

USING “ACTION CAPS” TO BOOST AMBITION AND LOWER COSTS FOR CLEAN POWER PLAN COMPLIANCE

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About Climate Law & Policy Project

Climate Law & Policy Project is a 501(c)(3) non-profit organization. CLPP's mission is to use its legal and policy expertise to help formulate and advocate environmentally, socially, and scientifically sound policies to reduce emissions and protect communities around the world from the impacts of climate change.

CLPP operates like a think tank – seeking practical and politically viable strategies – while simultaneously advocating for strong responses to avert the increasingly urgent problem of climate change.

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EXECUTIVE SUMMARY

If the U.S. Environmental Protection Agency's Clean Power Plan (CPP) is upheld in the courts – and, based on current electricity market trends, probably even if it is not – states and electricity generators must evaluate ways of reducing carbon dioxide (CO₂) emissions from the power generation fleet. This paper proposes that states that are considering adopting a mass-based emission standards approach in their CPP compliance plans utilize “**action caps**” – that is, use the proceeds from emission allowance sales to cost-effectively subsidize actions that achieve additional greenhouse gas reductions.

The conventional way a state would implement a mass-based emission standard under the CPP is by enacting an emissions budget or cap that makes available to its affected electric generating units (EGUs) a number of allowances equal to the state’s mass-based CPP goal. States have many options in designing such a system. Some states might opt to give the allowances away for free, which would lower costs for emitters but not consumers and would give away a valuable resource – the proceeds from allowance sales. Other states might opt to auction the allowances and direct the proceeds toward citizen dividends, offsets of other taxes, or general revenues. This option would address the problem of giving a valuable resource away for free, but it would not provide any more climate benefit than the first option.

Given the urgency of the climate challenge, a third option is to auction allowances and use the proceeds to achieve more greenhouse gas reductions. Some states already utilize this approach, but they may not do so cost-effectively or in a way that ensures reductions will be additional to those achieved by the cap alone. An action cap, in contrast, is designed to ensure cost-effective use of allowance proceeds to achieve reductions that are additional to those achieved by the cap.

An action cap would enable states to achieve significantly higher levels of emission reductions, going beyond the levels required under the CPP, at the same cost to both affected EGUs and consumers as simply achieving CPP targets with conventional auction-based options. For example, for the cost of achieving a 15% reduction with a conventional cap-and-trade system that auctions allowances, an action cap could in theory deliver a 53% reduction.

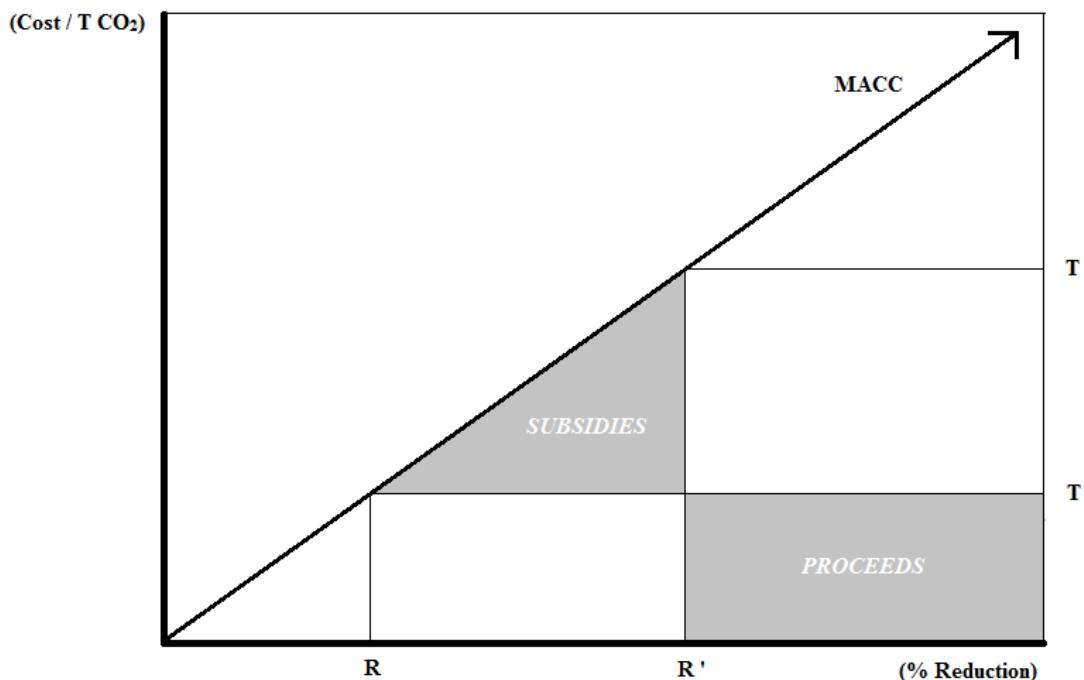
Conversely, states could use action caps to reduce costs rather than increase reductions, achieving CPP targets at much lower cost than, say, a cap system that puts the proceeds into general revenues. For example, an action cap could theoretically achieve a 15% reduction for about 1/12th the cost of doing so under conventional cap-and-trade. States also could use an action cap to achieve goals somewhere in between – anywhere on the spectrum from minimized costs to maximized reductions.

Implementing an action cap under a mass-based emissions standard in a state’s CPP compliance plan involves five simple steps. In advance of the start of a compliance period, the state would:

1. Ask affected EGUs to identify their emission abatement costs (for example, by issuing requests for proposals for projects and activities that could reduce the EGUs’ CO₂ emissions) and submit this information to the state;
2. Construct a statewide marginal abatement cost curve (MACC) of potential reduction actions in the electricity sector, based on the information submitted by EGUs;

3. Analyze the MACC to determine the price at which emission allowances will be sold and the level of reductions that will be achieved by the cost-effective subsidization of additional reduction activities;
4. Sell the number of allowances it anticipates its affected EGUs will need to cover emissions during the compliance period; and
5. Use the proceeds from allowance sales to subsidize reductions beyond those that will be achieved by the allowance price signal alone, starting with the cheapest reductions identified on the MACC (similar to a reverse auction). The subsidies would cover the difference between the abatement cost and the allowance price.

The figure below shows graphically how an action cap would work (with the simplifying assumptions that the MACC is linear and all reduction projects begin operation on the first day of the compliance period).



Suppose a state's CPP emissions budget is R . It plans to sell or auction allowances, but it wants to maximize the amount of reductions it can achieve at its sale price. Rather than auction the allowances corresponding to R , the state would ask affected EGUs to identify and submit their abatement costs and would use that information to construct a statewide MACC of reduction actions. The state would then determine where R intersects the MACC in order to find the price (T) at which allowances should be sold. Next the state would determine the maximum level of reductions (R') that could be achieved by using the proceeds from allowance sales to subsidize additional actions to reduce affected EGUs' emissions; R' is the point where subsidies equal the proceeds. The state then would sell the number of allowances it anticipates affected EGUs will need to cover their remaining emissions (those to the right of R') at price T and use the resulting proceeds to subsidize actions to achieve those additional reductions (between R and R'), with the subsidies covering the difference between the allowance price T and the abatement costs.

The result? Instead of a conventional cap that achieves R reductions with an allowance price of T, an action cap achieves R' reductions at the same cost. The table below illustrates how significant the reduction gains theoretically could be:

| Reduction with Conventional Cap | 5% | 10% | 15% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Reduction with Action Cap | 31% | 44% | 53% | 60% | 71% | 80% | 87% | 92% | 95% | 98% | 99% |
| Target | 15% | 20% | 40% | 60% | 80% | | | | | | |

If, instead, a state is trying to achieve its CPP mass-based target at the lowest possible cost, action caps would offer significant savings compared to a conventional cap that puts the proceeds into general revenues. The table below illustrates how significant the savings theoretically could be:

| Target | 15% | 20% | 40% | 60% | 80% |
|---|-------|-----|-----|-----|-----|
| Cost with Action Cap versus Conventional Cap | ~1/12 | 1/9 | 1/4 | 3/7 | 2/3 |

Action caps combine several concepts, such as imposing carbon prices and directing emitters' expenditures towards achieving reductions, that are being implemented in various jurisdictions in the United States and around the world. For instance, several emission reduction programs, notably California's AB32 and the northeast states' Regional Greenhouse Gas Initiative, already direct auction proceeds towards activities designed to achieve additional reductions, though they do not do so cost-effectively.

Action caps also introduce a number of new ideas to ensure that proceeds not only are used cost-effectively but also achieve reductions additional to those that would result from the cap alone (or, alternatively, achieve the cap at the lowest cost). These include requiring affected EGUs seeking reduction subsidies to reveal their actual abatement costs, selecting projects for subsidization in order of cost, subsidizing only the portion of abatement costs that exceeds the allowance price, and ensuring that achievement of additional reductions does not leave excess allowances in the system.

This paper is intended to demonstrate and quantify the theoretical potential of directing all allowance sale proceeds toward achieving additional reductions – recognizing that, in actuality, it might be desirable to devote some portion of the proceeds to other important climate-related purposes (e.g., repairing and reinforcing infrastructure to be more resilient to the impacts of climate change). This paper makes clear that the potential of action caps is quite significant. Compared to a conventional cap that auctions its allowances and directs the proceeds to non-climate purposes, directing allowance sale revenues to cost-effective subsidization of additional reductions can significantly increase levels of decarbonization without increasing the costs to EGUs and consumers, or it can reduce the costs of achieving a given level of reductions.

States should strongly consider incorporating action caps – or other types of “action approaches” that direct expenditures by emitters towards driving actions that cost-effectively achieve emission reductions – into their CPP compliance plans or into their climate policies generally.

I. A BRIEF OVERVIEW OF ACTION APPROACHES

There are several types of policies used to promote climate mitigation. Some set mandates for the amount of clean energy that must be generated. Some focus on making it more expensive to emit greenhouse gases. “Action approaches” are market-based policies that direct all expenditures by emitters towards driving actions that *cost-effectively* achieve emission reductions; they focus, as the name suggests, on spurring action to reduce emissions. The key elements of action approaches are:

1. Emitters pay based on the amount of their emissions;
2. Expenditures by emitters are used to achieve reductions; and
3. Reductions are achieved cost-effectively (i.e., using a reverse auction, trading, or other market-oriented mechanisms).

Action approaches can take a range of forms and can be incorporated into existing types of policies.¹ For example, an “action fee” approach is very similar to a conventional carbon tax, but the revenues are used to cost-effectively subsidize additional reductions (e.g., through a reverse auction that “buys” additional reductions, starting with the cheapest reductions beyond what the carbon price signal alone would achieve).² Likewise, the “action caps” that are the main focus of this paper are very similar to conventional cap-and-trade mechanisms, but proceeds from the sale of allowances are used to cost-effectively subsidize additional reductions.

“Action approaches” are market-based policies that direct all expenditures by emitters towards driving actions that cost-effectively achieve emission reductions.

Action approaches do not necessarily require revenue to be raised and invested. For instance, a jurisdiction could adopt a policy with an emission reduction target (“action target”) that requires emitters to achieve or acquire a certain amount of reductions for every ton emitted (essentially a tax paid in reductions rather than money); for cost-effectiveness, reductions would be tradable. While no revenue is raised under an action target, emitters are still paying to achieve reductions based on their level of emissions, all of their emission-related expenditures are used to achieve reductions, and the reductions are achieved cost-effectively.³

The key is to cost-effectively direct all resources towards actions to reduce emissions.

II. BASICS OF THE CLEAN POWER PLAN

In August 2015, President Obama and the Environmental Protection Agency issued the finalized Clean Power Plan (under Section 111(d) of the Clean Air Act), regulating carbon dioxide emissions

¹ See CLPP, *Accelerating Decarbonization with ‘Action’ Policies*, Discussion Draft, May 2015, [http://www.clpproject.org/CLPP action policies discussion draft May 2015.pdf](http://www.clpproject.org/CLPP%20action%20policies%20discussion%20draft%20May%202015.pdf)

² A regulatory fee, unlike a tax, uses the revenue to advance the goals of the regulation. See, e.g., *California Chamber of Commerce v. California Air Resources Board*, No. 34-2012-80001313, (Cal. Super. Ct., 11/12/2013)

³ See CLPP, *Accelerating Decarbonization*, *supra* note 1; Kevin A. Baumert and Donald M. Goldberg, *Action targets: a new approach to international greenhouse gas controls*, CLIMATE POLICY 5 (2006) 567-581

from fossil fuel-powered electric generating units. Mandatory reductions start in 2022 and go through three interim steps (2022-24, 2025-27, 2028-29) before culminating in final goals set for 2030. The rule sets out CO₂ emission performance rates for two specific categories of EGUs: fossil fuel-fired electric steam generating units (generally coal- and oil-fired power plants) and natural gas-fired combined cycle generating units. In addition, for each state, the rule spells out rate-based goals, mass-based goals, and mass-based goals with an added new source complement (to encompass new sources). When the CPP is fully in place in 2030, carbon pollution from the power sector is projected to be 32% below 2005 levels (though the cut from current levels is smaller, as power sector emissions already fell 15% between 2005 and 2013).

States have great flexibility in how they craft state plans to comply with the CPP. There are two basic designs for state plans described in the rule: an emission standards approach and a state measures approach.

- Under an ***emission standards approach***, states can pursue rate-based goals (pounds of CO₂ per MWh) or mass-based goals (tons of CO₂). If they pursue rate-based goals, states can create trading programs for emission rate credits (ERCs), with one ERC awarded for each megawatt hour (MWh) of electric generation (or reduced electricity use) with zero associated CO₂ emissions; for each ERC submitted by an EGU, one MWh is added to the denominator of the reported CO₂ emission rate, lowering the rate accordingly. If states pursue a mass-based plan, they can create emission budget trading programs, in which allowances (denominated in tons of CO₂) can be issued up to the emission budget (which must be equal to or lower than the mass-based goal laid out in the rule for that state).
- Under a ***state measures approach***, states can craft plans composed, at least in part, of measures implemented by the state that are not federally enforceable (e.g., Renewable Portfolio Standards, Energy Efficiency Resource Standards) but that result in the affected EGUs meeting the state's mass-based goal (or that goal plus the new source complement). State measures can apply to affected EGUs, other entities, or a combination. Such plans must include a backstop of federally enforceable standards on affected EGUs that will be triggered if the state measures fail to achieve the needed reductions on schedule.

The finalized CPP encourages emissions trading. While states can craft multi-state plans, they can also create individual state plans that are “ready for interstate trading” (i.e., contain the features necessary and suitable for a state’s affected EGUs to trade with affected EGUs in other “trading ready” states without formal arrangements between the states). Generally speaking, states have to be pursuing the same type of plan (mass- or rate-based) for their EGUs to be able to trade with each other.

The rule also sets forth a proposed federal model rule that will be imposed on states that fail to submit a compliance plan (and that can be used as a model by states developing their plans). In addition, the rule proposes creation of a Clean Energy Incentive Program to incentivize investment in wind, solar, and low-income energy efficiency during 2020 and 2021.

In February 2016, the Supreme Court stayed implementation of the CPP while legal challenges play out. This was not a decision on the merits of the rule, and the CPP’s prospects in the D.C. Circuit and the Supreme Court remain unclear.

III. ACTION APPROACHES TO CPP COMPLIANCE

Action approaches could be powerful tools for states to use as part of their CPP compliance plans. Action approaches are available to all states preparing a CPP compliance plan, whether they are pursuing an emission standards approach or a state measures approach.

A. Emission Standards Approach

As noted, under an emission standards approach, states can pursue either a rate-based or mass-based plan. The CPP's rate-based approach is a tradable performance standard, modified and extended to provide states with maximum flexibility consistent with the requirements of the Clean Air Act. The rate-based approach is similar or identical (depending on how states implement it) to an action approach: affected EGUs' compliance obligations are based on their emissions;⁴ compliance efforts are directed at achieving or purchasing emission reductions; and credit trading enables reductions to be achieved cost-effectively.⁵ As such, the rate-based approach is not analyzed further in this paper.

Based on news reports, many states have (or had) been leaning towards a mass-based approach, as it may be simpler and is already familiar to EGUs from other Clean Air Act regulations (e.g., on sulfur dioxide). Deploying action caps or other action approaches under a mass-based emission standards plan could help states seeking to maximize reduction ambitions (beyond CPP targets), reduce costs for meeting CPP targets, or anything in between.

1. Goal: Maximizing Reductions

Typically, a state would implement a mass-based emission standard approach by enacting an emission budget or "cap" that makes available to affected EGUs a number of allowances equal to the state's mass-based CPP emissions goal. As the state's CPP goal declines through the three interim periods (2022-24, 2025-27, 2028-29), the number of allowances available to affected EGUs declines accordingly, until it reaches the state's CPP emission level for 2030 and beyond.

Some states might opt to give these allowances away for free. This would lower costs for emitters but not consumers; experience in Europe and elsewhere suggests that allocating allowances for free provides a windfall to emitters, while consumers still pay the same amount they would have paid if emitters had purchased allowances.⁶ This approach would also give away a valuable resource – the proceeds from allowance sales.

⁴ More precisely, compliance obligations under the CPP rate-based approach are based on an affected EGU's emission rate.

⁵ Action targets are a similar rate-based policy option. They have the benefit of providing an approach that can be used across sectors, as the only elements of the ratio are emissions and reductions. However, since the CPP is focused only on the electric generating sector, its use of a rate that is based on MWh makes sense as a sector-specific action approach.

⁶ This is because it is not the cost of allowances, but their value, that will be reflected in the prices consumers pay for electricity and other energy-intensive goods. The value of allowances is determined by what emitters can sell them for, which in turn is determined by the secondary market and the marginal cost of abating emissions, which are independent of the price emitters may pay the state for allowances.

Other states might opt to auction the allowances and direct the proceeds toward citizen dividends, offsets of other taxes, or general revenues. This option would address the problem of giving a valuable resource away for free, but it would not provide any more climate benefit than the first option.

Given the urgency of the climate challenge, a third option is to auction allowances and use the proceeds to achieve more greenhouse gas reductions. In other words, states could choose to treat the CPP targets as a floor rather than a ceiling and pursue accelerated, enhanced levels of emission reductions.⁷ States that were given relatively easy targets by the EPA might find a high-ambition approach particularly attractive.

Some states already direct auction proceeds towards activities designed to achieve additional reductions, but they may not do so cost-effectively or in a way that ensures reductions will in fact be additional to those achieved by the cap alone.⁸ States could achieve much greater levels of reductions by using an action cap – cost-effectively directing proceeds from the sale of allowances towards subsidies for achievement of additional reductions – and they could do so at the same cost to affected EGUs and consumers as a conventional cap system that auctions allowances.⁹

a. The Initial Compliance Period (2022-24)

Here is a simple version of how an action cap could work for the initial 2022-24 CPP period. In advance of the start of the first compliance period, the state would:¹⁰

- Ask affected EGUs to identify their emission abatement costs for the 2022-24 period and submit this information to the state. EGUs could identify actions they could take directly to reduce their CO₂ emissions, as well as issue requests for proposals (RFPs) for “beyond-the-fenceline” activities, such as new renewable energy and energy efficiency projects.¹¹ The submissions to the state would describe the range of reduction projects and activities available,¹² how many reductions from each could be delivered during the 2022-24 period, and at what cost per reduction.¹³

⁷ The need for enhanced ambition was recently reinforced by adoption of the Paris Agreement (<http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>).

⁸ See section III.C. of this paper

⁹ It is also possible that some portion of the proceeds could be dedicated to other climate objectives — such as promoting climate resilience — though this would reduce the ambition of reductions levels to be achieved.

¹⁰ For simplicity, this paper assumes that each state acts independently. A state could be motivated to do so, for instance, out of a desire to keep the benefits of the investment of proceeds (e.g., jobs, energy savings) in the state. However, states could certainly collaborate on a multi-state plan to gather abatement cost information, sell allowances, and issue reduction subsidies across jurisdictions.

¹¹ For simplicity of operation under the CPP, the state could limit the pool of submitters to include only affected EGUs. Third-party vendors could contract directly with EGUs to provide reduction services that the EGUs would then submit to the state for inclusion in the state MACC and for potential subsidy support. This leaves ultimate responsibility for having enough allowances to meet emission levels with the EGUs.

¹² These would have to be specific actions that will result in quantifiable, non-duplicative, permanent, verifiable, and enforceable reductions in emissions by affected EGUs. If desired, states could take steps to ensure that actions taken

States could choose to treat the CPP targets as a floor rather than a ceiling and pursue accelerated, enhanced levels of emission reductions.

- Construct a statewide electricity sector MACC of potential reduction actions for the forthcoming 2022-24 compliance period, based on the information submitted by the EGUs.¹⁴
- Determine where the CPP's 2022-24 mass-based target intersects with the MACC to identify the price at which allowances would be sold, and then calculate how many more reductions could be achieved by using the proceeds from allowance sales to cost-effectively subsidize additional reductions.
- Sell the number of allowances it anticipates its affected EGUs will need to cover emissions during the 2022-24 period at the identified price.
- Direct the revenues from that sale to subsidize reductions beyond those that will be achieved by the allowance price signal alone, starting with the cheapest reductions identified on the MACC.¹⁵ This process would essentially operate like a reverse auction. The subsidy would cover the difference between the allowance price and the cost of the reductions.¹⁶ To ensure the funding is not wasted, the state's contract with EGUs could stipulate that subsidies will only be paid after the reductions have been achieved.¹⁷

Figure 1 below illustrates in more detail how an action approach would work in a state in the 2022-24 period. For simplicity, the model assumes (1) a linear MACC, which is generally consistent with many economic models,¹⁸ and (2) that all reduction projects begin operation on the first day of the compliance period. The point R corresponds to the quantity of emissions allotted to the state (the mass-based goal for 2022-24 set by the CPP), while R' corresponds to the further reduced level of emissions after additional reductions are achieved. The state determines where R intersects with the MACC to identify T, which is the price at which it will sell allowances. It then calculates what R' will be – determining where c (the proceeds from allowance sales) equals d (the subsidies for reductions).

to reduce emissions do not cause any inadvertent harm to vulnerable populations (e.g., by giving priority to reductions that assist low-income populations).

¹³ For each project or activity, EGUs would calculate the number of reductions that will occur over the lifetime of the project, and the project costs (and revenues), thus deriving the cost per ton of reduction.

¹⁴ Marginal abatement cost curves show the volumes and relative costs of opportunities to achieve additional reductions in pollution. For more, see McKinsey & Company's greenhouse gas abatement cost curves, http://www.mckinsey.com/client_service/sustainability/latest_thinking/greenhouse_gas_abatement_cost_curves. Under an action cap, the MACC will not reflect every potential reduction that could occur (e.g., due to spot market reactions to the price signal); the MACC constructed under the process here would only reflect information submitted to the state about reductions that will occur due to specific actions affected EGUs (or third parties via EGUs) will take.

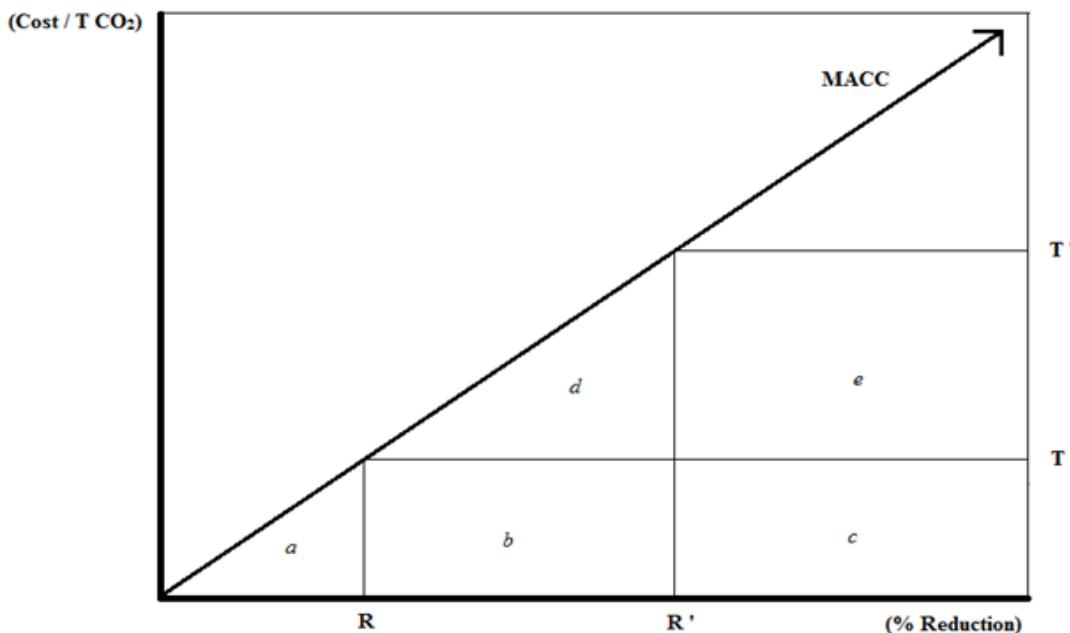
¹⁵ Clearly, therefore, only EGUs that submitted information to help construct the MACC would be eligible to receive subsidies for reduction projects.

¹⁶ This paper assumes the subsidies are provided as grants. Alternatively, states could put the funds into a green bank or a similar entity to provide low-interest loans, loan guarantees, loan-loss reserves, or other financial mechanisms to attract private investment, if that proves to be a more cost-effective approach.

¹⁷ If new reduction opportunities arise that are not captured in the MACC, those opportunities could theoretically be captured by allowing affected EGUs to trade not only allowances, but also subsidy commitments.

¹⁸ See, e.g., A. Denny Ellerman and Annelène Decaux, *Analysis of Post-Kyoto CO₂ Emissions Trading Using Marginal Abatement Curves*, Massachusetts Institute of Technology: Center for Global Change Science, 1998, http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt40.pdf

Figure 1 – High-Ambition Action Cap (2022-24)



Diagonal arrow: marginal abatement cost curve (MACC)

R: Reduction required by CPP target

T: Price of allowances with conventional cap set at R

R': Reduction achieved by investing proceeds under action cap

T': Price of allowances if a conventional cap had been set at R'

a: Cost to emitters of achieving reduction R

b: Investment by emitters in achieving additional reductions under action cap

c: Cost to emitters of purchasing allowances (with allowances sold up to R')

d: Subsidies from the state to achieve additional reductions

a + b + c: Expenditures by emitters to achieve reduction R under conventional cap set at R that auctions allowances, or to achieve reduction R' under action cap

a + b + c + d + e: Expenditures by emitters to achieve reduction R' under a conventional cap

Affected EGUs will eliminate any emissions with abatement costs lower than T (to the left of R) because cutting those emissions will cost less than buying allowances – the effect of the “price signal” from the allowance sales. The state would sell allowances to EGUs for their emissions with potential abatement costs above T' (to the right of R') at price T, which means the state will collect c in allowance proceeds.

Using these proceeds, the state will hold its “reverse auction” to subsidize elimination of the emissions with abatement costs between T and T' (the reductions between R and R'). The subsidies to eliminate those emissions will reflect the difference between T and the cost of the reductions (the abatement cost reflected in the MACC); in other words, each EGU will pay T for each additional reduction it achieves (in effect redirecting what it would have paid for emission allowances towards

achieving reductions), while the state will pay the remainder of the abatement cost.¹⁹ The state will thus spend d to get reductions to the level R' .

With the additional investments in achieving reductions, significantly more reductions will occur in the initial compliance period than would have occurred under a conventional CPP emission budget trading program, as Table 1 shows. Assuming that all allowance sale proceeds are invested cost-effectively in additional reductions, that reduction projects start on day one of the compliance period, and that everything runs smoothly, then c (the proceeds) equals d (the subsidies).²⁰ One can then derive mathematically that R' equals $\sqrt{(2R - R^2)}$.²¹ In theory then, as shown in Table 1, a conventional cap that auctions allowances to achieve a 15% reduction could achieve a 53% reduction as an action cap, without additional cost to affected EGUs and consumers.²²

Table 1 – Corresponding Values of R and R'

| R | 5% | 10% | 15% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| R' | 31% | 44% | 53% | 60% | 71% | 80% | 87% | 92% | 95% | 98% | 99% |

b. Successive Compliance Periods (2025-27, 2028-29, 2030+)

The additional reductions achieved in 2022-24 mean that the actual level of emissions in 2025 may already be below the levels set in the CPP for 2025-27. Similarly, the additional reductions achieved during 2025-27 mean emissions will likely be below the prescribed 2028-29 levels when that period starts, and the pattern repeats again for 2030, at which point emissions levels will be well below the state's final CPP goal, as shown in Figure 2 below.

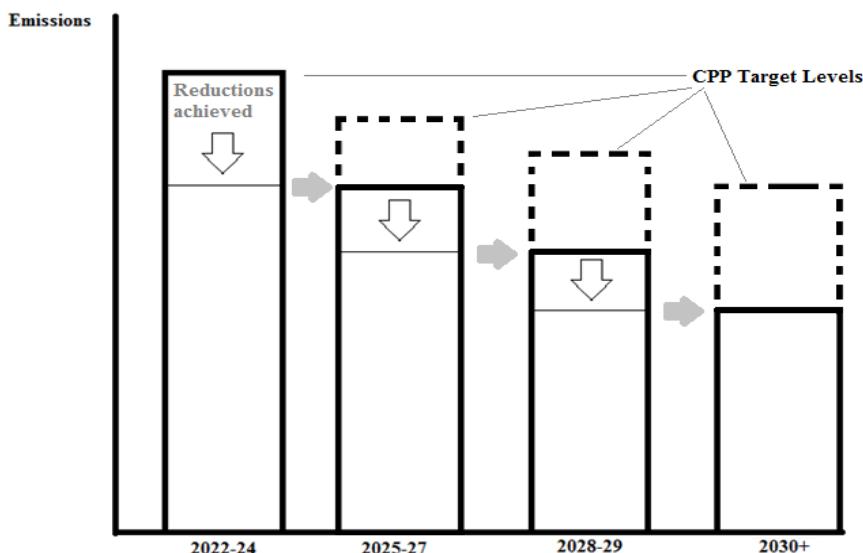
¹⁹ Requiring EGUs to contribute to the cost of reduction projects is equitable and consistent with the polluter pays principle. Responding to price signal T , emitters with potential reductions to the left of R will pay up to T to achieve those reductions, while emitters with potential reductions to the right of R' will pay T for emission allowances. It is fair that emitters with potential reductions between R and R' pay T as well (towards achieving reductions).

²⁰ If some projects are delayed or fail to achieve anticipated levels of reductions, EGUs that sponsored those projects will have to purchase allowances to cover their unanticipated emissions. Because the state distributed fewer allowances than budgeted by the CPP, it should have ample “emergency” allowances available. The result would be that the state achieves fewer additional reductions during the period and has a little more money available that it can roll into the next “reverse auction” or use to purchase a smaller amount of more expensive reductions.

²¹ The derivation is mathematically elementary and can be found in the appendix.

²² It is conceivable that reliability, technology, or other constraints beyond cost could limit the number of additional reductions that are realistically achievable during a given compliance period, which means the state would have excess funds that it could use to subsidize projects in later periods or devote to other purposes.

Figure 2 – Action Cap Over Time



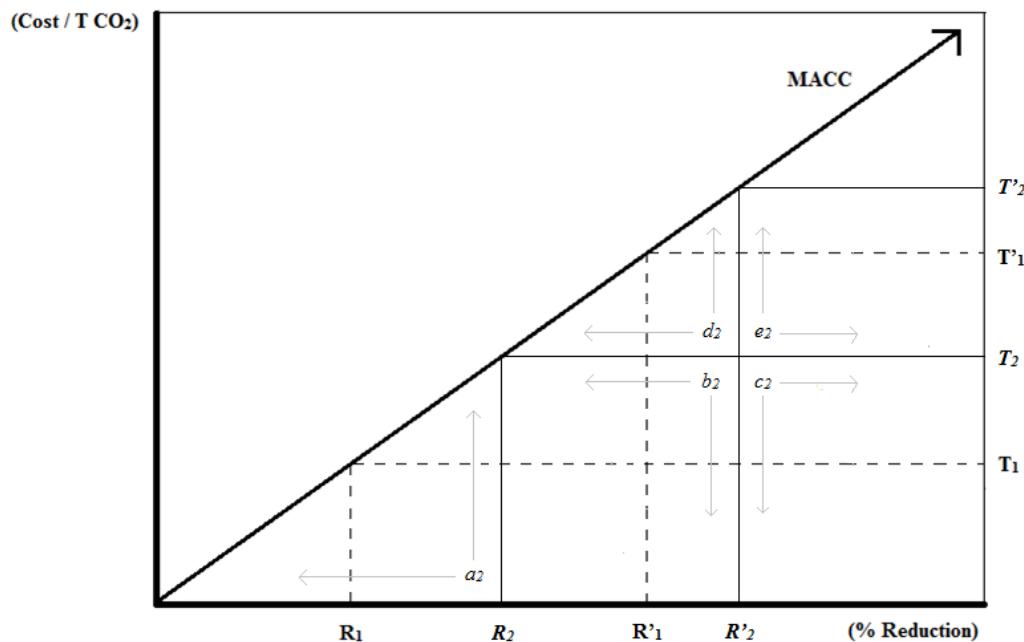
Nevertheless, the same basic process that states undertook for the first compliance period (2022-24) will be repeated in successive compliance periods. For example, in advance of the start of the 2025-27 period, the state would:

- Ask EGUs to identify their emission abatement costs for the 2025-27 period and submit this information to the state. Again, EGUs could identify actions they could take directly to reduce their CO₂ emissions, as well as issue RFPs for “beyond-the-fenceline” activities. The submissions to the state would describe the range of reduction projects and activities then available (which might or might not be the same as were available for the 2022-24 period),²³ how many reductions from each project or activity could be delivered during the 2025-27 period, and at what cost per reduction.
- Construct a statewide electricity sector MACC of potential reduction actions for the forthcoming 2025-27 compliance period, based on the information submitted by the EGUs.
- Determine where the CPP’s 2025-27 mass-based target intersects with the MACC to identify the price at which allowances would be sold, and then calculate how many more reductions could be achieved with proceeds from allowance sales.
- Sell the number of allowances needed to cover anticipated emissions at the identified price.
- Direct the revenues from that allowance sale to subsidize additional reductions, with the subsidy covering the difference between the allowance price and the cost of the reductions in 2025-27.

²³ This means the MACC may be different from period to period.

Figure 3 below illustrates in more detail how an action cap would work in a state in the 2025-27 period. (The figure is the same as Figure 1 but with a second compliance period added.) The point R_2 corresponds to the CPP mass-based goal for 2025-27, which, as noted above, is higher than the emission level actually achieved by the subsidies during the 2022-24 period (i.e., $R'_1 > R_2$). The point R_2 is solely used to identify the price to set for allowances (T_2), which is then used to determine R'_2 (where allowance proceeds (c_2) equals reduction subsidies (d_2)). The state would sell a volume of allowances that corresponds to R'_2 at the price T_2 .²⁴

Figure 3 – High-Ambition Action Cap in Successive Periods (2022-24, 2025-27)



Diagonal arrow: marginal abatement cost curve (MACC)

Dashed lines & items with subscript 1: Related to the first (2022-24) compliance period (same as in Figure 1)

Items signified by subscript 2: Related to the second (2025-27) compliance period

R: Reduction required by CPP target

T: Price of allowances with conventional cap set at R

R' : Reduction achieved by investing proceeds under action cap

T' : Price of allowances if a conventional cap had been set at R'

a_2, b_2, c_2, d_2, e_2 : Costs for the second compliance period (see Figure 1 for detail)

To the extent that affected EGUs have emissions with abatement costs below T_2 , the EGUs will eliminate those emissions rather than buy allowances.²⁵ The state would sell allowances to EGUs

²⁴ Using the T_2 price prevents costs from escalating at the same rate as reductions.

²⁵ In addition to reductions that will occur because the T_2 price signal is higher than T_1 , new reductions could also occur below T_1 – for instance, if new opportunities emerge at lower costs in later periods (e.g., if the costs for clean energy technologies rapidly decline). Ongoing reduction projects that started in the 2022-24 period would also be included in a_2 .

for their emissions with potential abatement costs above T'_2 (to the right of R'_2) at price T_2 , which means the state will collect c_2 in allowance proceeds. Using these proceeds, the state would again hold its “reverse auction” to subsidize additional reductions with abatement costs between T_2 and T'_2 , spending d_2 to increase reductions to R'_2 .

Since T_2 is higher than T_1 was, some EGUs that had received subsidies for additional reductions during the first period would no longer be eligible for them during the 2025-27 period, while some new reduction opportunities would be newly eligible (as triangle d has shifted up and to the right).

In sum, using an action approach allows states that view their CPP targets as relatively modest to be much more ambitious and achieve accelerated, larger emission reductions throughout the compliance periods at the same cost to affected EGUs and consumers as a conventional cap that auctions allowances, all within the bounds of a CPP mass-based emission standards approach.

2. Goal: Minimizing Costs

Several states may only be interested in complying with the CPP at the lowest possible cost (if they are interested in complying at all). If they plan to comply, they may opt to do so by freely allocating allowances to affected EGUs, as described in the proposed CPP federal plan.²⁶ As noted earlier, such an approach benefits emitters but not consumers and gives away a valuable resource. If, instead, the allowances are sold and the proceeds used strategically, costs to both affected EGUs and consumers can be kept low.

States seeking a low-cost plan to comply with CPP mass-based emission standards could use action caps, utilizing a virtually identical process as under a strategy aimed at maximizing reductions. A state could meet its target by selling the number of allowances designated in the CPP goal at a price that would correspond to a higher level of allowances (and lower level of reductions). It would then use the proceeds to subsidize a sufficient number of additional reductions to meet the CPP target.

If the allowances are sold and the proceeds used strategically, costs to both affected EGUs and consumers can be kept low.

Similar to the process it would follow to maximize reductions, a state aiming to minimize costs would, in advance of the start of the compliance period:

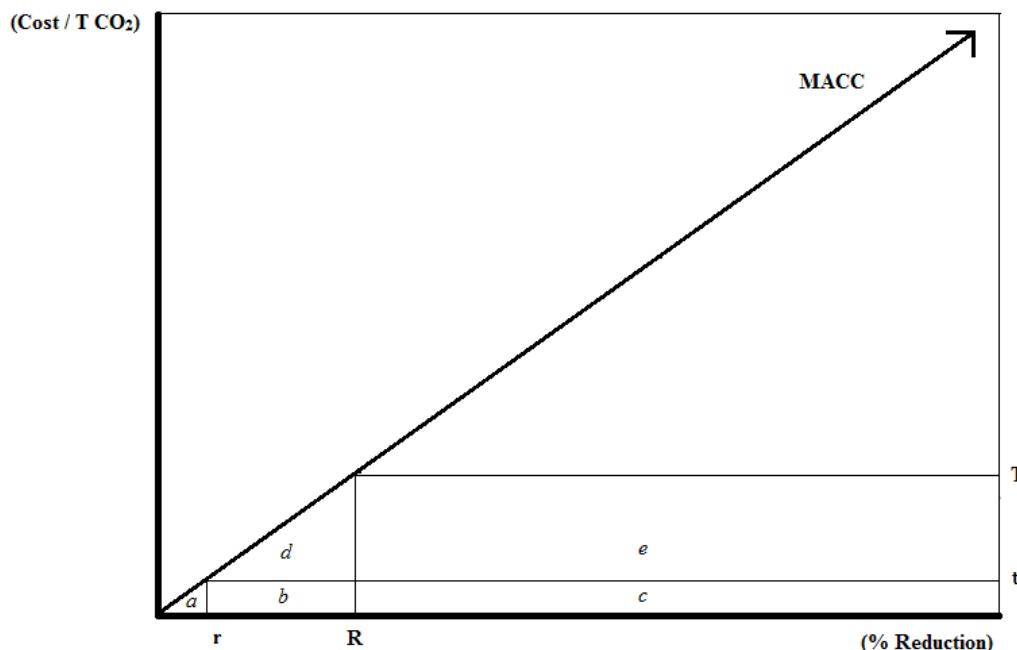
- Ask affected EGUs to submit information about abatement costs to the state, including the range of direct and “beyond-the-fenceline” activities available, how many reductions from each could be delivered during the period, and at what cost.
- Construct a statewide electricity sector MACC of potential reduction actions for the forthcoming compliance period, based on the information submitted by the EGUs.
- Calculate the total cost of achieving the state’s CPP mass-based goal, and then calculate where to put the price point so that the combination of the price signal and the expenditure of allowance proceeds would achieve the reductions needed to meet the CPP goal.

²⁶ The EPA’s proposal to allocate allowances for free under the federal plan appears to be based on a concern that proceeds from a federal allowance auction must go into general revenues.

- Sell its CPP-designated level of allowances at the predetermined price point.²⁷
- Direct the revenues from that allowance sale to subsidize reductions beyond those that will be achieved by the allowance price signal alone, starting with the cheapest reductions identified on the MACC. The subsidy would cover the difference between the allowance price and the cost of the reductions.

Graphically, as shown in Figure 4, using an action cap to minimize costs looks very much like the scenario illustrated in Figure 1, but compressed into the space to the left of R.

Figure 4 – Low-Cost Action Cap



Diagonal arrow: marginal abatement cost curve (MACC)

r: Reduction achieved by price signal of selling allowances at price t

R: CPP target

a: Cost to emitters of achieving reduction r

b: Investment by emitters in achieving the additional reductions needed to get to R

c: Cost to emitters for allowances

d: Subsidy from allowance proceeds to achieve the additional reductions needed to get to R

a + b + c: Expenditures by emitters to achieve reduction R under action cap, with allowances sold at t

a + b + c + d + e: Expenditures by emitters to achieve reduction R under conventional cap, with allowances sold or auctioned at T

²⁷ States may want to keep some allowances in reserve, in case some of the “additional” reductions do not materialize. In addition, to preserve low costs for its citizens (and avoid EGU windfalls), states using a low-cost approach may choose to limit trading to other low-cost states or impose an export tax on allowances.

The cost savings from achieving R with an action cap instead of a conventional cap are listed in Table 2. The equation $C_A/C_C = R/(2 - R)$ ($0 < R < 1$) shows how much cheaper it would be, proportionately, to achieve R with an action cap.²⁸ Table 2 shows, for example, that the cost to affected EGUs and consumers of achieving a 15% reduction in emissions with an action cap would be approximately one-twelfth the cost of doing so with a conventional cap that auctions allowances and places the proceeds into general revenue.²⁹

Table 2 – Cost of Achieving R with an Action Cap (C_A) Versus a Conventional Cap (C_C)

| R | 15% | 20% | 40% | 60% | 80% |
|---------------------------------|-------|-----|-----|-----|-----|
| C _A / C _C | ~1/12 | 1/9 | 1/4 | 3/7 | 2/3 |

B. State Measures Approach

As noted earlier, states also have the option under the CPP of utilizing a “state measures” approach that consists of state policies that are not federally enforceable but that result in the affected EGUs meeting the state’s mass-based goal (or that goal plus the new source complement). State measures can apply to affected EGUs, other entities, or a combination. There are several ways action approaches could be deployed to cost-effectively achieve reductions under a state measures approach. For instance, the action caps described earlier could be applied to a broader range of actors (e.g., economy-wide), as long as the EGUs still meet their mass-based goals.

Another way to cost-effectively achieve reductions would be to utilize an action fee, which, as noted earlier, is similar to an action cap but derives the revenues for a reverse auction from the proceeds of a carbon fee instead of from allowance sales.³⁰ The benefits of an action fee would be essentially the same as an action cap. In the Figures and Tables, R’ would be the enhanced level of reductions that could be achieved by an action fee set at T; the action fee would yield much greater decarbonization than a conventional carbon tax set at the same level. If the aim is to minimize costs, the fee would be set at t and achieve R reductions (the CPP emissions target) at much lower cost than with a conventional carbon tax set at T. The level of the fee could be adjusted over time should the level of reductions fall short of the CPP targets, or should states decide to be more ambitious.

State measures plans must include a backstop of federally enforceable standards on affected EGUs that will be triggered if the state measures fail to achieve the needed reductions on schedule. This backstop could take many forms, including converting the action fee to an action cap.

²⁸ The derivation can be found in the appendix.

²⁹ The exact benefits of an action cap in terms of cost to affected EGUs and consumers depends on the policy approach to which an action cap is being compared. The figures here are calculated assuming that the alternative to an action cap is to place the proceeds of the allowance auction into general revenues. No consideration is given to possible costs and benefits resulting from other uses of revenue, such as reducing corporate taxes or paying dividends to citizens.

³⁰ The CPP section on state measures specifically authorizes states to use fees to implement their plans (80 Fed. Reg. 64836)

C. Building on an Existing Track Record

Some of the core components of action approaches – emitters paying based on their emissions, emitter expenditures being directed at achieving reductions, the use of cost-effective measures to drive costs down – are not new. While combining them into a single approach is novel, doing so builds on a robust existing track record of emission reduction policies.

Several existing emission budget trading programs use revenues to achieve additional reductions. In the United States, both the California cap-and-trade program and the Regional Greenhouse Gas Initiative (RGGI) — the cap-and-trade program for the electric power sector operated by nine states in the Northeast and Mid-Atlantic — use revenues from allowance auctions to pay for additional measures to reduce emissions. In California, auction proceeds go into a Greenhouse Gas Reduction Fund to support programs on sustainable communities, clean transportation, energy efficiency, and clean energy.³¹ (The California Legislative Analyst's Office, though, recently questioned whether any additional reductions were actually being achieved given that subsidies were larger than needed and the allowances freed up by the reductions remained in the system for others to use rather than make reductions themselves;³² action caps address both of those issues.)

Combining the core components – emitters paying based on their emissions, emitter expenditures being directed at achieving reductions, the use of cost-effective measures to drive costs down – into a single “action approach” builds on a robust existing track record of emission reduction policies.

RGGI states decided from the outset to use some or all of the revenues from auction sales to achieve additional reductions. From 2009-2013, they invested more than \$1 billion in state programs to advance energy efficiency, clean and renewable energy, and greenhouse gas abatement; these programs have avoided about 1.3 million tons of CO₂ emissions to date and are projected to avoid more than 10 million tons over their lifetime (in addition to returning nearly \$3 billion in lifetime energy bill savings to 3.7 million households and 17,800 businesses in the region).³³ Given the modest caps initially adopted by the RGGI states, the investment program appears to have been highly effective, quite possibly achieving more decarbonization than the cap itself.³⁴ Neither California nor the RGGI states, though, utilize measures, such as reverse auctions, to ensure cost-effective subsidization of reductions.

³¹ California Legislative Analyst's Office. (2014). *The 2014-15 Budget: California Spending Plan*. <http://www.lao.ca.gov/reports/2014/budget/spending-plan/california-spending-plan-080414.pdf>; State of California. (2013). *Cap-and-Trade Auction Proceeds Investment Plan: Fiscal Years 2013-14 through 2015-16*. http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/final_investment_plan.pdf

³² California Legislative Analyst's Office. (2016). *Cap-and-Trade Revenues: Strategies to Promote Legislative Priorities*. <http://www.lao.ca.gov/Publications/Report/3328>

³³ RGGI (Regional Greenhouse Gas Initiative). (2015). *Investment of RGGI Proceeds Through 2013*. <http://www.rggi.org/docs/ProceedsReport/Investment-RGGI-Proceeds-Through-2013.pdf>

³⁴ Ramseur, J. (2013). *The Regional Greenhouse Gas Initiative: Lessons Learned and Issues for Policymakers*. Congressional Research Service. <http://fas.org/sgp/crs/misc/R41836.pdf>; Detrow, S. (2015). *As RGGI releases annual report, states debate its role in Clean Power Plan*. ClimateWire. <http://www.eenews.net/climatewire/stories/1060017292/>

Similarly, several governments that have instituted carbon taxes invest the proceeds in additional reduction measures. Some have made investment of proceeds in reductions the central feature of the policy, while for others it is more peripheral. The U.S. city of Boulder, Colorado, has a carbon tax based on electricity consumption that has funded most of the city's greenhouse gas reduction efforts since 2007, including transportation initiatives, energy efficiency, and renewable energy programs.³⁵ In Switzerland, one-third of carbon tax revenue is used to reduce emissions from buildings.³⁶ In Japan, the Tax for Climate Change Mitigation or Global Warming Countermeasures Tax (a tax on fossil fuels) directs its revenues toward various emission reduction measures, including energy conservation and renewable energy. In rolling out the tax, the Japanese government clearly distinguished between the 'price effect' on reductions and what it called the 'budget effect' (i.e., investing tax revenues for more reductions), projecting that by 2020 the budget effect will produce two to twelve times more reductions than the price effect.³⁷ It is not apparent, though, that any of these systems utilize a reverse auction or similar measures to spend the revenues cost-effectively.

Cost-effective mechanisms that drive down costs, such as reverse auctions, are used in a wide range of other jurisdictions to purchase renewable energy, energy efficiency, and other emission reductions – but none appear to have been linked to a climate-related source of funds. The Australian government instituted a reverse auction to purchase emission reductions, with the first auction occurring in April 2015, but it scrapped the country's carbon tax.³⁸ Reverse auctions have also been used to achieve savings in purchasing renewable energy and energy efficiency in the United States, India, and elsewhere,³⁹ and the World Bank used reverse auctions for its Pilot Auction Facility for Methane and Climate Change Mitigation, which held its first auction in July 2015.⁴⁰

³⁵ City of Boulder. (2014). *Climate Action Home Page* website. <https://bouldercolorado.gov/climate>; City of Boulder. (2013). *Your CAP Tax Dollars at Work*. https://www-static.bouldercolorado.gov/docs/Tax_At-a-Glance_v05-1-201307081503.pdf

³⁶ Swiss Office fédéral de l'environnement (OFEV). (2013). *Objectif de réduction 2012 non tenu: hausse de la taxe CO₂ sur les combustibles dès 2014*. Press release. <http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=fr&msg-id=49576>; Chuffart, S. (2013) Switzerland raises its CO₂ tax by almost 70% in order to fulfill its Kyoto obligations. *Climate Law Blog, Columbia Law School Center for Climate Change Law*. <http://blogs.law.columbia.edu/climatechange/2013/07/09/switzerland-raises-its-co2-tax-by-almost-70-in-order-to-fulfill-its-kyoto-obligations/>

³⁷ Japan Ministry of the Environment. (2012). *Details on the Carbon Tax (Tax for Climate Change Mitigation)*. https://www.env.go.jp/en/policy/tax/env-tax/20121001a_dct.pdf

³⁸ Australian Government (2015), *About the Emissions Reduction Fund* website, <https://www.environment.gov.au/climate-change/emissions-reduction-fund/about>

³⁹ After the introduction of reverse auctions, prices in the UK dropped to about half that of the prices in Germany's feed-in tariff. In China, the average price for a reverse auction concession project was 0.47 Renminbi (RMB)/kWh, whereas the average for a non-concession project was 0.71 RMB/kWh. In Brazil, reverse auction prices for wind decreased from 148 R\$/MWh in 2009 to 123 R\$/MWh in 2011. Cozzi, P. (2012). *Assessing Reverse Auctions as a Policy Tool for Renewable Energy Deployment*. The Center for International Environment & Resource Policy. <http://fletcher.tufts.edu/~media/Fletcher/Microsites/CIERP/Publications/2012/May12CozziReverseAuctions.pdf>. See also AEP Ohio. (2014). *Bid4efficiency* website. <https://www.aepohio.com/save/business/programs/EnergyEfficiencyAuction/>; Zahodiakin, P. (2012). *Connecticut Auction Cuts Clean Energy Costs While Providing a Template for Other States*. Breaking Energy. <http://breakingenergy.com/2012/12/07/connecticut-auction-cuts-clean-energy-costs-while-providing-a-te/?icid=mostPopular2>; Pearson, N. (2011). *India's 'Astonishing Auction' Pushes Down Global Solar Price*.

While these core elements are well established, linking them into an “action approach” is new. Action caps also incorporate a number of novel features to achieve more reductions than the cap alone, while keeping costs to both affected EGUs and consumers below those of other similarly effective climate policies. As described earlier, these include requiring EGUs seeking reduction subsidies to reveal their actual abatement costs, selecting projects for subsidization in order of cost, subsidizing only the portion of the abatement costs that exceeds the allowance price, and ensuring that achievement of additional reductions does not result in excess allowances in the system.

Combining all these elements could be a powerful way to achieve cost-effective emission reductions under the CPP. Dedicating revenues to decarbonization could also enjoy greater public support than other uses of funds. For instance, a July 2014 survey found that support for a carbon tax in the United States was higher across all political categories (majorities of Democrats, Republicans, and Independents) when the proceeds of the tax were used for climate purposes (in this survey, to fund renewable energy R&D) than when the revenues went towards deficit reduction; using the proceeds for climate purposes also received more support than rebating the proceeds to the public.⁴¹

CONCLUSION

This paper is intended to demonstrate and quantify the theoretical potential of directing all allowance sale proceeds toward achieving additional reductions – recognizing, however, that it might be desirable to devote some portion of the proceeds to other important climate-related purposes (e.g., repairing and reinforcing infrastructure to be more resilient to the impacts of climate change).

Compared to a conventional cap that auctions allowances and directs the proceeds to non-climate purposes, action caps – by directing allowance sale revenues to cost-effective subsidization of additional reductions – can significantly increase levels of decarbonization without increasing costs to affected EGUs and their customers. Alternatively, action caps can be used to reduce the costs of simply achieving CPP targets. States also could use action caps to achieve goals anywhere on the spectrum from minimized costs to maximized reductions.

Action caps combine existing policies that are already widely implemented – such as imposing carbon prices and directing emitters’ expenditures towards achieving reductions – with new policy ideas designed to ensure cost-effective use of allowance proceeds to achieve reductions that are additional to those achieved by the cap.

In designing their CPP compliance plans, or in their climate policies generally, states should give serious consideration to utilizing action caps or other types of action approaches. Given the urgency of the climate challenge, what is needed now is action.

Bloomberg Business. <http://www.bloomberg.com/news/articles/2011-12-02/india-s-solar-power-bid-prices-sink-to-record-consultant-says>

⁴⁰ Pilot Auction Facility for Methane and Climate Change Mitigation website, <http://www.pilotauctionfacility.org/>; The World Bank, *First Pilot Auction to Capture Methane a Success*, Press Release, July 17, 2015, <http://www.worldbank.org/en/news/press-release/2015/07/17/first-pilot-auction-to-capture-methane-a-success>

⁴¹ Amdur, D., Rabe, B.G., and Borick, C. (2014). Public Views on a Carbon Tax Depend on the Proposed Use of Revenue. *Issues in Energy and Environmental Policy*, 13, 1-9. <http://closup.umich.edu/files/ieep-nsee-2014-spring-carbon-tax.pdf>

APPENDIX: DERIVATIONS OF EQUATIONS

Derivation of R'

As noted in the paper and in the graphics, allowance sale proceeds are c , and the subsidy expenditures for more reductions are d . If all proceeds go to subsidies, then $c = d$.

$$c = (1-R') \times T$$

$$d = \frac{1}{2} x (R' - R) x (T' - T)$$

$$\text{So } (1-R') \times T = \frac{1}{2} x (R' - R) x (T' - T)$$

Because the MACC is linear, the ratio of R' to R is the same as the ratio of T' to T , so:
 $T' = T \times R'/R$

$$(1-R') \times T = \frac{1}{2} x (R' - R) x ((TR'/R) - T)$$

$$T - TR' = \frac{1}{2} x ((TR'^2/R) - TR' - (TR'R/R) + TR)$$

$$2(T - TR') = (TR'^2/R) - TR' - TR' + TR$$

$$2T - 2TR' = (TR'^2/R) - 2TR' + TR$$

$$2T = (TR'^2/R) + TR$$

$$2 = (R'^2/R) + R$$

$$2R = R'^2 + R^2$$

$$2R - R^2 = R'^2$$

$$\sqrt{(2R - R^2)} = R$$

Derivation of C_A / C_C

Again, because the MACC is linear, the ratio of R to r is the same as the ratio of T to t , so:

$$T = t \times R/r$$

C_A = cost to emitters to get to R under action cap = $a+b+c$, which, if all proceeds go to subsidies (and thus c equals d), also equals $a+b+d$.

$$C_A = a+b+d = T \times R/2$$

$$= t(R/r) \times R/2$$

$$= tR^2/2r$$

C_C = cost to emitters to get to R under conventional cap = $a + b + c + d + e$ = triangle $a+b+d$ plus rectangle $c+e$

$$c + e = T(1 - R) = tR/r \times (1 - R) = tR/r - tR^2/r$$

$$\text{So } a + b + c + d + e = tR^2/2r + tR/r - tR^2/r$$

$$= tR^2/2r + 2tR/2r - 2tR^2/2r$$

$$= 2tR/2r - tR^2/2r$$

$$= (2tR - tR^2)/2r$$

$$C_A / C_C = (tR^2/2r) / ((2tR - tR^2)/2r)$$

$$= tR^2/(2tR - tR^2)$$

$$= R^2/(2R - R^2)$$

$$= R/(2 - R)$$