UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

To: Docket EPA-HQ-OAR-2015-0199

From: U.S. Environmental Protection Agency, Office of Air and Radiation

Date: August 2015

Subject: Renewable Energy (RE) Set-aside Technical Support Document (TSD)

This memorandum provides additional information regarding the RE set-aside that is proposed as part of the allowance allocation in the mass-based implementation approach of the proposed federal plan and model trading rules. As detailed in section V.D.3.b of the preamble to the proposed federal plan and model trading rules, the RE set-aside is proposed primarily in order to address leakage, along with set-asides for output-based allocation.

This memorandum specifically provides the analysis supporting the proposed proportional size of the RE set-aside. A separate memorandum, titled "Allowance Allocation Technical Support Document," details other aspects of the proposed allowance allocation approach.

This memorandum is organized as follows:

1.0 Introduction
2.0 Analytical Framework
3.0 Results

1.0 INTRODUCTION

The EPA is proposing that it would create a unique RE set-aside (in addition to the output-based allocation and Clean Energy Incentive Program (CEIP) set-asides) for each state covered by a mass-based federal plan. For each vintage year, the set-aside would be composed of allowances reserved from that year's state-specific mass budget prior to allocation of allowances to affected electric generating units (EGUs). The EPA is proposing that the amount reserved from the state's allocation be equal to 5% of total allowances. As stated in the proposal, we are also taking comment on a percentage of allowances to be reserved ranging from 1% to 10% of total allowances in each state.

As stated in the preamble to the proposed federal plan and model trading rules, the proposed percentage has been determined to provide a meaningful additional incentive for RE activities in each state, while the vast majority of allowances are allocated to affected EGUs. The following sections of this memorandum describe the analysis that supports that determination. The EPA made this conclusion based upon determining an appropriate volume of set-aside allowances that, at a range of possible allowance prices, are projected to mitigate emissions leakage to new natural gas combined cycle (NGCC) units under a mass-based Clean Power Plan (CPP) policy.

2.0 ANALYTICAL FRAMEWORK

The RE set-aside is proposed to reserve a set-aside of allowances based on a standard percentage of total allowances in each state budget. This national-level analysis estimates the $/MWh incentive that the RE set-aside would support across a range of whole number percentages between 1% and 10%, assessed at four different potential national average allowance prices.

The $/MWh incentive under these various set-aside and allowance price levels is compared to the projected difference in the levelized cost of energy (LCOE) between a representative NGCC unit and onshore utility-scale wind and solar photovoltaic (PV) technologies (projected to comprise the bulk of new RE capacity), in order to evaluate whether it is reasonable to expect that a given incentive level is sufficient to mitigate emissions leakage to new NGCC sources under a mass-based CPP policy.

The steps for this analysis are described below and the calculations are provided in Appendix 1.

Step 1: Estimating the amount of new NGCC generation associated with emissions leakage under a projected mass-based approach

As the basis for estimating the amount of new NGCC generation associated with emissions leakage under mass-based approach, the EPA compared projected new NGCC generation levels between the rate- and mass-based CPP approaches using the EPA's Integrated Planning Model (IPM).[1] The mass-based CPP model run without an RE set-aside was projected to have approximately 164 TWh more nationwide generation from new NGCC units than the rate-based approach in 2030; however, not all of that difference in generation is associated with emissions leakage. An important factor to consider is that the mass-based model run projects more than 12 GW of coal-fired EGU retirements additional to what is projected in the rate-based model run. If these incremental coal retirements are replaced by new NGCC units, this action represents the replacement of higher CO_2 emissions-intensive sources (e.g., coal-fired EGUs) with less CO_2 emissions-intensive sources (natural gas-fired EGUs). This outcome, which

[1] EPA analyzed a mass-based scenario without any set-asides using IPM. The scenario can be found in the docket for the final rule, and is called "Mass-based without set-aside."

reduces overall utility power sector CO_2 emissions, is not consistent with how the EPA has defined emissions leakage and is therefore subtracted from the difference between projected mass- and rate-based new NGCC generation to produce the EPA's estimate of new NGCC generation associated with emissions leakage under a mass-based approach.[2]

Step 2: Calculating the RE generation level consistent with mitigating emissions leakage to new NGCC units under a projected mass-based approach

The RE generation level that is consistent with mitigating emissions leakage to new NGCC units is simply the sum of the RE generation already projected to occur under the mass-based approach in 2030 (approximately 259 TWh) and the amount of new NGCC generation associated with emissions leakage in 2030 (approximately 72 TWh) that the RE set-aside is seeking to replace with new RE (approximately 331 TWh).

Step 3: Calculating the incentive available through the RE set-aside, assuming total RE generation consistent with mitigating emissions leakage ($/MWh)

First, to determine the number of allowances at each of the considered percentage options, the total number of available allowances in each year (equal to the combined total of all of that year's state mass budgets) was multiplied by each whole number percentage between 1% and 10%.[3]

Second, the number of allowances reserved in the set-aside at various percentages, calculated in step 1, are multiplied by a range of four possible national average allowance prices: $5, $10, $15, and $20. This yields a range of total potential funds that may be available to RE providers after receiving RE set-aside allowances at each percentage level. These funds are obtained in practice when recipients of these set-aside allowances sell those allowances in the marketplace to interested buyers, including affected EGUs subject to a requirement to hold such allowances to cover their emissions.

Third, the total potential funds for each combination of set-aside percentage and allowance price is converted into a $/MWh incentive available to RE providers under the assumption that the RE set-aside is designed to support an RE generation level consistent with the RE generation level calculated in step 2 (331 TWh).

[2] Refer to Appendix 1 for calculations and assumptions regarding this calculation.

[3] The assumed state mass budgets are based upon the 2030 state mass goals provided in Table 8 in section V.B of the proposal preamble, corresponding with the proposed approach specified in that section.

Step 4: Quantifying the LCOE difference between new NGCC and RE technologies in 2030 ($/MWh)

In this step, we calculate an illustrative incentive range at which new RE projects may become more economical than new NGCC projects, from an LCOE perspective.[4] The cost and performance assumptions used in this step to calculate LCOE represent base estimates for advanced NGCC compared to onshore wind and utility-scale solar PV (the technologies projected by IPM to comprise the bulk of new RE capacity). The base cost and performance estimates are based on broadly representative technological assumptions across a host of factors (geography, resource class, cost step, etc.) and are therefore only indicative of an illustrative difference of cost at an average, national level; in practice, site-specific LCOE comparisons of new NGCC and new RE would vary and could already yield economic parity between those options in certain locations.[5] In 2030, the calculated LCOE for onshore wind in Appendix 1 is $2.72/MWh higher than advanced NGCC; the LCOE for utility-scale solar PV is $9.80/MWh higher than advanced NGCC.

3.0 RESULTS

This section summarizes the results tables that are provided in Appendix 1 and describes how the results inform our proposal for the percentage of allowances included in the RE set-aside.

The methodology described above is designed to identify two results – a reasonable RE set-aside level that is consistent with mitigating emissions leakage to new NGCC, as well as a reasonable maximum RE set-aside level beyond which it is unlikely that the amount of new RE incentivized will be directly responsive to mitigating emissions leakage. To establish the first result of a reasonable RE set-aside level, the EPA relied upon onshore wind as the benchmark technology due to its lower LCOE. Assuming a national average allowance price consistent with the mass-based CPP model run of $13/ton, the greatest set-aside levels consistent with an incentive of $2.72/MWh is 5%. Consequently, the EPA believes that 5% represents a reasonable RE set-aside level commensurate with the objective of mitigating emissions leakage to new NGCC units. To establish a reasonable maximum RE set-aside level, the EPA relied on utility-scale solar PV as the benchmark technology due to its higher LCOE. An incentive level of $9.80/MWh can be achieved with an RE set-aside of 10% at a national average allowance price of $15 - $20/ton. Consequently, the EPA believes it is unlikely that a set-aside greater than 10% would be necessary to mitigate emissions leakage to new NGCC units. For complete results and associated calculations, refer to Appendix 1.

[4] The EPA understands there are several metrics by which to compare the relative cost of (dispatchable and non-dispatchable) generation technologies, including levelized avoided cost of energy (LACE); however, due to its widespread use and the illustrative nature of this analysis the EPA feels it is appropriate to use LCOE.

[5] Refer to Appendix 1 for additional information on the calculation of the national LCOE estimates.