

RFF REPORT

# Approaches to Address Potential CO<sub>2</sub> Emissions Leakage to New Sources under the Clean Power Plan

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On behalf of Resources for the Future (RFF), I am pleased to offer the attached comments to the US Environmental Protection Agency (EPA) on its Proposed Federal Plan and Model Trading Rules for the Clean Power Plan.

As you know, RFF is a nonprofit and nonpartisan organization that conducts independent research—rooted primarily in economics and other social sciences—on environmental, energy, and natural resource policy issues. RFF neither lobbies nor takes positions on specific regulatory proposals, although individual researchers are encouraged to express their unique opinions—which may differ from those of other RFF experts, officers, and directors. All RFF research is available online, for free.

For the past several decades, RFF experts have helped decisionmakers better understand climate policy challenges and assess the costs and benefits of possible solutions, such as a clean energy standard, Clean Air Act regulation, and various state-level programs, among others. As always, the goal at RFF is to identify the most effective ways—from an economic perspective—to meet environmental objectives through regulation, policy, or market mechanisms. To that end, researchers at RFF have been actively analyzing EPA's Clean Power Plan and assisting states and other stakeholders to understand the implications of their choices in developing ways to comply with the plan.

My colleagues and I have developed comments on issues raised in the proposed model rule and federal plan. These comments address the initial distribution of emissions allowances to help achieve the goals of the program, actions that might be required of states, and actions that EPA can itself take to help the implementation of the Clean Power Plan. We hope they are useful.

If you have any questions or would like additional information, please do not hesitate to contact me or any of the other researchers directly.

Sincerely,

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**Approaches to Address Potential CO<sub>2</sub> Emissions Leakage to New Sources  
under the Clean Power Plan**

Comments to EPA on the Proposed Federal Plan Requirements for Greenhouse Gas  
Emissions from Electric Utility Generating Units Constructed on or Before January 8, 2014;  
Model Trading Rules; Amendments to Framework Regulations  
(FR. October 25, 2015; V80.205)

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## I. Key Findings

### Findings about Allowance Allocation

1. EPA should make the New Source Complement, thereby covering all sources, an element of the mass-based model rule. The federal plan should retain the mass-based option for states. (CFR page numbers: 64969, 64978). *See page 6.*
2. If EPA chooses not to require states that use a mass-based approach to adopt the New Source Complements, then EPA should require updated allocations for 100 percent of the emissions allowances. (CFR page numbers: 64978, 65015, 65016, 65020, 65021, 65022, 65027). *See page 7.*
3. EPA should recognize that updating allocation to existing natural gas combined cycle (NGCC) units and new nonemitting units reduces leakage to new NGCC units. Updating allocation to all affected units covered under the cap achieves comparable results and may have advantages. Updating allocation to existing nonemitting sources is not an effective leakage mitigation strategy. (CFR page numbers: 65018, 65020, 65021, 65022, 65025). *See page 8.*
4. If EPA does not require coverage of new sources in the model rule, EPA should reduce the delay between generation and updating allocation and eliminate the threshold on utilization. (CFR page numbers: 64994, 65021, 65024). *See page 9.*
5. Any free allocation not based on updated generation shares in the model rule or federal plan should be directed either to local distribution companies on an updating basis or to generators, assigning equal prominence to both approaches rather than the exclusive focus on allocation to generators in the current proposal. (CFR page numbers: 65016, 65017, 65018, 65027). *See page 9.*

### Requirements for State Compliance Plans

6. States that attempt to demonstrate equivalence in their plans should use an appropriate baseline assumption for other states' actions, and should be compelled to evaluate "other environmental outcomes." (CFR page numbers: 64980, 64986, 65001, 65028). *See page 10.*
7. States that do not use the new source complement should be required to build programmatic energy efficiency into their compliance plans as a measure to reduce leakage. (CFR page number: 65020). *See page 11.*
8. The model rule and federal plan should require the use of consignment sales for entities that receive free allocation to build program confidence and transparent multi-state compliance. (CFR page numbers: 64977, 64981, 64997, 65018). *See page 12.*

## EPA Implementation of the Clean Power Plan

9. EPA should provide greater certainty on program implementation and development by affirming the schedule for reconsideration of the New Source Performance Standard under section 111(b). (CFR page numbers: 64969, 64995). *See page 13.*
10. EPA should commit to a schedule for program review of 111(d). (CFR page numbers: 64976, 64977, 64995). *See page 13.*

## **II. Introduction and Summary**

To guide state implementation of the Clean Power Plan, EPA has proposed a model rule for states that regulates only existing affected generating units on a mass basis. The model rule also is expected to form the basis for a federal plan. The model rule, when finalized, would be presumptively approvable for states.

Our comments are presented as 10 recommendations that are organized in three groups:

- Allowance Allocation
- Requirements for State Compliance Plans
- EPA Implementation of the Clean Power Plan

We summarize the recommendations in this introduction.

Our comments focus on the emissions outcome that can be achieved under the mass-based proposed model rule and the cost of achieving those emissions reductions. A state's choosing an emissions cap that covers only existing sources raises generation costs relative to costs of new sources that are excluded from the cap. This may cause generation to shift from existing to new sources with an associated increase in emissions outside the emissions cap. This emissions leakage can be reduced by lowering the costs for existing sources so they are more competitive with new sources. Greater utilization of existing sources will reduce the use of new sources and help reduce leakage.

A key feature of the proposed model rule is the use of production incentives to encourage the use of existing covered units and discourage the substitution to new fossil units that would not be covered under the mass-based emissions goal. The proposed approach is updating the allocation of emissions allowances to new renewable units (through the new source set aside) and separately to existing natural gas units on the basis of their share of generation in the corresponding group in a recent period. The supplementary material "Introduction to Updating Output-Based Allocation" in these comments provides background on why this approach can be expected to increase the utilization of these units and reduce the generation shift to uncovered units.

The Clean Power Plan seeks to achieve equivalency, which we interpret as a comparable emissions outcome, between state plans that exclude new sources and the best system of emissions reduction (BSER). EPA has defined the BSER as a dual rate emissions rate standard, but EPA has also described a mass-based approach that covers all sources and offers states additional allowances as achieving the equivalent emissions to the emissions rate standard. We therefore interpret the mass-based approach that covers all sources, which we refer to as the *New Source Complement*, as the relevant point of comparison for the model rule for states that do not cover all sources.

The easiest way to ensure that an emissions outcome is equivalent to the New Source Complement would be to design the mass-based model rule so that it includes the New Source Complement. This would not constitute a mandate to do so because states would retain other options for compliance instead of adopting the model rule, such as the dual emissions rate standard.

In an extensive modeling exercise we explore the ability of the updating allocation strategy to achieve its intended result of reducing emissions to the level of the New Source Complement when only existing units are covered under a cap. The supplementary material “Modeling Report” finds that in general the proposed updating allocation fails to achieve equivalency. Our modeling indicates that the magnitude and the form of the production subsidy proposed by EPA are inadequate, and cause emissions to be 238 tons (14 percent) higher than the New Source Complement in 2030. Nonetheless, we believe that straightforward extensions of EPA’s proposed ideas would overcome roughly 60 percent of the emissions difference between the proposed model rule and the New Source Complement. Further, some elements of our model design may underestimate the extent to which emissions would actually be reduced by a policy that covers only existing sources and these elements may amplify the difference with the New Source Complement.

A key element of the more successful approaches we identify is that they greatly expand the portion of allowances that are allocated based on updated information about future generation activity, rather than basing the allocation on historic information about generation activity that occurred several years in the past. These updating approaches may be applied to the same set of eligible generators, on a comparable basis of generation share, and would continue to use free allocation. We applaud EPA for recognizing the value of an updating approach to allocation; however, we find the agency has not employed this strategy to a sufficient extent in the proposed model rule. EPA can substantially improve the outcome in the final model rule.

Our second set of recommendations addresses elements that can be required as part of a state’s compliance plan, both as part of the model rule and outside the model rule. Outcomes anticipated by EPA with respect to programmatic energy efficiency differ from our model assumptions and may differ from what might occur in some states; and this difference would contribute to an emissions difference. Other environmental outcomes associated with compliance also could be

affected, and as suggested in statute they should be considered. We recommend these elements be explicitly addressed in the state's plan if it chooses a mass-based approach. We also suggest a role in the model rule and federal plan for revenue-neutral consignment sales of free allocations to provide a strong price signal to allowance market participants. This information would help ensure that the potential flexibility and cost effectiveness of a mass-based approach are fully realized.

Our third set of recommendations focuses on EPA's role in guiding the state planning process. Although these suggestions primarily concern issues outside the model rule, they should be included there as well. EPA should clarify that upon a revision of the new source performance standards recently constructed generating units would be re-designated as existing sources and trigger a revision to a state's plan at a specific date if the plan covers only sources. Also, we suggest EPA set at timetable for a program review to ensure emissions outcomes are being achieved.

In summary, although our modeling and analysis have identified an important potential lack of equivalence in emissions outcomes between the proposed model rule and the New Source Complements, we identify several additional individual measures that collectively we expect could achieve equivalence. The most straightforward path would be to require the New Source Complement as part of the model rule and federal plan for mass-based compliance. However, with the measures we recommend, we believe an equivalent emissions outcome can be achieved under a policy that covers only existing sources.

### **III. Findings about Allowance Allocation**

#### **1. EPA should make the New Source Complement, thereby covering all sources, an element of the mass-based model rule. The federal plan should retain the mass-based option for states. (CFR page numbers: 64969, 64978)**

The goal of the Clean Power Plan is to reduce total emissions from the electricity sector. Our modeling analysis of mass-based implementation approaches indicates that emissions will be lower if states include new sources of generation under the CO<sub>2</sub> emissions cap than they will be if states exclude new sources from the cap. As discussed below, this is true regardless of different allocation approaches that states could take to attempt to minimize leakage, which is the increase in emissions caused by a shift in generation from covered to uncovered emitting sources. Because EPA has deemed as equivalent to BSER a mass-based policy that includes new sources, which allows states to take advantage of their New Source Complements, requiring states to include new sources is the most direct and complete approach to achieving equivalence.

Making this provision part of the model rule would not constitute a mandate on the part of EPA because states are not required to exercise this version of the model rule. States can develop their own mass-based plans to submit to EPA and they could also adopt the rate-based model rule or

develop their own plan that deviates from those rates. Requiring states to incorporate new sources under the model rule might cause more states to choose a rate-based approach to compliance. However, the translation of emissions goals to a mass-based target has been characterized as generous, given the adherence to 2012 outcomes and allowances for growth in generation from renewables that are assumed in the calculations of the mass-based targets.

There are other advantages to a mass-based approach that could also help to sway states toward that approach. One advantage is administrative simplicity in not having to deal with the actions that accompany the creation and certification of emission rate credits (ERCs) under a rate-based system. Adopting a mass-based approach also leads to more certainty in planning because the number of allowances that will be created under the CPP is known, whereas there is uncertainty about how many ERCs might be available in the market. Moreover, in a rate-based market, buyers of ERCs who would use them for compliance are liable for the integrity of the ERCs created by renewables and energy efficiency. No such liability exists under mass-based approaches.

**2. If EPA chooses not to require states that use a mass-based approach to adopt the New Source Complements then EPA should require updated allocations for 100 percent of the emissions allowances. (CFR page numbers: 64978, 65015, 65016, 65020, 65021, 65022, 65027)**

Emissions leakage to new sources arises because implementation of a cap on emissions from only existing sources raises generation costs relative to costs of new sources that are excluded from the cap. Greater utilization of existing sources will reduce the use of new sources and help reduce leakage. EPA has proposed the use of updating output-based allocation to affected existing natural gas combined cycle (NGCC) units to offer a production incentive that is analogous to that under a rate-based approach. This is an important strategy to reduce leakage, given that section 111(d) does not allow EPA to require states to cover new sources. Our research shows that this approach leads to greater utilization of sources that are eligible for the allocation, consistent with expectations. EPA proposed allocating roughly 5 percent of allowances to existing NGCC generators based on generation shares and an additional 5 percent to new renewable generations. We find that the portion of allowances distributed in this way in the proposal is insufficient to meaningfully reduce leakage. We recommend that 100 percent of the emissions allowances should be distributed based on updating information. Anything less than 100 percent would cause emissions to be higher and even 100 percent may not be sufficient to eliminate all emissions leakage.

Allocation based on updated information relies on the same information, but updating it over time, as allocation based on historic information that EPA suggests for the majority of allowances in the proposed model rule. Both forms of allocation use free allocation with quantities that are based on generation shares from the set of eligible EGUs. Both historical and updating allocations have the disadvantage that allowance value cannot be directed to other



purposes and the advantage for the industry and consumers that allowance value is kept in the electricity sector. The *only* difference is that historic-based allocation relies on activity in the past. Updating-based allocation rewards activity that helps meet electricity demand in the present and future. It is this difference that causes updating allocation to reduce emissions leakage.

**3. EPA should recognize that updating allocation to existing NGCC and new nonemitting units reduces leakage to new NGCC units. Updating allocation to all affected units covered under the cap achieves comparable results and may have advantages. Updating allocation to existing nonemitting sources is not an effective leakage mitigation strategy. (CFR page numbers: 65018, 65020, 65021, 65022, 65025)**

Based on RFF's analysis, updating allocation to existing NGCC and new nonemitting generators is effective at reducing leakage. Our analysis shows that inclusion of new nonemitting generators for eligibility to earn allowances is slightly less effective than making eligible only existing NGCC, but the difference is small. Eligibility for new nonemitting sources would lead to more investment in such units and may have benefits beyond leakage mitigation. If new nonemitting sources are not eligible to earn allowances, they will nonetheless benefit from an anticipated rise in wholesale electricity price that would accompany implementation of the Clean Power Plan.

A strong case can be made for allocation to all existing affected units (including coal). Allocating to coal could increase or decrease emissions, but our analysis shows that the difference is likely small. On one hand, allocating to coal leaves fewer credits available for allocation to NGCC, reducing incentives to increase existing NGCC generation and elevating leakage. On the other hand, coal competes directly with new fossil sources in certain regions and time periods, so allocating to coal reduces leakage. RFF modeling shows that there is only a slight increase in the emissions outcome when all existing affected units including coal are eligible (see supplemental material). However, this more inclusive approach may have a policy or legal advantage by treating all affected sources symmetrically.

A concern raised by EPA in the model rule is that making coal boilers eligible for an updating allocation will raise allowance prices and production costs for existing units, thereby undermining the goal of mitigating leakage. Allocation to coal will raise allowance prices, but if all allowances are allocated by updating then an elevated allowance price will raise not only the costs of emissions but also the value of the production incentive. The average production costs of covered sources would be unaffected by making coal boilers eligible to earn allowances.

Eligibility to earn an updating allocation for existing nonemitting generators is not effective at reducing leakage. These sources have little potential to increase production and are therefore not responsive to a production incentive. Allowing such sources to earn allowances therefore does not reduce production from new fossil sources but does reduce the number of allowances available to other existing sources and reduces their incentive to increase production. Our analysis shows that making existing nonemitting generators eligible raises emissions

substantially compared to their ineligibility. We note that existing nonemitting units benefit anyway from an anticipated rise in wholesale electricity prices associated with the implementation of the Clean Power Plan.

**4. If EPA does not require coverage of new sources in the model rule, EPA should reduce the delay between generation and updating allocation and eliminate the threshold on utilization. (CFR page numbers: 64994, 65021, 65024)**

The proposed model rule includes a delay between generation that will earn allowances and the allocation of those allowances based on that generation. The delay is a full compliance period that could translate into up to three years and introduce uncertainty that erodes the value of the production incentive. Reducing the delay will make the production incentive more potent and thus more effective in combatting leakage.

EPA has also introduced a threshold in providing updating output-based allocation. The proposed model rule would make allowances available to NGCC only for generation above a 50 percent utilization rate. We believe that this design is intended to avoid the allocation of emissions allowances for generation that would have happened anyway. We note this is similar to what happens when allowances are distributed through grandfathering for generation that has already happened in that it does not affect behavior. The avoidance of an allocation for activities that happen anyway may be legitimate in either context. However, one problem with the 50 percent threshold is that it is uniform and does not account for differences in operating conditions across NGCC units. Two hypothetical units might be equally effective at reducing leakage but, in the absence of updating allocation, one may operate above 50 percent and the other may operate below 50 percent. Under the proposed allocation scheme, only the higher utilized unit would be eligible for updating allocation.

The 50 percent threshold also introduces uncertainty in how affected units would be utilized, with the opportunity for strategic behavior to shift utilization among units to capture the incentive without actually changing total generation from existing units. In fact, this design may not have a unique equilibrium outcome. EPA should consider lowering the threshold or preferably removing this aspect of the allocation scheme.

**5. Any free allocation not based on updated generation shares in the model rule or federal plan should be directed either to local distribution companies on an updating basis or to generators, assigning equal prominence to both approaches rather than the exclusive focus on allocation to generators in the current proposal. (CFR page numbers: 65016, 65017, 65018, 65027)**

The current discussion of allocation in the proposed model rule, other than using updating output-based allocation to combat leakage, exclusively describes grandfathering to generators. This approach could deliver very different effects on electricity prices between states that operate in competitive electricity markets and those where prices are cost-of-service regulated. In the

competitive states there will be higher wholesale (and retail) electricity prices and higher profits for generators, whereas in the regulated states price impacts will be muted.

Allocating allowances to local distribution companies, which are universally regulated, would return allowance value to ratepayers in the form of lower prices, provide more uniform rate impacts, and reduce the effect of the Clean Power Plan on prices paid by electricity consumers. States should be aware of both options and that either could be presumptively approvable once states have satisfactorily established a method for addressing leakage.

#### **IV. Requirements for State Compliance Plans**

**6. States that attempt to demonstrate equivalence in their plans should use an appropriate baseline assumption for other states' actions, and should be compelled to evaluate "other environmental outcomes." (CFR page numbers: 64980, 64986, 65001, 65028)**

States are given three options if they choose to use a mass-based approach. In addition to the New Source Complements or the (proposed) model rule, if states want to cover only existing sources and not use the model rule they can attempt to demonstrate that their state plan will not cause leakage. In general, this demonstration is difficult because electricity markets do not align with state borders. Emissions leakage to new sources can occur because of a shift in generation to new sources constructed within the state not only from existing sources in the state but also from existing sources in neighboring states, which export power. In general, for any individual state, the emissions leakage depends not only on that state's compliance plans, but also on the compliance plans of all surrounding states.

When a state submits its plan, it is likely that EPA will not have already approved the final plans of all surrounding states. Consequently, in demonstrating equivalence a state will have to make assumptions about other states' plans. This issue might be of greatest concern when a state that chooses to regulate only existing sources is located in a power region where other states have chosen the New Source Complement. In this context, substitution to new fossil units that are not covered by the compliance plan within a state may result in an emissions increase due to leakage to uncovered sources in the state from covered units both in that state and in the surrounding states where all sources are covered. This regulatory design choice may jeopardize the achievement of climate and other air quality goals within this state and in all surrounding states and may confer an unfair advantage in the investment climate to states that do not cover new sources. Hence, this setting is potentially the most compelling as a framework in which to evaluate equivalence.

We recommend that if states opt not to use the New Source Complement and not to use the model rule, they should conduct their demonstration of equivalence assuming that all surrounding states use the New Source Complement.

A second element of this demonstration should be an evaluation of the change in conventional emissions that may result under the state's compliance plan. Statute indicates that consideration of "other environmental outcomes", including changes in SO<sub>2</sub> and NO<sub>x</sub>, should be a part of the development of a state plan under the regulation. Science, policy and the courts increasingly have recognized that the actions in one state can directly affect the ability of other states to achieve air quality standards. This framework is loosely described as the *good neighbor provision* of the Clean Air Act and it has been applied in various ways. We recommend that the potential effect on air quality in neighboring states be applied as part of EPA's evaluation of state compliance plans especially as part of the demonstration of equivalence.

**7. States that do not use the new source complement should be required to build programmatic energy efficiency into their compliance plans as a measure to reduce leakage. (CFR page number: 65020)**

Another way to combat leakage to new units is to reduce demand growth in the electricity sector. Capping emissions from existing sources creates incentives to increase generation from new sources, and those new generators are more likely to be built if demand is growing. Reducing demand growth through energy efficiency programs reduces the likelihood that investors will deem new units to be profitable and thereby reduces the potential for leakage under a mass-based program covering only existing units. In EPA's Regulatory Impact Analysis of a mass-based approach that covers only existing units, the agency assumes that states adopt efficiency programs that realize 1 percent incremental energy savings each year, which effectively eliminates future load growth and dramatically reduces the potential for emissions leakage. In our modeling analysis, summarized in the attached modeling report, we assume a more modest amount of energy efficiency, which is the same across all the scenarios and which accounts for important differences in our emissions findings. That is, if states fail to realize the assumed 1 percent incremental savings per year, emissions leakage could be higher than EPA projects.

This combination of analyses suggests that requiring effective programmatic energy efficiency in conjunction with updating allowance allocation could help states that choose not to accept the New Source Complement to more fully mitigate leakage. An important requirement for employing such an approach would be that states must be sure that there is credible ex-post evaluation, measurement and verification of energy savings resulting from investments in energy efficiency. EPA has issued a draft guidance document for states on standard practice methods for conducting such evaluations and in separate comments we suggest ways to bolster that guidance. Note that the guidance is particularly targeted to energy savings that would be credited with emissions reduction credits (ERCs) under a rate-based state compliance plan, and is not focused on mass-based programs where compliance is determined by whether tons of CO<sub>2</sub> emissions fall below the mass-based guidelines and energy savings from efficiency are an ancillary matter to the EPA (unlike in a rate-based world). But the final version of EPA's guidance in this area could be more broadly applicable if EPA acknowledges energy efficiency as a potentially potent means for combatting leakage.

**8. The model rule and federal plan should require the use of consignment sales for entities that receive free allocation to build program confidence and transparent multi-state compliance. (CFR page numbers: 64977, 64981, 64997, 65018)**

Free allocation introduces concerns about whether allowances will go to their highest valued use. This misallocation may be due to market inefficiencies or the lack of salience within the firm and may be most apparent in a cost-of-service state or region. Transparent and liquid compliance markets help address this concern, and EPA and the states have an interest in their development where trading among compliance entities occurs across state lines. Updating output-based allocation and auctions inherently provide market turnover of allowances and a reasonable expectation that allowances will go to their highest valued use. However, where there is extensive use of free allocation, especially in the context of allocation based on historic information (grandfathering), the allowances may not be distributed initially to the entities that ultimately need them for compliance. In a mature allowance market one can expect liquidity, but in an emerging and potentially small market liquidity, equal access to information and the law of one price cannot be assumed. This would cause a mass-based approach to fail to minimize compliance costs. The supplementary material “Background on Consignment Sales” provides more information.

To ensure the availability and efficient use of allowances, we recommend that EPA require in the model rule and federal plan that states where there is extensive use of free allocation submit all of or a major portion of these allowances to a consignment sale with revenues flowing back proportionately to the original holders of the allowances. While the virtues of consignment sales exist for any plan that involves the use of free allocation, this requirement is especially important for states that allocate emissions allowances on the basis of a historic metric such as 2012 generation shares or where allowances are allocated to local distribution companies.

Consignment sales have been used previously in Title IV of the SO<sub>2</sub> trading program. They are used currently in California where allowances are initially allocated for free to distribution companies. Those companies also own generation assets and independent power producers expressed concern about access to allowances, which is addressed by the consignment sale. Among the benefits of this approach is that it ensures that sources that need allowances will have a way to acquire them. It will also help the market identify marginal compliance costs and elevate the salience of emissions reductions opportunities within firms. Consignment sales have minimal administrative costs. Further, in a consignment auction, bids can be structured to guarantee regulated entities that they can acquire a portion of their needed allowances at the market clearing price through the use of noncompetitive bids, a feature of US Treasury auctions. This provision can be used to assure smaller firms that they will be able to purchase back 100 percent of their bid offer.

## **V. EPA Implementation of the Clean Power Plan**

### **9. EPA should provide greater certainty on program implementation and development by affirming the schedule for reconsideration of the New Source Performance Standard under section 111(b). (CFR page numbers: 64969, 64995)**

The Clean Air Act calls for re-evaluation of the New Source Performance Standards (NSPS) every 8 years, although the agency can do so at any time. If EPA adheres to an 8 year interval, a possible revision to the NSPS would be scheduled for 2024. However, in practice EPA has not reviewed standards on the 8 year schedule. Because technology is rapidly changing in the electricity sector, as EPA notes in the preamble to the Clean Power Plan, there is a justification for anticipating the re-evaluation of the standards in a timely manner.

We recommend that EPA affirm the schedule for technical re-evaluation of the NSPS for fossil units. Doing so would benefit states and compliance entities in their planning. In addition, it would help reduce the potential leakage of generation activity and emissions to new fossil units. The re-evaluation of NSPS would lead newly constructed units to be re-designated as existing units that would then be covered by the cap on existing sources. Investors likely already recognize this outcome as a possibility, but EPA's affirmation of the schedule would cement the expectation that newly built units would not profit indefinitely from their exclusion from the cap on existing sources. Fixing this expectation would reduce the incentives to construct the emitting sources in the first place, and reduce leakage.

In affirming a schedule for revising the NSPS, EPA should also affirm that a change in the NSPS would change the designation of recently constructed units at that juncture, putting them into the existing source category. States that choose not to use the model rule and instead to demonstrate equivalence should anticipate the revision of the NSPS in their compliance plans or else the state plans should be revised in 2024.

We also recommend that EPA clarify that the complement of allowances made available to new sources would no longer be available to states in 2024 when newly built units are re-designated as existing if states have previously exercised the option to regulate existing sources only. The complement should be available only to states that cover new sources in their original plan.

### **10. EPA should commit to a schedule for program review of 111(d). (CFR page numbers: 64976, 64977, 64995)**

Several factors could change the emissions outcome under the Clean Power Plan if states do not use the New Source Complement. One key factor that EPA describes in the preamble is the rapidly changing technology in the electricity sector. The technical findings that underpin the program may be affected.

We recommend EPA commit to a program review of the Clean Power Plan at a future certain date. The existing state climate programs have this feature and the outcome has been improved

program design and environmental outcomes. This schedule will help states in their compliance planning to balance short run emissions reduction and long run infrastructure planning.

## **VI. Supplementary Material**

### **Introducing a Production Incentive Using Updating Allocation**

Dallas Burtraw, Karen Palmer, and Anthony Paul

EPA's proposed model rule and federal plan suggest the use of updated information about the share of generation among eligible electricity generating units as a basis for initially distributing a portion of the emissions allowances in states that choose to use a mass-based approach covering only existing sources. This allocation approach provides an incentive to expand generation in order to earn a larger share of valuable emissions allowances, thereby encouraging greater use of existing resources that are covered by the program and avoiding the substitution of generation to new, unregulated units. This narrative provides background for why this approach can be expected to increase production by eligible units, and provides information in support of our formal comments and recommendations to EPA.

#### **Introduction**

Introducing a price on carbon through mass-based cap-and-trade or emissions-rate trading creates an asset in emissions allowances or emissions rate credits potentially worth billions of dollars. The initial distribution of emissions asset value into the economy can shape technological outcomes that relate to goals of the Clean Power Plan. In particular, EPA identified the allocation of a portion of emissions allowances (and implicitly their asset value) to specific technologies to mitigate the possibility of generation and emissions leakage.

Two types of leakage have surfaced as concerns in the implementation of the Clean Power Plan, and both have the potential to contribute to an increase in overall CO<sub>2</sub> emissions. One is leakage of electricity generation or emissions across state borders, where states use different approaches such as mass-based versus rate-based approaches to compliance. The second is leakage from existing covered sources to uncovered new generation.

Various approaches to allocating emissions allowances including the use of updating output-based allocation to provide incentives to overcome leakage are expected to affect both forms of leakage. The idea of updating output-based allocation is fundamentally simple. Updating allocation contrasts with an approach, known as grandfathered allocation, that bases allocation on activity in the past and that provides no incentives for specific behavior going forward. In contrast, updating allocation distributes the emissions asset value based on current or recent behavior and updates that allocation over time thereby providing an incentive to do more of that behavior. If the behavior is electricity generation (output), then eligible entities receive a share of the allocation based on their share of electricity generation. Because their share of generation is

updated over time, entities have an incentive to grow their generation. An important aspect of this approach to allocation is the determination of the set of entities that are eligible to receive this production incentive. The allocation design can target the production incentive to technologies that reinforce program goals, as EPA has proposed.

Previous research demonstrates that such approaches can be effective at mitigating leakage or even achieving negative leakage, meaning an increase in generation in the state using updating output-based allocation and lower total emissions of CO<sub>2</sub> (Fischer 2003; Burtraw et al. 2015). However, the use of allowance value for the purpose of mitigating leakage has an opportunity cost because as a result of that choice the allowance value is not available for other uses. Also, the use of allocation to combat leakage may suppress the change in electricity prices that would otherwise occur, thereby encouraging additional electricity consumption. Therefore it is important to understand the relationship between allocation strategies and outcomes and to link those outcomes to program goals.

The Proposed Federal Plan identifies output-based allocation to existing natural gas combined cycle units in states that use mass-based compliance as a *presumptively approvable strategy* to mitigate leakage from existing gas units that would be covered under the program to new natural gas units that might not be, depending on the design of state compliance activities. The strategy is also useful for addressing the so-called seams issue, which describes the interaction between states with mass-based compliance and other states with rate-based compliance. An important question concerns how this allocation approach can be designed to achieve its intended outcome while preserving as much of the allowance value for other purposes.

### Conceptual Background

Output-based allocation is effective because it provides an incentive, in the form of valuable emissions allowances, as a reward to generation using the targeted technology(ies). In its most potent form, some or all of the allowances under an emissions cap are dedicated to this purpose and each eligible facility's share of the allowances depends on its share of generation from amongst all eligible facilities. For example, the Proposed Federal Rule identifies existing natural gas combined cycle units as eligible for roughly five percent of the allowances under a mass-based approach.

Let us label the share of allowances set aside as an incentive to generation from existing natural gas units as  $A$ . Imagine each existing gas facility  $j$  earns a share  $s_j$  of these available allowances  $A$ , where that facility's share is the portion its generation  $g_j$  of total generation  $G$  by all existing gas facilities:  $s_j = g_j / G$ . The total number of allowances earned by facility  $j$  is  $s_j A$ , and consequently it has an incentive to increase generation because as it does so it earns a larger share of the allowances. The facility has an obligation to comply with the emissions cap, so it has to surrender emissions allowances, but the output-based allocation acts like a rebate that offsets some, all, or more than all, of that burden (depending on the facility's own emissions rate),



thereby giving it an advantage compared to other technologies that do not receive an allocation. This can be represented as a change in the variable cost of running the existing natural gas facility. If the variable cost of generation for each MWh of production depends only on fuel costs  $f_j$  and its emissions related allowance burden  $e_j$  and the price of allowances is  $p$  then the variable cost is:

$$V_j = f_j + p(e_j - s_j A)$$

The allocation reduces its variable cost by  $ps_j A$ , giving it an advantage in the merit order of technologies for meeting load. Moreover, as the facility increases its generation, its variable cost declines further ( $\partial V / \partial g_j < 0$ ), so the targeted technology has an incentive to increase generation further, while the overall emissions cap is maintained.

To be effective, output-based allocation has to be updated, so that the share of allowances going to each facility may change over time if the facility's share of eligible generation changes. A standard way this approach is described is to look back one data period. For example allocation in year  $t$  might depend on the share of generation in year  $t-1$ , and would be announced mid-year after data for the previous year is verified.

### **Why Updating Output-Based Allocation is Useful in the Clean Power Plan**

Output-based allocation is useful for two main reasons under the Clean Power Plan. First, states that use a mass-based approach may interact through the power market with states that use a rate-based approach. A rate based approach implicitly provides a production incentive that is strongly analogous to updating output-based allocation under cap and trade. Under a rate-based approach, covered facilities have an obligation to surrender credits at their observed emissions rate but also earn credits at the specified emissions rate target, which is analogous to an allocation under cap and trade. The major difference between output-based allocation under cap and trade and emissions rate trading is that there is no cap under an emissions rate approach. Therefore, the production incentive in the rate-based system may not only attract investment away from the cap and trade region, but it may lead to an overall increase in emissions. Updating output-based allocation in a mass based system provides a potential antidote to this interaction between the systems by providing a mechanism to mimic the production incentive provided by a rate based system.

Second, the Clean Power Plan does not cover all electricity generation technologies in a similar way. Although new natural gas units have an obligation to comply with new source performance standards, they may be excluded from compliance with the existing source performance standards, creating asymmetry and potentially conveying advantage to new generators. If these facilities are not covered by the cap, this would lead to an increase in emissions. Updating output-based allocation to existing facilities provides an incentive to production at these facilities, and a potential antidote to leakage to new sources.

While there is an opportunity cost to using allowance value to provide incentives for a specific technology, that purpose may be explicitly consistent with other elements of the program. For example, in the Regional Greenhouse Gas Initiative (RGGI) approximately two-thirds of allowance value has been directed to investment in energy efficiency, which is a parallel priority for states in the region. The use of allowance value to promote energy efficiency is a form of output-based allocation (without updating) if one views energy efficiency as a non-emitting resource. In fact, it qualifies as such a resource under the Clean Power Plan. The updating output-based allocation to a specific technology may substitute for other approaches to support technologies such as direct budget expenditure by state or federal jurisdictions, or spending a share of auction revenue as in RGGI. The allocation may avoid the need for budget expenditures or auctions, which can be politically difficult.

In our comments to EPA, we describe an extensive modeling exercise where we examined the advantages of different eligibility rules for updated output-based allocation. We also examine the potency of this approach to achieve EPA's goals.

## **References**

- Butraw, Dallas, Karen Palmer, Anthony Paul, and Sophie Pan. 2015. A Proximate Mirror: Greenhouse Gas Rules and Strategic Behavior under the US Clean Air Act. *Environmental and Resource Economics* 62(2): 217–241.
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# Approaches to Address Potential CO<sub>2</sub> Emissions Leakage to New Sources under the Clean Power Plan

## *Technical Background for Public Comments to EPA*

**Dallas Burtraw, Karen Palmer, Anthony Paul, and Hang Yin**

Resources for the Future

January 21, 2016

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# Introduction

EPA's Clean Power Plan (CPP) prescribes emissions rate standards covering most existing fossil electricity generating units (EGUs) and mass-based alternatives. States have the responsibility to adopt one approach. An important concern is the equivalence of a mass-based approach to emissions rate standards, in particular with respect to the expanded utilization of new fossil generating units and associated CO<sub>2</sub> emissions.

EPA has indicated that if a state uses a mass-based policy that covers new sources and includes the New Source Complement the policy would achieve equivalence. If only existing sources are covered under a mass-based policy then the state must demonstrate that it does not lead to expanded utilization of new fossil units.

The mass-based Proposed Model Rule distributes a portion of emissions allowances based on updating generation data to provide a production incentive for existing covered units intended to offset the incentives that otherwise exist to shift generation away from these units to new uncovered units. Another portion of allowances is allocated on an updating basis to new renewables. If finalized, this approach would be presumptively approvable as a design for state compliance plans.

# Updating the distribution of emissions allowances provides a production incentive to eligible units

EPA's proposed approach would distribute allowances based on recent information about an EGU's share of electricity generation (output) and update that information over time. Previous research indicates that this approach can provide an incentive that changes the utilization of facilities and affects the environmental outcome.

**This research** examines the expected performance of EPA's proposal and several alternatives using a highly parameterized capacity planning and operation model of the electricity system called Haiku.

We evaluate EPA's dual-rate emissions rate standard, the mass-based approach that covers all sources and includes the New Source Complements, and a representation of the Proposed Model Rule with updating distribution to new renewable sources and existing natural gas combined cycle (NGCC) units.

We also evaluate several variations of updating allocation, including expanding the portion of allowances allocated on an updating basis, pooling the set-asides for new renewables with the allocation for NGCC, applying various weights other than uniform across eligible technologies, expanding the set of eligible technologies to include coal and existing non-emitting units, and other special issues.

# Main Findings

- A **mass policy covering all sources** and including the new source complements yields emissions that are less than the options we consider for mass-based approaches that cover only existing sources.
- **Updating allocation is a potent approach** to reducing total emissions when new sources are not covered under a mass-based emissions cap. **EPA should consider expanding the portion of allowances allocated on an updating basis and the technologies eligible to earn them.**
- Designating all affected units (including coal) as eligible to receive updating allocation can be nearly as effective at reducing leakage to uncovered new fossil units as excluding coal from eligibility. This may have a policy or legal advantage in treating all affected sources symmetrically. In contrast, eligibility for existing non-emitting generators is not an effective leakage remedy.
- Some aspects of the model framework may amplify the leakage we identify. If newly constructed units were expected to be designated as existing units at a future date this would narrow the gap. Greater investment in effective programmatic energy efficiency also would narrow the gap. More EE would also lead to lower allowance prices and reduce the impact of any allowance allocation scheme.

# Summary of Model Results

1. The proposed model rule leaves an important gap in total emissions reductions compared to an approach covering all sources. EPA is right to be concerned about leakage.
2. Updating allocation is effective at reducing leakage to new sources compared to distributing allowances on an historic basis. Increasing the share of updating allocation beyond the ~10% proposed in the model rule can substantially reduce leakage.
3. Expanding eligibility for updating allocation to include all affected sources (including coal) only slightly increases emissions. This expansion would elevate allowance prices without necessarily raising average production costs for affected sources or retail electricity prices.
4. Expanding eligibility for updating allocation to include existing non-emitting generators is not an effective leakage remedy.
5. Pooling the allowances provided on an updating basis with those set-aside for renewables may yield slightly more new renewables and slightly greater emissions from new sources.
6. Weighting allocation based on the two different approaches that we modeled leads to more emissions than a uniform approach with eligibility to only gas or to all fossil generation.
7. National average retail electricity prices in 2030 typically increase by less than 3% compared to the Proposed Model Rule in scenarios that expand updating allocation to reduce leakage.

# Important Caveats

1. The model includes modest programmatic investment in energy efficiency beyond the *Annual Energy Outlook* baseline. We believe greater energy efficiency investment would directly reduce leakage.
2. We do not represent the Clean Energy Incentive Program (CEIP).
3. We do not report emissions or emissions changes from existing unaffected sources such as gas turbines.
4. The model assumes newly constructed units not covered by the existing source program would forever remain outside the program. However, statute indicates EPA should revise the performance standard for new sources every eight years, and can do so earlier. When EPA does so, newly constructed units are likely to be designated as existing and subject to regulation at that time. This model assumption likely exaggerates the role of new units.
5. We do not represent the 50% utilization threshold for allocation to existing natural gas combined cycle units that is in the proposed model rule. All generation from existing natural gas is eligible for allocation.
6. The set-asides for new renewables and existing NGCC units are always fully allocated to eligible units based on their shares of generation.
  7. The updating allocation approach that we model assumes the allocation is coincident in time with when the allowances are used; in the proposed model rule updating allowances for NGCC are allocated based on generation in the recent past.
8. We model a national market for emissions allowances and do not model banking.



# Outline for the remainder of this report

- Defining leakage and equivalence
- Description of the Haiku model
- Addressing leakage by updating output-based allocation
  - Increasing the share of updating allocation
  - Alternative forms of eligibility
- Our “bottom line”

# EPA on Leakage and Emissions

- Leakage is "... the potential of an alternative form of implementation of the BSER\* (e.g., the rate-based and mass-based state goals) to create a larger incentive for affected EGUs to shift generation to new fossil fuel-fired EGUs relative to what would occur when the implementation of the BSER took the form of standards of performance incorporating the subcategory-specific emission performance rates representing the BSER."  
\* *Best System of Emissions Reduction*
- "... the EPA recognized that the statutory construction regarding the BSER is to reduce emissions.", "... leakage, where shifts in generation to unaffected fossil fuel-fired sources result in increased emissions, relative to what would have happened had generation shifts consistent with the BSER occurred, is contrary to this construction."
  - Federal Register Vol. 80, No. 205, Pg. 64822
- ❑ EPA projects total emissions from implementation of BSER equal to emissions under mass-based policy that includes the New Source Complements.

# Emissions Equivalence in 2030

CO <sub>2</sub> Emissions (million short tons)	Dual-Rate BSER	New Source Complements	Proposed Model Rule
Affected EGUs	1,342	1,427	1667
+ New NGCC	230	281	278
Total*	1,572	1,708	1,946

\* Total does not include emissions from unaffected units other than new NGCC.

- RFF analysis, subject to our model assumptions including a lower level of energy efficiency than anticipated by EPA in its Regulatory Impact Analysis and other caveats, finds emissions from affected EGUs and new sources in 2030 do not reflect emissions equivalence between the Dual-Rate BSER, the New Source Complements and the Proposed Model Rule. We believe more programmatic efficiency would increase emissions under BSER and lower emissions under the Proposed Model Rule, with no effect on the published New Source Complements targets.
- Leakage under the Proposed Model Rule relative to the New Source Complements is 238 M short tons, which is less than 278 M tons of emissions from new NGCC under the model rule. The New Source Complements scenario is treated as the reference point for equivalence when measuring leakage in this modeling exercise.

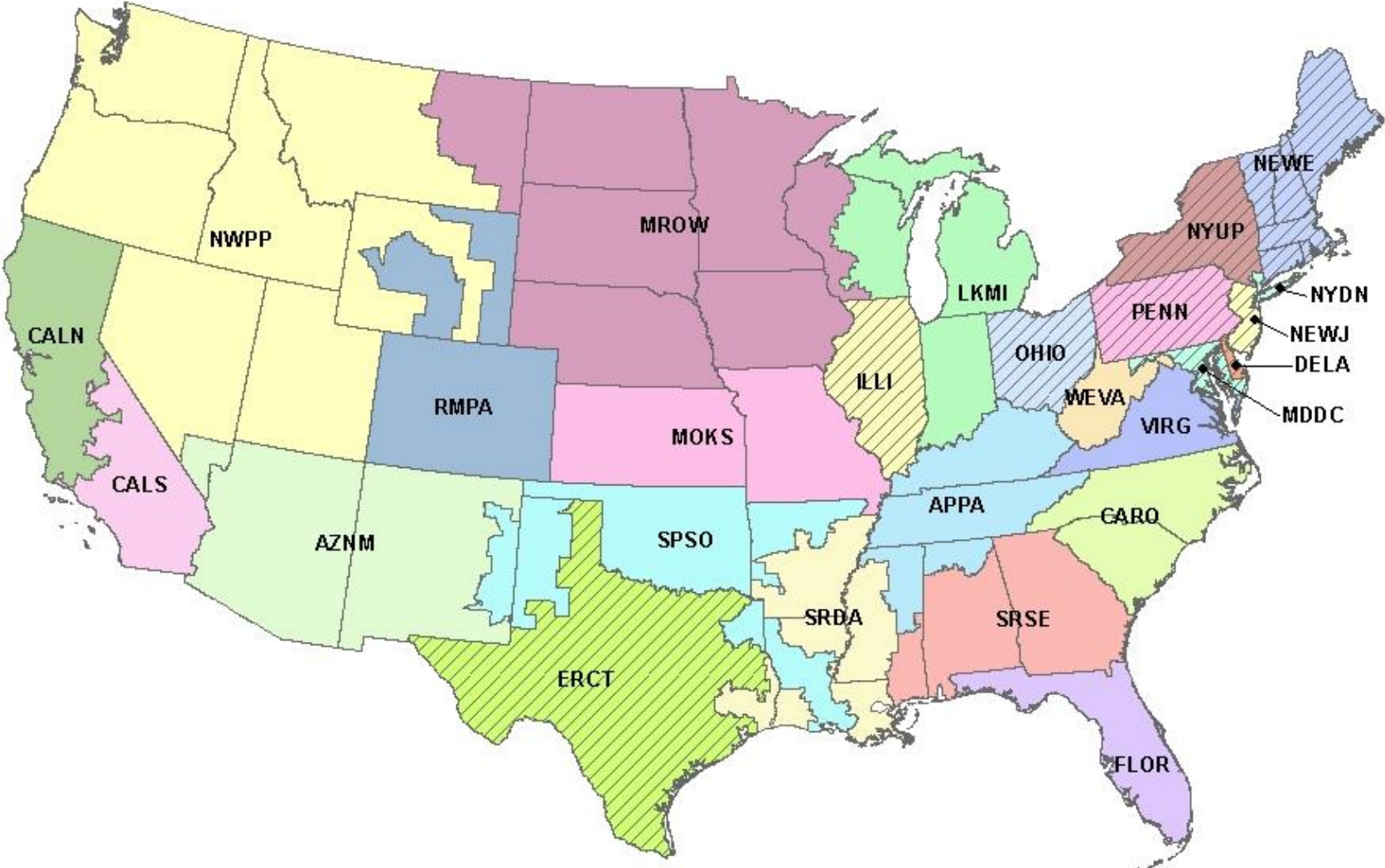
# Policy Exercise


- We do not focus on the difference between a sub-categorized emissions rate approach (BSER) and the New Source Complements, recognizing that model differences and assumptions as described may be influential to the outcome.
- We examine emissions equivalence (among affected units and new NGCC) between mass-based policies that do not cover new sources and one that does cover new sources and includes the New Source Complements.
- This framework provides a laboratory to examine the effectiveness of various approaches for updating the distribution of emissions allowances to prevent leakage to new sources.

# RFF Modeling: Baseline

- Retail electricity prices and consumption, natural gas and coal prices calibrated to EIA's *Annual Energy Outlook 2013*.
- Clean Air Interstate Rule (CAIR) and Mercury and Air Toxic Standards (MATS)
- Regional Greenhouse Gas Initiative (RGGI) and California's AB32
- State renewable portfolio standard and mercury policies
- Federal and state renewable production and investment tax credits expire (recent policy changes are not represented).
- Programmatic energy efficiency achieves about 3.4% cumulative demand reduction by 2025 and is maintained thereafter (roughly half the level anticipated by EPA).

# Model Regions



 Competitive Cost Regions

# RFF Modeling of the Clean Power Plan

- National allowance trading
- No CEIP
- A mass-based policy with the New Source Complements is the reference point for leakage.
- We study alternative methods of updating allowance allocation under mass-based policies without the new source complements for their effectiveness at eliminating leakage.
  - Allocate up to 100% allowances by updating allocation?
  - Instead of 50/50 split between existing NGCC and new renewables, is another share more effective? Include existing coal boilers in the scheme?
  - Instead of set of set-asides, would pooling technologies be more effective?
  - Should all eligible generators receive the same allocation per MWh of production or should different technologies get different allocation weights?
- Other special issues.

# RFF Modeling of Bookend Scenarios

Six scenarios are described on the next page.

- Proposed Model Rule

- New sources not covered under the cap (New Source Complements are not adopted). Shares of allowances are set aside for new renewables (5%) and existing NGCC (~5%) to be distributed according to updated shares of generation (output based allocation). Remaining allowances (~90%) are allocated based on historic emissions (grandfathering).

- 100 Percent Updating Allocation without New Source Complements

- Four scenarios are similar to the Proposed Model Rule scenario with the share of allowances that is allocated by updating output-based allocation increased to 100%. The scenarios vary by the technologies eligible to earn allowances and by the existence of technology-specific set-asides vs. combining eligible technologies within a single allowance pool.

- New Source Complements

- Cover all affected and new NGCC units and include New Source Complements. All allowances are allocated based on historic emissions (grandfathering).

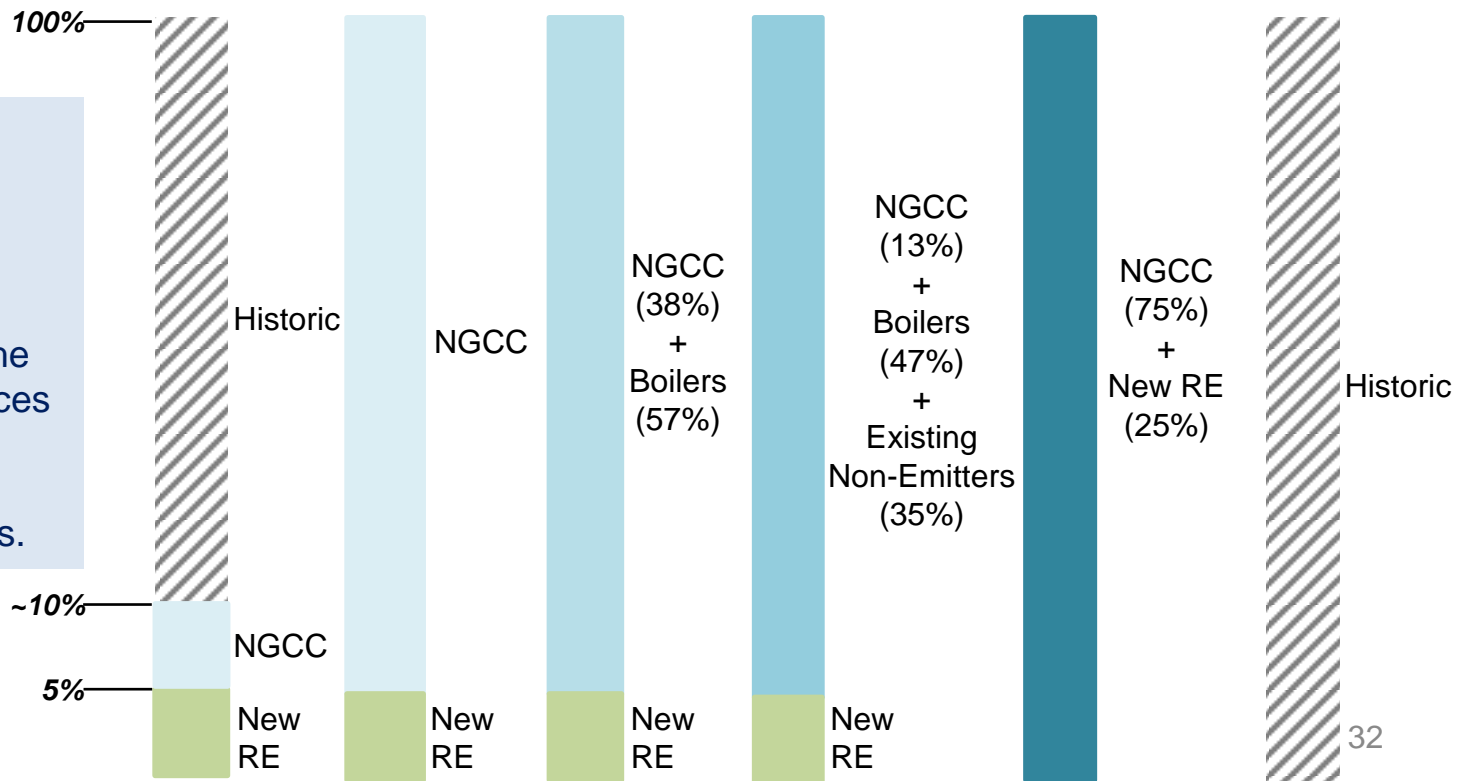


# 100 Percent Updating Allocation Scenarios (2030)

	Proposed Model Rule	Alternative Updating Approaches				New Source Complements
<b>Covered Sources:</b>		Existing NGCC & Boilers				All NGCC & Boilers
<b>Updating Share:</b>	~10%	100%				0%
<i>New Renewables:</i>		5% Set-Aside			Pooled	
<i>Existing Sources Eligible for Allocation:</i>	NGCC	NGCC	Affected EGUs	All	NGCC	

Solid colored bars represent updating allocation.

Percentages (in parentheses) indicate the fraction of total allowances earned by each technology. These are model results, not inputs.



# Results for 100 Percent Updating Allocation (2030)

		Proposed Model Rule	Alternative Updating Approaches				New Source Complement
Covered Sources:		Existing NGCC & Boilers					All NGCC & Boilers
Updating Share:		~10%	100%			0%	
New Renewables:		5% Set-Aside			Pooled		
Existing Sources Eligible for Allocation:		NGCC	NGCC	Affected EGUs	All	NGCC	
Generation (TWh)	Existing Boilers	1,405	1,205	1,253	1,410	1,249	1,148
	Existing NGCC	469	965	870	455	860	573
	New NGCC	735	337	385	732	384	742
	New Wind	147	203	220	160	241	206
Emissions (M tons)	Existing Boilers	1,464	1,244	1,290	1,470	1,293	1,180
	+ Existing NGCC	203	422	377	197	373	247
	= Affected EGUs	1,667	1,667	1,667	1,666	1,666	1,427
	+ New NGCC	278	128	146	277	146	281
	= Total	1,946	1,794	1,812	1,943	1,812	1,708
Leakage (M tons)		238	86	104	235	104	-
Leakage Reduction (%)		-	64%	56%	1%	56%	-
Allowance Price (\$/ton)		4	7	20	4	5	17
Electricity Price (\$/MWh)		102	105	104	102	104	106

Leakage Reduction is percent reduction from Leakage under Proposed Model Rule compared to coverage of existing affected and new sources using the New Source Complements.

# Updating Allocation Mitigates Leakage (2030)

All 100% updating scenarios reduce total emissions compared to the Proposed Model Rule (10% updating, 90% historic). Given our model assumptions, leakage mitigation is 1%-64%.

None of these allowance allocation schemes completely achieve emissions equivalence.

As noted elsewhere, other policy measures (such as programmatic energy efficiency) can further mitigate leakage.

		Proposed Model Rule	Alternative Updating Approaches			New Source Complement	
<b>Covered Sources:</b>		Existing NGCC & Boilers					All NGCC & Boilers
<b>Updating Share:</b>		~10%	100%			0%	
<b>New Renewables:</b>		5% Set-Aside			Pooled		
<b>Existing Sources Eligible for Allocation:</b>		NGCC	NGCC	Affected EGUs	All	NGCC	
Generation (TWh)	Existing Boilers	1,405	1,205	1,253	1,410	1,249	1,148
	Existing NGCC	469	965	870	455	860	573
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Emissions (M tons)	Existing Boilers	1,464	1,244	1,290	1,470	1,293	1,180
	+ Existing NGCC	203	422	377	197	373	247
	= Affected EGUs	1,667	1,667	1,667	1,666	1,666	1,427
	+ New NGCC	278	128	146	277	146	281
	= Total	1,946	1,794	1,812	1,943	1,812	1,708
Leakage (M tons)		238	86	104	235	104	-
Leakage Reduction (%)		-	64%	56%	1%	56%	-
Allowance Price (\$/ton)		4	7	20	4	5	17
Electricity Price (\$/MWh)		102	105	104	102	104	106



# Existing/New NGCC Substitution (2030)

The primary leakage mitigation pathway is substituting generation from existing NGCC for new NGCC.

Inclusive approaches, when boilers are eligible or when new RE is pooled with NGCC, are nearly as effective at mitigating leakage as making only NGCC eligible for non-set-aside allowances.

Eligibility also for existing non-emitting (“All”) is less effective because those sources<sup>1</sup> are not responsive to the incentive from updating allocation. This approach waters down the incentive directed to other technologies.

		Proposed Model Rule	Alternative Updating Approaches			New Source Complement	
<b>Covered Sources:</b>		Existing NGCC & Boilers				All NGCC & Boilers	
<b>Updating Share:</b>		~10%	100%			0%	
<i>New Renewables:</i>		5% Set-Aside			Pooled		
<i>Existing Sources Eligible for Allocation:</i>		NGCC	NGCC	Affected EGU	All	NGCC	
Generation (TWh)	Existing Boilers	1,405	1,205	1,253	1,410	1,249	1,148
	Existing NGCC	469	965	870	455	860	573
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Leakage (M tons)		238	86	104	235	104	-
Leakage Reduction (%)		-	64%	56%	1%	56%	-
Allowance Price (\$/ton)		4	7	20	4	5	17
Electricity Price (\$/MWh)		102	105	104	102	104	106

1. Our modeling finds no nuclear plant retirement even in the baseline. If they would retire in the absence of the CPP, then an updating allocation to nuclear plants could prevent that retirement.

# Electricity and Allowance Prices (2030)

Electricity prices rise as leakage is mitigated, but by less than 3% compared to the Proposed Model Rule.

Allowance prices are elevated when boilers are eligible, but electricity prices are not. This is because all of the allowance value, which is highest when boilers are eligible, is returned to the power sector. This offsets the cost of an elevated price on emissions.

		Proposed Model Rule	Alternative Updating Approaches			New Source Complement	
		Existing NGCC & Boilers					All NGCC & Boilers
		~10%	100%			0%	
		5% Set-Aside				Pooled	
<i>Existing Sources Eligible for Allocation:</i>		NGCC	NGCC	Affected EGU	All	NGCC	
Generation (TWh)	Existing Boilers	1,405	1,205	1,253	1,410	1,249	1,148
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Leakage (M tons)		238	86	104	235	104	-
Leakage Reduction (%)		-	64%	56%	1%	56%	-
Allowance Price (\$/ton)		4	7	20	4	5	17
Electricity Price (\$/MWh)		102	105	104	102	104	106

# Summary of 100 Percent Updating Approaches

1. Updating allocation is effective at reducing leakage to new sources compared to distributing allowances on an historic basis.
2. Expanding eligibility for updating allocation to include all affected sources (including coal) only slightly increases emissions. This expansion would elevate allowance prices without necessarily raising average production costs for affected sources or retail electricity prices.
3. Expanding eligibility for updating allocation to include existing non-emitting generators is not an effective leakage remedy.
4. Pooling the allowances distributed on an updating basis to existing fossil and new renewables generating units may yield slightly more new renewables and slightly greater emissions from new fossil sources.
5. National average retail electricity prices in 2030 increase typically by less than 3% from the Proposed Model Rule in all scenarios that expand updating allocation to reduce leakage.

# An Expanded Set of Scenarios

- In this section **we consider a range of updating allocation shares** under both the pooled and set-aside approaches described above to study the effects of incremental changes in the number of allowances being allocated through updating to existing natural gas units.
- We also explore the consequences of **weighted allocations** where the number of allowances awarded per MWh of generation differs across technologies in a way that tries to map to the incentives under BSER.
  - The first approach uses the BSER emission rate goals for coal, gas and non-emitting as inverse weights to yield the following allocation weights in 2030:
    - RE: 1
    - Gas: Interim –  $(1534-832)/1534=0.458$  Final –  $(1305-771)/1305=0.409$
    - Coal: 0.
  - The second approach takes the production incentive outcomes from the dual-emissions rates BSER scenario, in the form of emissions allowances earned per MWh, which vary according to individual generator's emissions rates to define the following allocation weights in 2030:
    - RE: 0.57. (The allowances earned by a new MWh of non-emitting generation.)
    - Gas: 0.34-0.42. (This accounts for gas shift ERCs awarded to existing gas generation).
    - Coal: 0.69-0.72.
- Note the Proposed Model Rule sets aside allowances for existing NGCC and new renewables but applies no weighting otherwise. The weighting considered here would introduce another difference from the proposal.

# Expanded Scenario Specifications

We model 20 scenarios, described in four rows and five columns below, that vary the magnitude and form of updating allocation with the following characteristics:

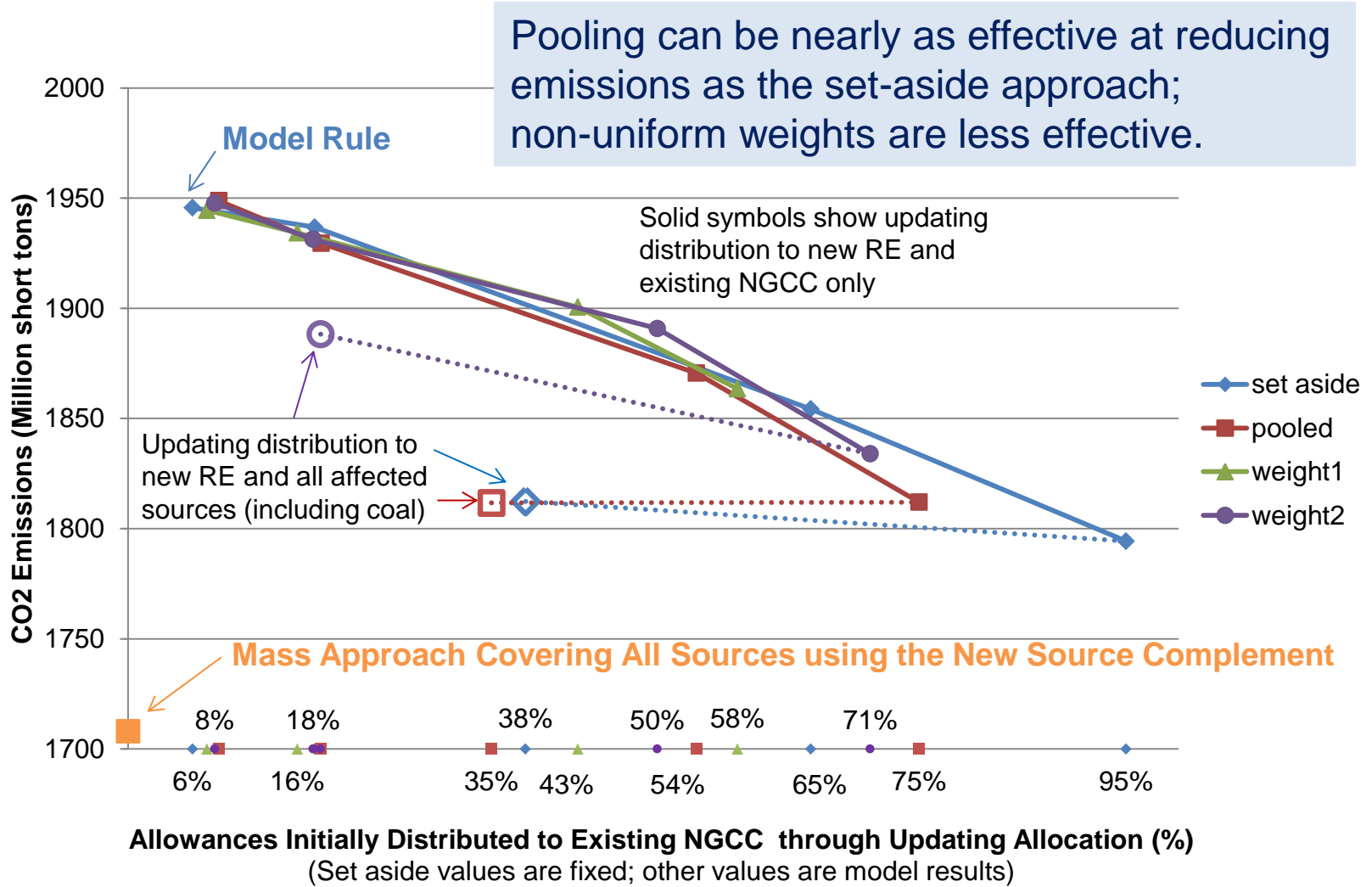
1. Set asides for existing NGCC and new RE, pooled eligibility , included eligibility for boilers and 2 versions of weighting.
2. Share of allowances allocated by updating varies : 10%, 23%, 70%, 100%, 100%.

In previous results we described the 10% and 100% cases. Here we present intermediate outcomes and other observations.

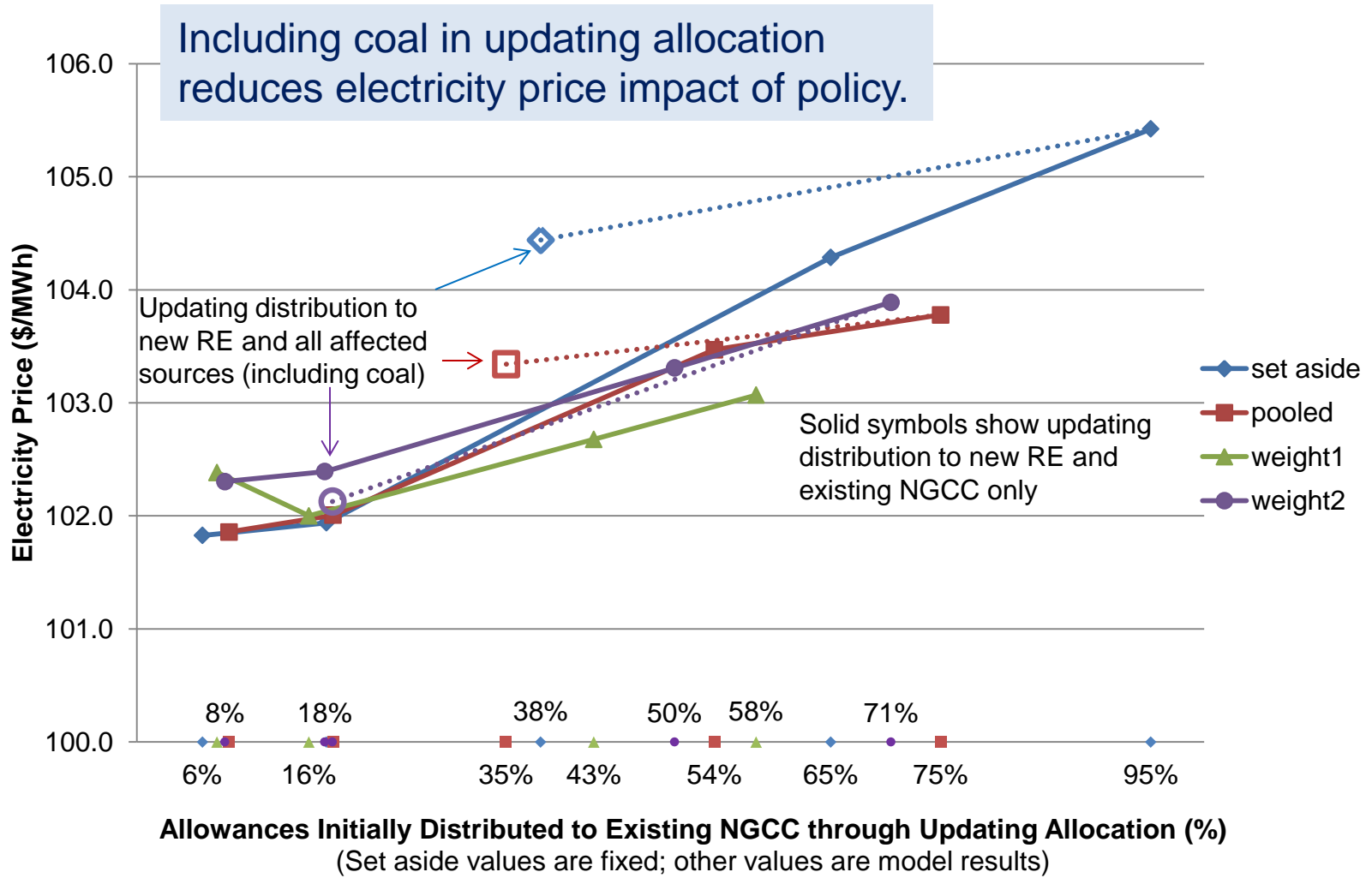
Updating Share:	10%	23%	70%	100%	
<b>Set-Asides</b>	5%: RE 5%: NGCC 90%: <i>Historic</i>	5%: RE 18%: NGCC 77%: <i>Historic</i>	5%: RE 65%: NGCC 30%: <i>Historic</i>	5%: RE 95%: NGCC 0%: <i>Historic</i>	5%: RE 95%: NGCC, Boilers 0%: <i>Historic</i>
<b>Pooled Eligibility w/ Uniform Weights</b>	10%: RE, NGCC 90%: <i>Historic</i>	23%: RE, NGCC 77%: <i>Historic</i>	70%: RE, NGCC 30%: <i>Historic</i>	100%: RE, NGCC 0%: <i>Historic</i>	100%: RE, NGCC, Boilers 0%: <i>Historic</i>
Weights 1: (BSER Goals)	10%: RE, NGCC 90%: <i>Historic</i>	23%: RE, NGCC 77%: <i>Historic</i>	70%: RE, NGCC 30%: <i>Historic</i>	100%: RE, NGCC 0%: <i>Historic</i>	N/A
Weights 2: (BSER Outcomes)	10%: RE, NGCC 90%: <i>Historic</i>	23%: RE, NGCC 77%: <i>Historic</i>	70%: RE, NGCC 30%: <i>Historic</i>	100%: RE, NGCC 0%: <i>Historic</i>	100%: RE, NGCC, Boilers 0%: <i>Historic</i>



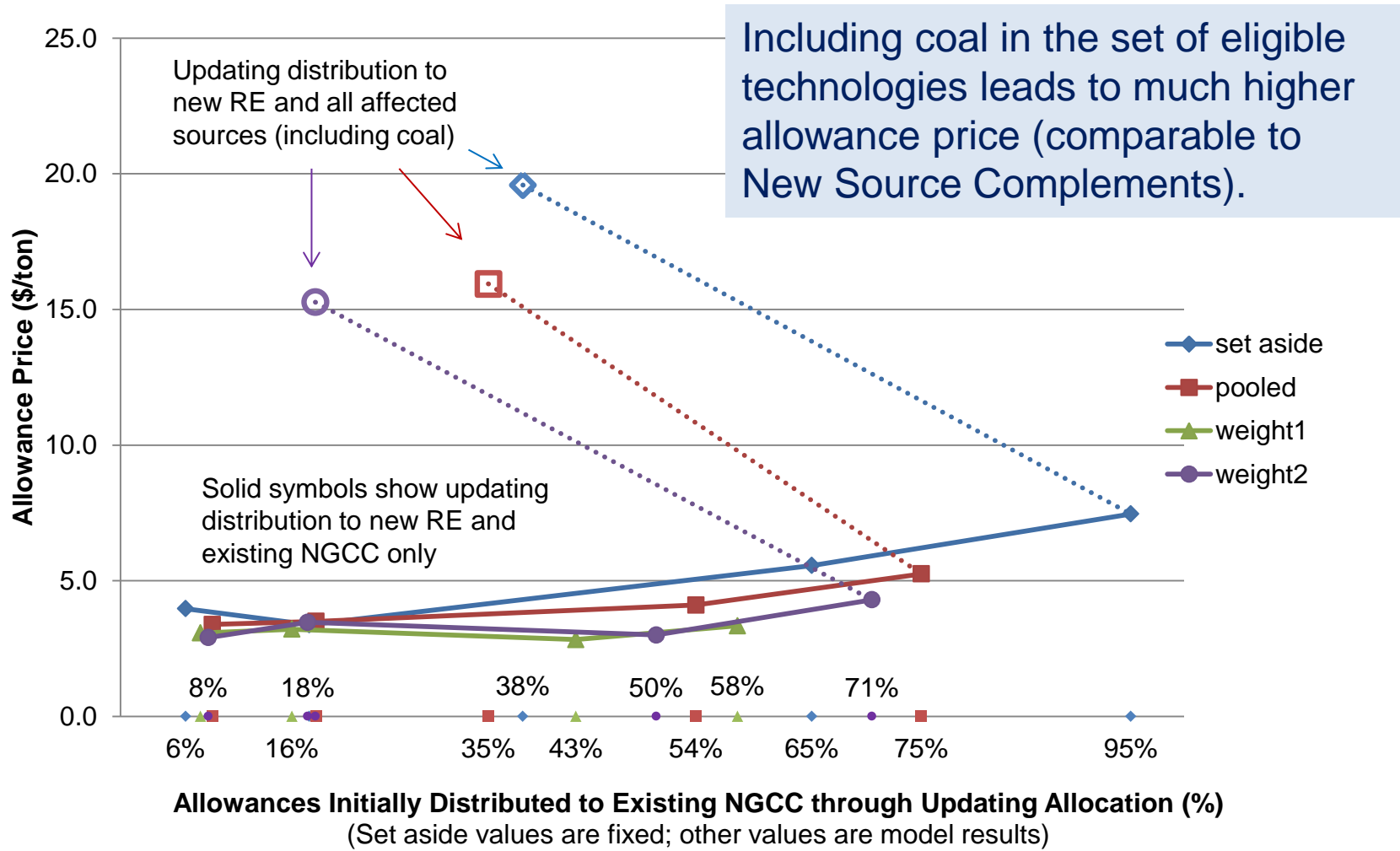
# CO<sub>2</sub> Emissions from Affected EGUs + New NGCCs (2030)



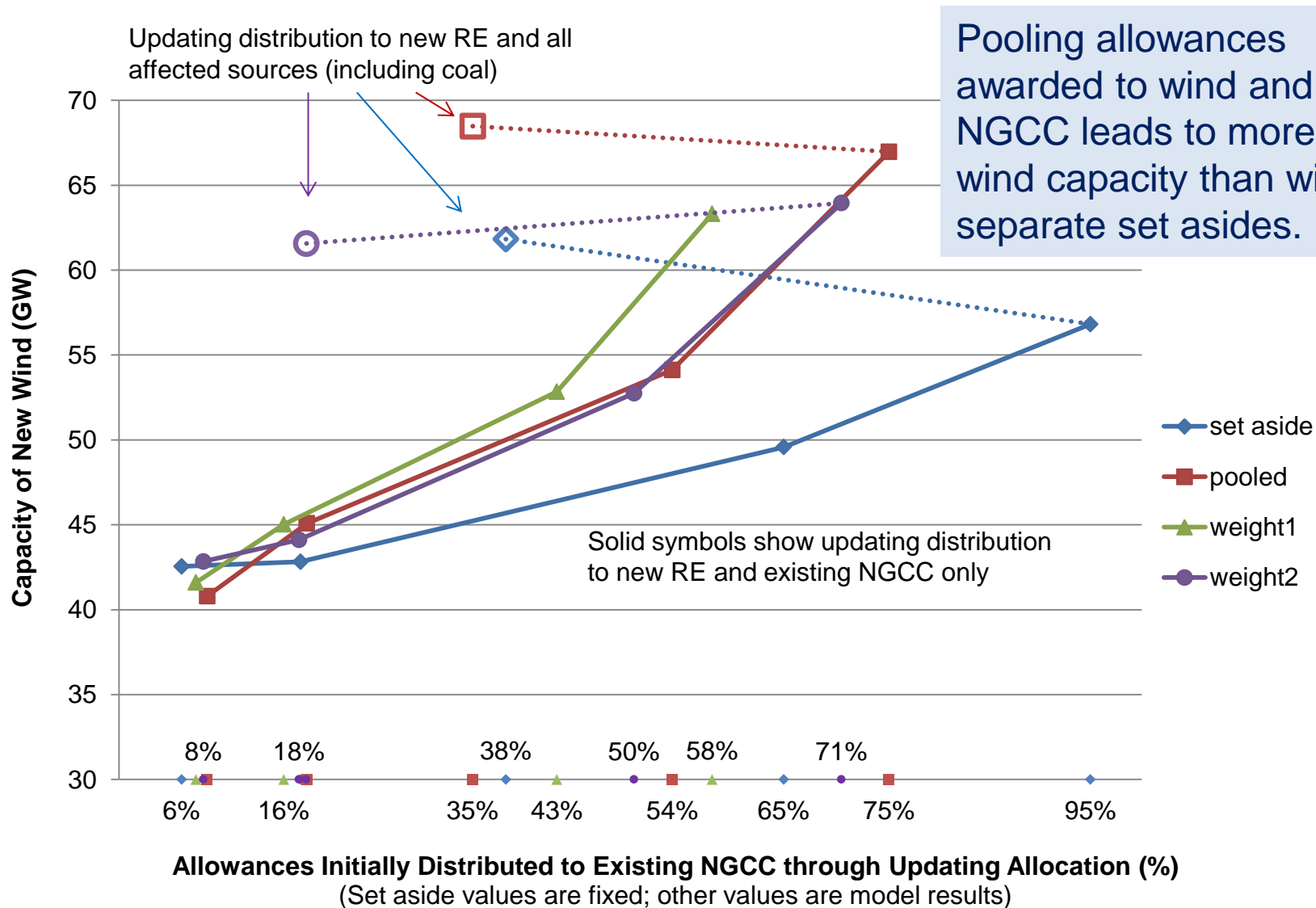
# Electricity Price (2030)



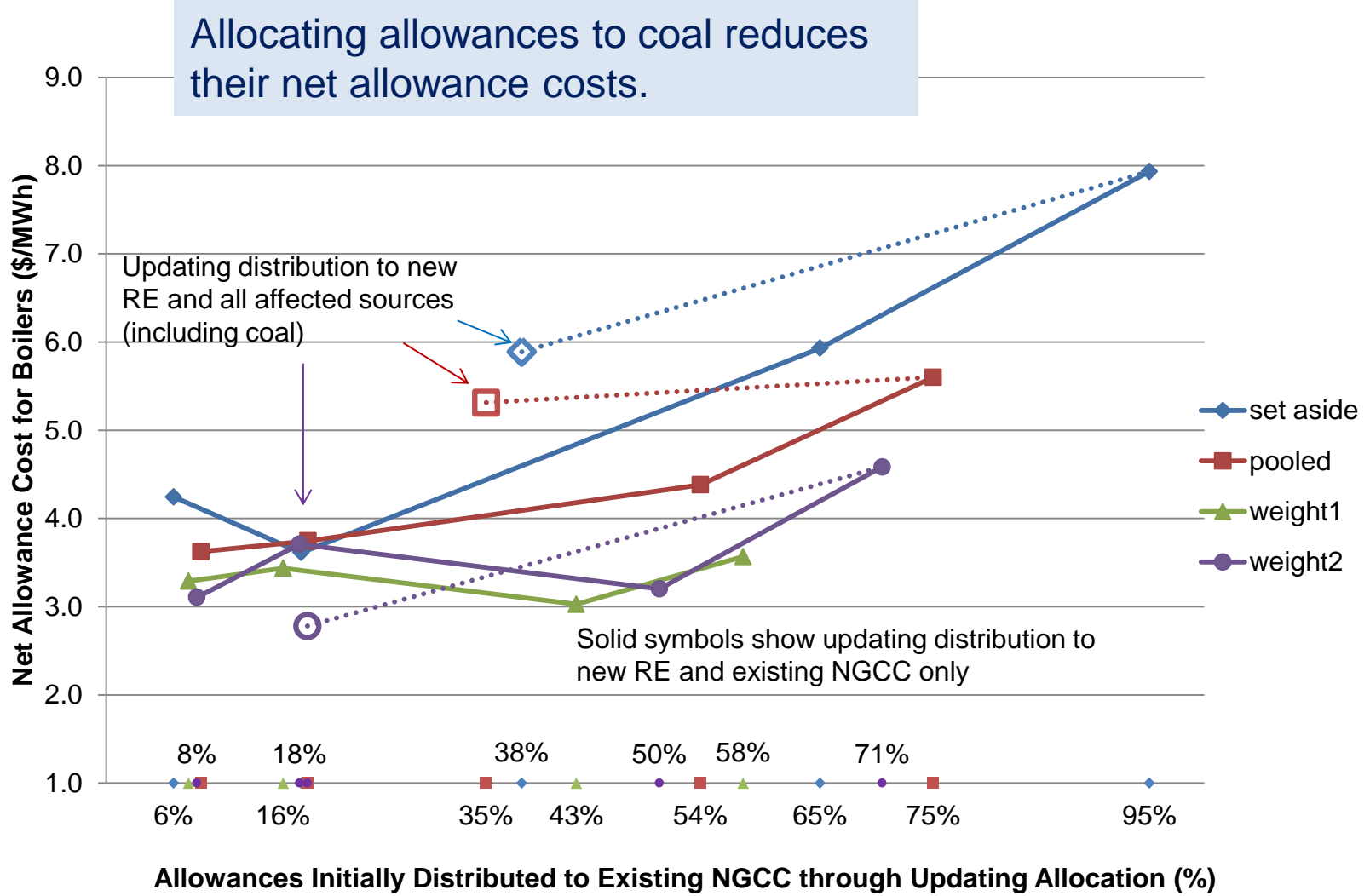
# Allowance Price (2030)



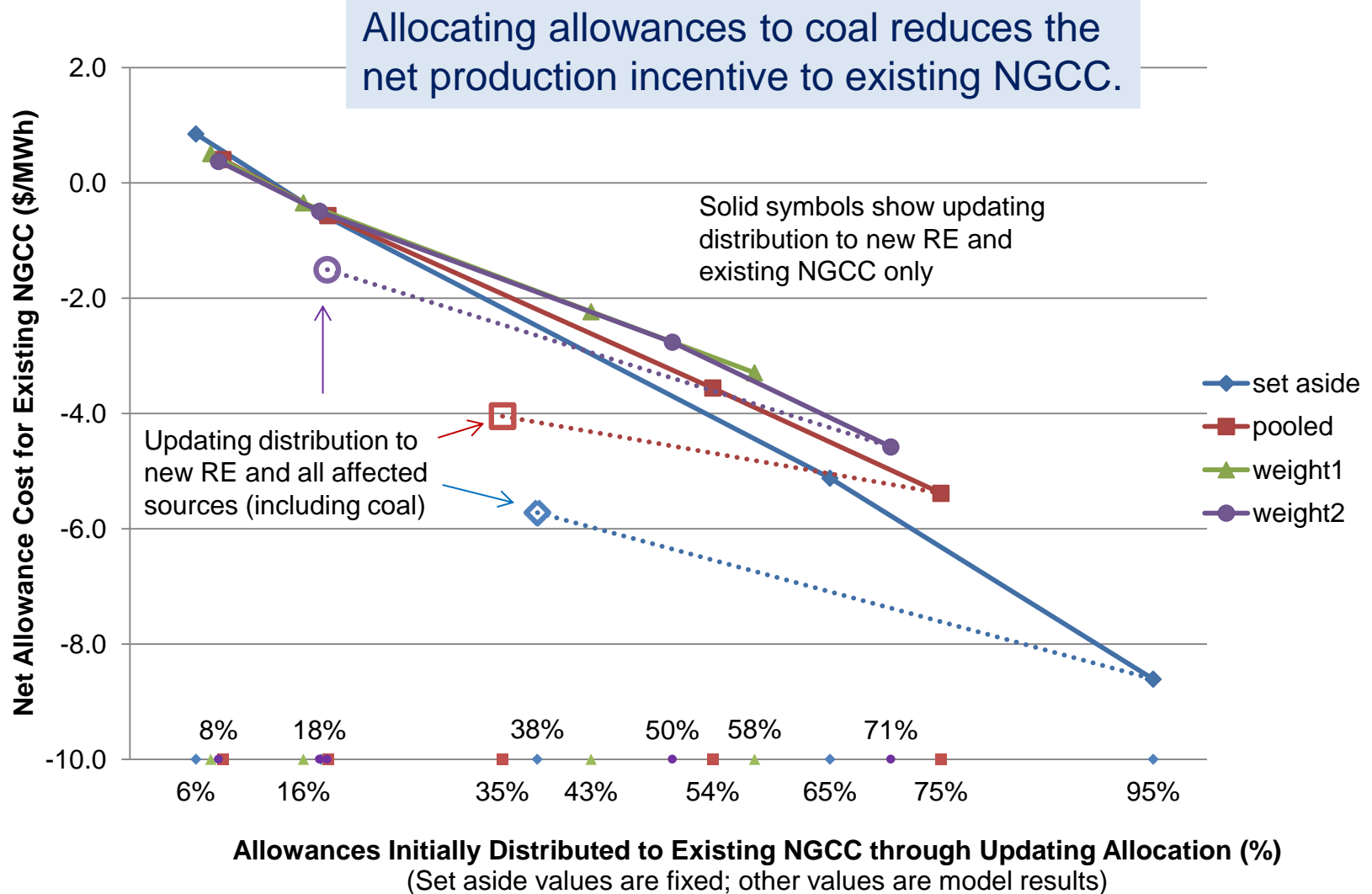
# Capacity of New Wind (2030)



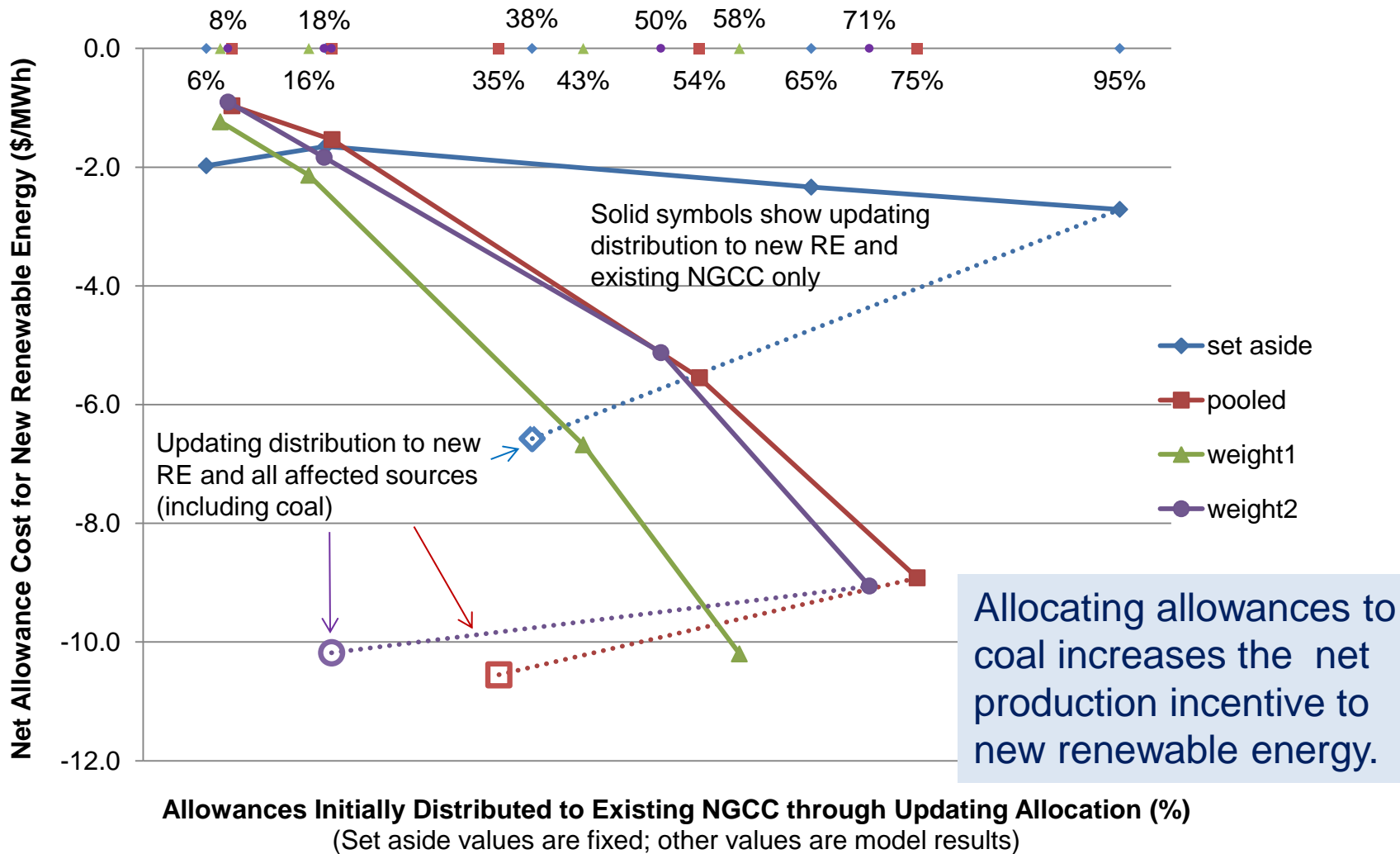
# Net Allowance Cost for Boilers (2030)



# Net Allowance Cost for Existing NGCC (2030)



# Net Allowance Cost for New Renewable Energy (2030)



# Additional Scenarios (1)

We have explored several other approaches:

- Expanded eligibility to include existing non-emitting units
  - A) 5% Set aside for new RE; 95% pooled for all existing generation.
  - B) Pooled 100% to new RE and all existing generation.
- ❖ In both cases this approach diverts a significant share of allowance value to technologies that have little opportunity to change utilization (hydro, existing wind and nuclear). This approach has an effect on the profitability of these technologies, but the technological outcome is similar to grandfathering the same portion of allowances to any group of generators.
- ❖ Note that existing non-emitting sources receive an effective production subsidy under the program even if they do not receive a share of emissions allowances. The anticipated change in the national average retail price of \$2-3/MWh is an increase in revenue to these sources without an associated increase in cost.



# Additional Scenarios (2)

- Greater Level of Energy Efficiency
  - ❖ This approach reduces the financial return to new natural gas units and results in lower emissions.
- Allocation to Local Distribution Companies
  - ❖ This approach directs allowance value that was grandfathered in another scenario to consumers. In cost-of-service regions this is almost exactly the same as grandfathering, however it leads to a noticeably different outcome with lower retail electricity prices in competitive regions resulting in slightly greater demand and leakage.
- Delay in Awarding Allowances
  - ❖ A delay between the generation activity that earns an allocation and the receipt of an allowance lowers its value as a production incentive, leading to less generation from existing NGCC and more generation from new NGCC. Although not considered in our model, it also introduces uncertainty about the value of the allowance and further lowers the incentive to generate.

# Our Bottom Line (1)

What recommendations would we give to EPA to address leakage?

1. Include the New Source Complements in the model rule.

Otherwise,

2. Expand the portion of allowances distributed through updated information about a unit's share of generation.
3. Reconsider the definition of sources eligible to receive allocation using updating. For example, including eligibility for all existing affected and new non-emitting units has a small effect on emissions and may have a policy or legal advantage by treating all affected sources symmetrically.

# Our Bottom Line (2)

Additional recommendations to address leakage and improve the implementation of the Clean Power Plan.

If the mass-based model rule does not require inclusion of new sources:

4. Consider programmatic energy efficiency in state compliance plans as a measure to reduce leakage.
5. Affirm the agency's commitment to timely re-evaluation of the new source performance standard according to the schedule described in statute or sooner, based on technological developments.
6. Reduce the delay when using allocation based on updated information about generation shares.
7. For any allowances not based on updated information about generation shares, a distribution to local distribution companies rather than generators would protect consumer interests in competitive regions.
8. In separate analysis we recommend a requirement for revenue-neutral consignment sales of allowances that are distributed based on historic generation shares to ensure equal access to allowances for all affected sources.

## **Consignment Sales of Free Emissions Allowances in the Clean Power Plan**

Dallas Burtraw and Kristen McCormack

In its mass-based proposed model rule, EPA considers an initial distribution of a portion of emissions allowances for free based on information about generation shares among eligible electricity generating units (EGUs). The proposed model rule bases free allocation on historic information about generation shares from a previous year (2012). Ostensibly this approach is a placeholder for a decision about allocation that is not intended to affect emissions outcomes; that is the prerogative of states. However, this suggestion is a sticky one and has become a focal point in many state conversations.

Free allocation based on historic activity (grandfathering) raises several concerns about the efficiency and fairness of the allowance trading program. These concerns may affect the confidence in the market and compliance behavior of affected units, and it ultimately may influence the success of the program.

We propose a nearly zero-cost remedy: a requirement that recipients of free allowances consign the allowances for sale into the market with revenues returning to their original owners. This approach can improve the efficiency of the market and the perceived (and actual) fairness of a program that involves free allocation of any form. These sales would ideally encompass all freely allocated allowances to fully capture the following benefits, further described below:

1. Facilitating a functioning market,
2. Increasing transparency and perceived fairness, and
3. Reducing intra-firm barriers to trade.

In a consignment sale, entities that have received free allowances sell these allowances and receive a pro-rata share of the revenue, thereby capturing all of the value of allowances originally allocated to them for free. In the same market, these entities re-purchase the allowances they require for compliance. This approach not only ensures that all of the allowances are entering the market (instead of solely being used for compliance), but it also brings all firms into the market at the start (instead of allowing them to bank allowances, potentially not engaging in a market transaction for years).

Consignment sales enable cap-and-trade programs to capture efficiencies and improve the perceived fairness of a well-functioning market while retaining the possible public policy justification for free allocation. This is not a new policy approach; it has been successful in the past. In the sulfur dioxide (SO<sub>2</sub>) trading program under Title IV, for example, consignment sales implemented through a revenue-neutral consignment auction were given credit for important early attributes of the program's success. California's existing carbon dioxide (CO<sub>2</sub>) cap-and-trade program also uses consignment sales for a majority of allowances distributed to the electricity sector.

Since entities make and lose no money from allowances they sell and re-purchase in consignment sales (except for very minimal transaction costs), the importance of including these sales in the model rule may be unintuitive. The merits of consignment sales stem from the fact that market imperfections and institutional complexities present obstacles to achieving an efficient and fair allocation of allowances. If allowances are used directly for compliance and do not enter the market, low liquidity and slow price discovery may result. In addition, firms not receiving allowances sufficient to cover their compliance obligation may fear limited access to allowances, and within firms receiving allowances, the opportunity cost of using allowances for compliance may not be salient, resulting in inefficient firm behavior.

Consignment sales (including consignment auctions) can mitigate these challenges by catalyzing early and salient price discovery (Burtraw et al. 2010), ensuring ongoing market liquidity and transparency, minimizing transaction costs, overcoming regulatory hurdles for utilities, and reducing opportunities for collusion. Some of the benefits of consignment sales would be concentrated at the beginning of the program while others would accrue over a longer time frame. Importantly, there are long-term benefits to reducing even short-term inefficiencies which, if left unresolved, may lead to inferior long-term capital decisions, raise allowance prices, harm market competition, and make future programs and policies less politically feasible (Hausker 1992). To provide a safeguard against those outcomes, we urge EPA to ensure that consignment sales are conducted in programs involving free allocation as a feature of the model rule and federal plan.

### **Benefit 1: Facilitating a Functioning Market**

Two central components of an efficient allowance market are early discovery of an allowance price close to the long-term equilibrium and early, as well as sustained, market liquidity. These components are essential in enabling long-term investment planning and efficient distribution of allowances in the market (Hahn & Noll, 1982).

In a system involving free-allocation, a large portion of allowances may be used directly for compliance and therefore never enter the market. With the opportunity to bank allowances, some firms may not engage in a market transaction for years. If allowances are distributed solely through free allocation, businesses are presented with the burden of identifying their own market opportunities in an area that is not their core business. These factors may result in infrequent trades and fewer trading partners participating in the market (Hahn & Noll, 1982), which may be inimical to the development of a liquid market (Holt, Shobe, Burtraw, Palmer, & Goeree, 2007). In addition, fewer transactions may prevent early price discovery (Hahn & Stavins, 2010; Stavins, 1995).

Because consignment sales ensure that freely allocated allowances enter the market, they help facilitate liquidity and early price discovery.<sup>1</sup> This rationale has been used to justify the use of consignment sales in the SO<sub>2</sub> trading market and in California's trading market. At the beginning of the SO<sub>2</sub> program, bids for allowances revealed a wide variety of estimates for compliance costs, and when early consignment sales resulted in prices far below those existing in bilateral transactions, there was a worry that they were not reflecting compliance costs. However, roughly a year into the program, prices in the secondary market converged to those of consignment sales, indicating that these sales were pivotal in leading to price discovery (Ellerman, 2000; Holt et al., 2007). The importance of price liquidity and the success of SO<sub>2</sub> consignment sales in improving market functioning was recognized in the process of designing California's cap-and-trade program (Burtraw and Szambelan 2012; EAAC 2010; Holt et al. 2007).

Consignment sales may also reduce transaction costs, which can significantly impact efficiency (Hahn and Stavins 2010; Liu et al. 2012; Stavins 1995) and welfare (Stavins 1995). Compared to bilateral market transactions alone, consignment sales (through a revenue-neutral auction) provide greater price information and enable easier identification of trading partners, which Stavins (1995) notes may reduce uncertainty and "search and information" costs. In addition, by establishing a structure for trading, the consignment sale facilitates transactions, relieving firms of the burden of coordinating trades. By serving a brokerage role, consignment sales can avoid significant transaction costs that may be reflected in private brokerage fees, especially in small markets (Jaraitė-Kažukauskė and Kažukauskas 2015; Stavins 1995).

## **Benefit 2: Increasing Transparency and Perceived Fairness**

Through the use of consignment sales, states may also be able to more easily monitor, interpret, and report transaction information. This could increase the transparency of the trading program. In addition, consignment sales equally broker for all parties, equalizing potential differences in access to trade that exist among firms. For example, smaller firms and firms without the opportunity to conduct intra-firm trades may face higher transaction costs (Jaraitė-Kažukauskė and Kažukauskas 2015). By providing equal access to information and allowances at a transparent price, consignment sales may increase the perceived procedural fairness of the trading program. Incidentally, the role of consignment auctions in improving the functioning of markets and increasing perceived fairness is especially important in states where the new source complement is adopted; new sources may not have direct access to allowances.

By establishing a structure that ensures the availability of allowances and the liquidity and fairness of the market over the extent of the program, consignment sales may boost confidence in

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<sup>1</sup> In a paper comparing free allocation with a consignment sale to a revenue-generating auction, Dormady and Healy (2015) find that a revenue-generating auction outperforms free allocation with a consignment sale. The authors do not make the comparison between free allocation with and without a consignment sale that we make here.

and increase the longevity of the program. They may also reduce uncertainty about the future trading market. This is especially important for electric utilities. Because utilities are obligated to serve all demand, concern that the market may not be sufficiently liquid to ensure the future purchase of allowances may introduce a perceived one-sided risk for the firm, preventing it from selling allowances in efficient transactions (Hausker 1992).

Consignment sales may be designed in a way that explicitly protects firms who are concerned about retaining some number of allowances for compliance. Firms with this concern could choose to submit infinite bids for a portion of their consigned allowances, which would guarantee that some portion of their consigned allowances would be returned to them.

### **Benefit 3: Reducing Intra-Firm Barriers to Trade**

Even in a functioning market with transparent price information, barriers may exist within firms that prevent efficient transactions from taking place. Regulated electricity providers, for example, may be discouraged from completing transactions because doing so puts the firm at greater risk for regulatory challenges (Hausker 1992). Prudence reviews often penalize utilities for uneconomic transactions but rarely reward them for economic ones (Bohi and Burtraw 1992). Therefore, utilities may engage in fewer transactions than would be efficient. In addition, because state public utility commissions often prevent investors from profiting from economic transactions, utilities have little incentive to risk regulatory scrutiny. Finally, delays may prevent efficient transactions from occurring if EPA or other regulatory authorities are required to approve compliance plans before trades are conducted.

By requiring utilities to sell and re-purchase allowances they receive for free, consignment sales may sidestep potential delays in transactions. In addition, because transactions must be made, this program design may limit the perceived risk of regulatory scrutiny regarding economic transactions.

Administrative and organizational complexity may also impede transactions for both unregulated and regulated firms. The allowance price may be less salient to firms receiving free allowances; in fact, environmental innovation may actually be stunted in firms receiving free allowances (Martin, Muûls, and Wagner 2013). If there is less need to engage in the market to obtain allowances, there may be weaker signaling to higher managerial levels, and without that signaling fewer strategic decisions may be made to reduce emissions. By involving these firms in the allowance market, consignment sales may help increase the salience of the allowance price in firms receiving free allowances.

While not all studies provide evidence of the link between initial allocation of allowances and the equilibrium distribution (Reguant and Ellerman 2008), if phenomena recognized by behavioral economics are present in firms, consignment sales may alleviate some of their effects. For instance, Hahn and Stavins (2010) discuss the possibility that firms exhibit the endowment effect, where one overestimates the value of something in one's possession, or status quo bias,

where one has a preference for the present situation. A laboratory experiment conducted by Murphy and Stranlund (2005), in which “firms” selling allowances tended to sell fewer allowances than would be expected in an efficient market, may provide further evidence of these effects (Hahn and Stavins 2010).

### **Key Takeaways**

Consignment sales are a simple element of good design for cap-and-trade programs that involve free allocation, for several reasons:

- They serve to bring maximal information to the market, which is available to all market participants and the regulator.
- They may boost confidence in the functioning of the market, which will help firms to trust the market process as a way to minimize their costs of compliance.
- These features also help to boost the perceived fairness of cap-and-trade overall as well as the process that is used to achieve regulatory outcomes.
- Finally, consignment sales can be valuable to decision-making within the firm.

Program inefficiencies may have long-term effects, leading to suboptimal long-term investment decisions. Further, an inefficient program may provide erroneous information to policymakers about the cost of abatement. Inefficient programs may therefore beget political opposition to program goals.

These benefits come at very little cost or risk to states or the firms, who receive the same value under free allocation as they do under free allocation with consignment auctions. Indeed, both firms receiving and firms not receiving free allowances may benefit from reduced transaction costs compared to bilateral market transactions (especially in the absence of a well-identified market price) and the increased salience of the allowance price that results from the requirement of consignment sales. Due to the expected benefits of consignment sales, we recommend that the model rule and federal plan prescribe a plan for cycling ideally all (or at minimum a portion of) freely allocated allowances through consignment sales.

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