Energy Incentive Program, but even with a uniform national formula to use, the conversion between MWh and tons will add a level of complexity to future multi-sector trading programs.

CONCLUSION

States may elect to create rate-based interstate trading programs to implement the Clean Power Plan. These programs would allow EGUs to administratively lower their emission rate by surrendering ERCs generated from designated sources. This provision will likely change the fuel mix that could be expected under the Clean Power Plan in a given state by providing a direct incentive for low or non-emitting sources. Notably, even while a rate-based program does not have an absolute cap on emissions, each unit of emissions over the Clean Power Plan standard will require a corresponding volume of clean generation or energy efficiency either in that state or another state implementing a rate-based plan. This will tend to reduce absolute emissions as well as emissions intensity, at least under a scenario of fixed electricity demand.

A rate-based approach may appeal to state regulators and utilities who are expecting high levels of electricity demand growth. A rate-based approach does theoretically allow for unlimited generation from existing EGUs, provided that additional non-emitting sources including energy efficiency are brought online to generate ERCs. New power plants could also serve increasing electricity demand, but their emissions would be regulated outside of rate-based Clean Power Plan implementation.

Regulators must keep in mind the additional EM&V requirements they will need to develop for rate-based plans and also the interaction with any future greenhouse gas regulations on other sectors.

A final, political factor will determine how rate-based plans operate in practice. The price of ERCs will be determined by which states implement rate-based plans. Some states have large opportunities for low-cost ERC generation while others do not. If many states with large opportunities select a rate-based approach, then there would likely be a large supply of ERCs and relatively low prices. If, however, few states with large opportunities for low-cost ERC generation choose this option, the price of ERCs would be higher. In the extreme case, if only one state implements a rate-based approach, the benefits of ERC trading would be much more limited. Understanding the benefits and limitations of rate-based approaches can help state regulators make the best choice for consumers in their state while ensuring emissions reductions under the Clean Power Plan.

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2101 WILSON BLVD. SUITE 550 ARLINGTON, VA 22201 703-516-4146 C2ES.ORG