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Next Steps for California Climate Policy II: Moving Ahead under Uncertain Circumstances

Todd Schatzki
Analysis Group, Inc.

Robert N. Stavins
Harvard University

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Todd Schatzki and Robert N. Stavins*

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In March of 2009, we began our paper, "Next Steps for California with Federal Cap-and-Trade Policy on the Horizon" with the following observation:

> When California first enacted the California Global Warming Solutions Act of 2006 ("AB 32"), the legislation stood out for the concrete steps it proposed toward the development of policies to reduce greenhouse gas (GHG) emissions. The hope that California's first steps in reducing GHG emissions would lead others to action was explicitly written into AB 32's findings and declarations: "[A]ction taken by California to reduce emissions of greenhouse gases will have far-reaching effects by encouraging other states, the federal government, and other countries to act."[1]

These goals were made with the recognition that, given the global nature of the climate problem, action by California alone will do little to address the climate problem. These facts have not changed.

What has changed are the cyclical political winds that have again shifted the likely timing and potential design of climate policy at the federal, state and Canadian provincial level. While other regions consider their next steps, California has begun to implement policies aimed at achieving AB 32's 2020 GHG targets, with its cap-and-trade system scheduled for implementation in 2012. Thus, California faces the prospect that it may begin implementation of its climate policy, and particularly its cap-and-trade system, without the commensurate action it had hoped to stimulate from neighboring states and provinces, and the federal government.

In this paper, we consider the implications of these and other uncertainties for the implementation of California climate policy. Given these concerns, and California's on-going recovery from the recent economic downturn, we focus particular attention on policy design aimed at "containing" the cost of AB 32 policies, and the cap-and-trade system, in particular. While cost-containment is a serious consideration in the design of any cap-and-trade system, irrespective of current economic or political conditions, the

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* Robert Stavins is the Albert Pratt Professor of Business and Government, John F. Kennedy School of Government, Harvard University; Director of the Harvard Environmental Economics Program; a University Fellow of Resources for the Future; and a former Chair of the Environmental Economics Advisory Committee of the U.S. Environmental Protection Agency. Todd Schatzki is a Vice President at Analysis Group, Inc. The Western States Petroleum Association (WSPA) provided financial support for this paper. However, this paper reflects the authors' views alone, and does not necessarily reflect the views of the WSPA or its members.

[1] Borck, Jonathan, Todd Schatzki and Robert N. Stavins, "Next Steps for California with Federal Cap-and-Trade Policy on the Horizon," July 2009.

uncertainties facing California are in many ways unique. The Air Resource Board's (ARB) Preliminary Draft Cap-and-Trade Rule (PDR) includes certain provisions aimed at containing costs and indicates that it is considering additional measures. Additional cost containment can provide significant benefits to California, and we discuss tradeoffs between various options, including those explicitly identified by the ARB.

Implications for California of Uncertain Commitments by Neighboring States and Provinces and the Federal Government

It is well recognized that meaningful global action to limit atmospheric concentrations of GHGs can only be achieved though broad action taken across all major global economies.[2] Moreover, an integrated market-based national policy provides the most environmentally effective approach to achieving GHG targets at the least cost to national economies. Our earlier paper assessed California's options for its cap-and-trade system in the event a national cap-and-trade system is adopted.

However, the slow pace at which other states, provinces and the federal government are taking on legally binding commitments to regulate GHGs creates the possibility that California will implement policies in its AB 32 Scoping Plan without corresponding commitments by neighboring economies, and that such commitments may not be undertaken by other jurisdictions for some period of time. This would have a number of adverse consequences for California.

First of all, AB 32 policies, including command and control and market-based policies, implemented outside a broad regional or national system would be less environmentally effective due to emissions leakage. Within the context of climate policy limited to California, emissions leakage could occur through several channels. First, if the economic costs of new regulations shift economic activity outside the state, emissions reductions in California would be partially, fully or more than fully offset by increases in emissions outside the state. Second, contract reshuffling, a particular risk for the electricity sector, may lower emission reductions if existing contracts for high-GHG (electricity) imports are swapped for contracts for low-GHG (electricity) imports, without any change in economic activity. Expanding the cap-and-trade system to cover the entire western power grid would significantly reduce the risk of contract reshuffling.[3] Finally, overlapping federal and state regulations could negate any incremental emission reductions sought by state policies. For example, if California's petroleum industry is subject to both AB 32's proposed Low Carbon Fuel Standard (LCFS) and national fuel

[2] Twenty countries and regions together account for approximately 80% of global carbon dioxide emissions.

[3] Contract reshuffling alone could allow the electricity sector to lower its emissions to 1990 levels "on paper," while achieving no actual emission reductions. Bushnell, Carla Peterman, and Catherine Wolfram, "California's Greenhouse Gas Policies: Local Solutions to a Global Problem?" Center for the Study of Energy Markets, Working Paper 166, April 2007.

standards, then any reductions in the carbon content of fuel from the LCFS may be offset by relaxed requirements on out-of-state refiners subject to the national standards.

Limiting the cap-and-trade system to California would also raise costs to California's economy if opportunities to reduce GHG emissions are more costly in California than outside the state. Several economic analyses, in fact, suggest that this is likely the case. For example, a recent study examining a cap-and-trade system for the electricity sector found that allowance prices were substantially higher ($103 per ton versus $21 per ton) under a system limited to California as compared to a system covering the Western Climate Initiative.[4]

Along with raising the cost of achieving GHG reductions, shifts in economic activity due to more stringent GHG regulations – one source of emission leakage – would magnify economic impacts on the state's economy. These impacts would be greatest to industries whose production processes are energy (GHG) intensive and that are potentially vulnerable to competition from producers outside the state (in either in-state or export markets).

While raising AB 32's *expected* costs, a California-only policy could also be subject to greater allowance price volatility. In addition to raising financial risks to market participants, price volatility can also raise costs if firms respond to unanticipated but potentially temporary increases price increases with costly measures to reduce emissions. Although financial markets can help to mitigate volatility risks, risk management raises costs to market participants, and these practices, when employed, typically do not fully mitigate these risks.

Geographically broadening the cap-and-trade system beyond California could either increase or decrease allowance price volatility, depending upon market conditions. However, several forces would tend toward lowering volatility. First, a larger system generally has more participants and volume which improves price discovery, matching of buyers and sellers, and liquidity, all of which tend to reduce volatility. Second, broader system generally have greater market heterogeneity that, through pooling of risks, can mitigate the impact of individual economic and market events that otherwise could lead to large price movements.

Thus, climate policy limited to California would be less environmentally effective and have greater economic impacts than comparable efforts implemented within broad regional or national cap-and-trade systems. Given these potential outcomes, policies that can mitigate these adverse economic and environmental consequences should be

[4] When allowances are freely allocated to local electric distribution companies, allowance prices were $21 per ton in the WCI system and $103 per ton in a California system. When allowances are auctioned, allowance prices were $17 per ton in the WCI system and $47 per ton in the California system. Palmer, Karen Dallas Burtraw and Anthony Paul, "Allowance Allocation in a CO2 Emissions Cap-and-Trade Program for the Electricity Sector in California," Resources for the Future Discussion Paper 09-41, October 2009.

considered. Policies that reduce costs, such as reliance on market-based policies and expanded offset use within a cap-and-trade system, will not only reduce economic impacts, but will also improve environmental effectiveness by reducing emissions leakage. Policies can also address particular problems arising if broad-scale regional or national cap-and-trade systems fail to emerge. For example, measures targeting "energy intensive trade exposed" industries can address economic and emissions leakage arising from the imbalance in regulatory burdens between California and other regions.

This uncertainty about the development of federal climate legislation is compounded by the simultaneous development of GHG regulations by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act. In particular, there is significant uncertainty about how EPA will regulate stationary sources, including which sources will be regulated, when requirements will be effective, the form of requirements, and the flexibility provided to states. This uncertainty raises many questions for ARB as it designs AB 32 requirements and policies: Will EPA policies overlap or conflict with California policies, potentially leading to various problems including emissions leakage? Will EPA requirements limit the flexibility of in-state sources regulated under California's cap-and-trade system, potentially raising costs? Will EPA requirements distort incentives regarding facility investment by creating biases against development of new sources or modification of existing sources, also potentially raising costs? Will EPA impose incremental administrative requirements on state agencies that divert limited resources from the state's policies? These and other questions suggest that ARB needs to remain flexible in the design and implementation of its policies to minimize or avoid potential adverse interactions between its state and federal policies.

Other Uncertainties Facing California Climate Policy

The development of climate policies outside of California is far from the only uncertainty affecting the economic consequences of AB 32 implementation. Many factors will affect the eventual economic costs of AB 32 implementation, some of which are unique to California's market and regulatory circumstances. For example, the effectiveness and cost of AB 32's Complementary Policies[5] is highly uncertain, but accounts for a large share of anticipated emission reductions. If these programs are less successful than anticipated, reliance on the cap-and-trade system to achieve remaining emission reductions would grow, which could affect costs. ARB's recently completed Updated Economic Analysis found that allowance prices would rise from $21 to $102 per ton and the decline in gross state output would increase from 0.2% to 1.4% if emissions reductions from complementary policies were about 60% below anticipated levels.[6] Similarly, if the costs of Complementary Policies are higher than ARB assumes, the economic consequences of the overall AB 32 policy will be greater.

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[5] These policies include the Pavley II vehicle GHG standards, the LCFS, the 33% Renewable Portfolio Standard and others.

[6] Based on Cases 1 and 5. ARB, "Updated Economic Analysis of California's Climate Change Scoping Plan," Staff Report to the Air Resources Board, March 24, 2010.

However, there is significant uncertainty about the likely cost of the Complementary Policies. While ARB anticipates that the Complementary Policies would lower AB 32 costs, others have reached different conclusions.[7] An independent analysis performed at the ARB's request concluded that these policies would raise AB 32 costs.[8] For example, while ARB found that increasing the effectiveness of Complementary Policies (from 40 percent to 100 percent of anticipated reductions) lowered household income impacts by $300 per capita, the other analysis found that household impacts rose by $116 per capita.[9] Thus, irrespective of which of these studies provides a more accurate estimate of *expected* costs of the Complementary Policies, these results suggest that there is significant *uncertainty* about these policies' costs.

In addition to these uncertainties regarding AB 32 implementation, many other economic, market and policy factors will affect the eventual cost of AB 32 policies, such as the responsiveness of households and businesses to changing energy prices and technological opportunities, technological developments affecting energy use (e.g., solar power and electric vehicles), and the supply of offset credits. The recession has illustrated the degree of uncertainty regarding economic growth, which is a key driver of the stringency and cost of AB 32. Updates to ARB's economic forecasts, reflecting these changed conditions, have been significant, and reflect this uncertainty. As a consequence of this lower economic forecast, ARB's estimate of GHG emissions in 2020 has declined by about 5% (25 MMT-CO2e), thereby substantially reducing the expected costs of achieving AB 32 targets.[10] While changes in long-run macroeconomic conditions of this magnitude are rare, ARB finds that significantly smaller changes in policy stringency lead to potentially large changes in economic costs. For example, ARB finds that requiring an additional 15 MMT-CO2e in reductions over the period 2012 to 2020 (i.e., 0.6 MMT-CO2e for each year during this period) would lead to $21 to $28 per MT increases in allowance prices.[11]

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[7] The authors have raised concerns with ARB's earlier studies and their findings that many AB 32 policies would impose net benefits, *see*: Stavins, Robert, "Comments on Economic Analysis Supplement, Pursuant to AB 32, California Global Warming Solutions Act of 2006, Prepared by the California Air Resources Board," Peer Review of the Economic Supplement to the AB 32 Draft Scoping Plan, November 2008; Stavins, Robert, Judson Jaffe, and Todd Schatzki, "Too Good to be True? An Examination of Three Economic Assessments of California Climate Change Policy," Washington, D.C.: AEI-Brookings Joint Center for Regulatory Studies, Related Publication 07-01, January 2007.

[8] See Charles River Associates, "Analysis of the California ARB's Scoping Plan and Related Policy Insights," March 24, 2010.

[9] See Case 1, in which Complementary Policies are 100 percent effective, and Case 5, in which Complementary Policies are excluded or partially effective.

[10] ARB, March 2010, p. 21. These figures appear to exclude high-GWP GHG emissions.

[11] ARB, March 2010, Table 17. These figures may overstate the magnitude of the price impact because they do not account for emission reductions achieved from the reduced economic activity caused by the higher allowance prices.

Options for Cost Containment in a Cap-and-Trade System

Because many factors affecting the eventual costs of achieving cap-and-trade targets are not known prior to program implementation (and continue to evolve subsequently), the economic costs of a cap-and-trade system are uncertain. As a result, provisions aimed at mitigating cost uncertainty are an important consideration in the design of any cap-and-trade system. Moreover, given the many uncertainties particular to AB 32 implementation and broader concerns about the state's economy as it emerges from the recession, design aimed at reducing costs and cost uncertainty may be particularly relevant in the design of AB 32's cap-and-trade system

The primary decision affecting the cost of a cap-and-trade system is the stringency of the cumulative emissions targets as reflected in the trajectory of annual emissions. Flexibility regarding the timing of emission reductions can lower the cost of achieving cumulative reductions in GHG emissions, although the value of such flexibility is greatest when considered over decades rather than years. This long-run perspective on costs suggests that ARB can impose emission reductions gradually over the period from 2012 to 2020, thus avoiding near term economic risks, while increasing cap stringency over time. Because AB 32 only specifies an emission target for 2020, ARB has the flexibility to impose reductions gradually during this initial period.

Further, because emission targets for the years prior to 2020 are not specified, ARB has cap-setting flexibility that it can utilize when implementing cost containment mechanisms.

Cap-and-trade design has implications for several dimensions of a system's costs:

1. *Long-run emission reduction costs.* Cost containment can *reduce* the expected level of costs under a cap-and-trade system, or *limit* the magnitude of costs to levels deemed acceptable or reasonable in light of environmental benefits.
2. *Allowance price volatility.* Cost containment can mitigate volatility in allowances prices that would otherwise arise from temporary, unanticipated changes in market conditions. Mitigating price volatility can lower costs by avoiding high cost emission reductions made in response to these temporary price signals.
3. *Market uncertainty.* Cost containment can reduce the market's uncertainty about future allowance prices, which can affect investment and other emission reduction decisions.

Design choices vary in their ability to affect these different aspects of economic costs. Further, these choices can have implications for GHG emissions.[12] While many options can lower costs without affecting GHG emissions, others may either increase or decrease emissions.

Cost Containment within the Preliminary Draft Cap-and-Trade Rule

The ARB's PDR includes certain provisions aimed at cost containment and indicates that ARB is considering additional rules that would provide further cost containment or modify elements of proposed cost containment rules.

Provisions that can reduce the long-run cost of achieving GHG targets include banking and offset use. Banking allows emission reductions in early years of the program to be substituted for those in later years, which can lower costs if the cap is more stringent in later years. Offset use allows low-cost emission reductions achieved outside of the cap to be substituted for higher cost in-state emission reductions.[13] However, ARB has proposed limiting allowance use to 4 percent of each complying entity's total emissions.[14] ARB's analysis indicates that even this limited level of offset use can significantly lower costs, while other economic analyses indicate that offset use beyond ARB's proposed 4 percent limit could reduce costs further, possibly quite significantly.[15] The PDR also includes provisions for the linkage of California's cap-and-trade systems with those of other regions, such as the European Union's Emission Trading System. Such linkages lower the overall costs of achieving emission reductions in the combined system,

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[12] These decisions may also have implications for co-pollutant emissions. While actions to reduce GHG emissions typically also lead to reductions in co-pollutants, this relationship varies dramatically across GHG emission reduction opportunities. As we have argued elsewhere, this heterogeneity, among other factors, suggests that cap-and-trade system design should not be modified to simultaneously address both GHG and co-pollutant emissions. Schatzki, Todd and Robert N. Stavins, "Addressing Environmental Justice Concerns in the Design of California's Climate Policy," October 2009.

[13] The PDR also includes other rules affecting offset use, such as lists of eligible project types, potential geographic restrictions, approval procedures, and liability rules for cancelled offset credits. These rules can significantly affect the ability of offsets to lower costs through their affect on offset supplies, transaction costs, and product uniformity. For example, the PDR proposes buyer liability for cancelled offset credits. Such liability rules may increase transaction costs by requiring buyers to ascertain offset quality and reduce market liquidity by reducing the uniformity of offset products. Given that both outcomes would reduce the effectiveness of offsets in lowering costs, other mechanisms for addressing liability (e.g., insurance pools) may be more effective.

[14] By comparison, the American Clean Energy and Security Act of 2099 (the Waxman-Markey Bill) passed by the U.S. House of Representatives would allow up to 2 billion tons CO_2e of offsets annually, which is over 30 percent of annual emission targets in the early years of the program.

[15] ARB finds that offset use can lower allowance prices from $102 per ton (with no offsets) to $21 per ton (with 4% of compliance achieved through offsets). ARB, March 2010. See also, CRAI, March 2020 for analyses allowing further use of allowances.

although allowance prices may rise in one of the linking regions if it becomes a source of allowance supply for the other region.[16]

The ARB's PDR also includes a number of provisions that would reduce allowance price volatility, including three-year compliance periods and banking. Permitting compliance over three-year, rather than one-year, periods can reduce costs and volatility by allowing emission reductions to be substituted over the three year period, and diluting the impact that any one market event can have on market prices.[17] A related alternative that was not considered by ARB is rolling compliance. Under rolling compliance, regulated sources can surrender allowances for each year's emissions on a rolling basis. This approach could further smooth demand in allowance markets by avoiding potential surges in demand that can arise at the end of even lengthy compliance periods when regulated sources must surrender allowances.[18] Banking can also reduce volatility by providing a pool of allowances that can be drawn upon to moderate price variation over time.[19]

The PDR includes no specific provisions that would limit economic costs in the event they are higher than anticipated and above levels deemed acceptable. The PDR does indicate that ARB is considering including provisions to address these concerns, including four specific cost containment measures[20] and administrative "adjustment mechanisms" based on a "set of focused criteria."[21] The latter approach, which suggests the use of administrative determinations rather than pre-determined and transparent mechanisms and price triggers, creates potential economic risks. When markets are subject to administrative interventions that are not guided by clear and transparent rules, the timing and extent of these interventions can increase market uncertainty, thus adversely affect investment and emission reduction decisions, and increasing market volatility, due to speculation about administrative decisions. Also, other than the cement industry, the PDR also does not include any specific provisions designed to reduce emissions and economic leakage. The final report for the Economic Allocation and

[16] Subarticle 12. *See* Jaffe, Judson, Matthew Ranson, and Robert N. Stavins, "Linking Tradeable Permit Systems: A Key Element of Emerging International Climate Policy Architecture," *Ecology Law Quarterly* 36(2010): 789-808.

[17] § 95930. Bankruptcy provisions requiring that regulated sources submit in each year a portion of the allowances needed for compliance should not limit the effectiveness of three-year compliance periods in reducing allowance price variability so long as this portion is not set too high. See § 95960. Also, although the PDR proposes that final compliance would occur in the first year of the next compliance period (§ 95980), this final true-up does not allow the use of any allowances from the subsequent compliance period. § 96090(b).

[18] For example, allowances for emissions in 2012 could be submitted in pre-determined proportions at the end of the following three years (2012, 2013 and 2014).

[19] § 96090. CARB has suggested that limits on banking are being considered, although such limits provide unclear benefits, would potentially limit economic gains from shifting the timing of emission reductions, and could limit the effectiveness of banking at reducing avoidable allowance price volatility.

[20] § 96040.

[21] § 95910.

Advisory Committee (EAAC) discusses options for addressing emission leakage, as do we in a prior paper.[22]

Additional Options for Cost Containment

As we have discussed, California faces significant uncertainty in the economic consequences of its climate policies. Further, the potential that California will pursue these policies outside of broader regional or national systems changes the nature of the potential consequences for California. For example, under a California-only system, increased economic costs not only have economic consequences, but also have potential environmental consequences if those increased costs exacerbate emissions leakage.

The ARB indicates that it is considering adoption of certain cost containment mechanisms. These and several other options available to the ARB include:

- Expanded offset use by eliminating or relaxing quantitative limits on offset use;
- Relaxed offset use limits or allowance reserves, subject to pre-determined price triggers;
- Allowance price caps and/or floors; and
- Allowing borrowing of allowances from future compliance periods.

These approaches provide ARB with a range of options for expanding cost containment.

Eliminating or raising the quantitative limits on offset use would lower costs of achieving cap-and-trade targets, assuming the proposed 4 percent offset cap would otherwise be binding. However, the extent to which offsets can lower costs depends upon the volume, liquidity and costs of supplies available to complying entities, which in turn depends not only on global offset markets, but also on the specific design of AB 32's offset program. Thus, the effectiveness of these markets in lowering costs depends on some factors under the California regulator's control, such as coordination between California's offset markets and other mandatory offset markets (e.g., CDM) and restrictions on geographic origin and type of project, and other factors that are not under California's control.[23]

While the use of offsets, banking, and multi-year compliance periods all can help to lower costs and generally reduce price volatility, none provide any direct mechanism to mitigate allowances prices if they rise to unacceptable levels for either brief or extended

[22] Economic and Allocation Advisory Committee, "Allocating Emissions Allowances Under a California Cap-and-Trade Program," March 2010. Borck, Jonathan, Todd Schatzki, and Robert N. Stavins, "Options for Addressing Leakage in California's Climate Policy," February 2010.

[23] For example, ARB has indicated its intent "to move beyond international project-based crediting towards the development of international sector-based crediting mechanisms to achieve emissions reductions in the developing world." § 96400. Depending upon how and when such preferences are implemented, offset supplies and liquidity could be affected, particularly in the early program years.

periods.[24] A number of mechanisms are available to provide such mitigation, including those being considered by ARB.

The most effective approach to limiting prices is a price cap in which a sufficient supply of allowances is made available to the market to satiate demand at the trigger price. While the extent of cost containment provided by many other options depends on particular details about the *size* of allowance reserves or the *degree* to which offsets limits are relaxed, cost containment through a price cap provides certainty about the resulting limit on cost. While providing certainty about the limit on costs, a price cap could result in additional emissions depending upon the source of additional allowances. One approach to limiting the extent of additional allowances is to borrow them from future compliance periods.

Another approach to ensuring environmental benefits is to pair a price cap with a price floor. A price floor prevents allowance prices from falling below the pre-determined minimum price. Although mechanisms vary, if prices fall to this minimum price, the stringency of emission targets is increased, thus further reducing emissions beyond initial targets. Thus, a price collar, which combines a price cap and price floor, can actually achieve the same (or even lower) *expected* emissions, compared with a policy without a price collar, so long as the likely increases in emissions from the price cap is offset by likely price decreases from the price floor.

Other mechanisms would similarly increase allowance supplies when allowance prices rise to pre-determined price triggers by relaxing restrictions on offset use or releasing allowances from an allowance reserve. Relaxing offset use would increase the supply of offsets available for compliance, but could leave allowance prices either above or below the price trigger depending on the size of the adjustment to the offset limit. The impact on allowance prices of any particular adjustment to offset limits would be difficult, if not impossible, to determine in advance. While a series of smaller market adjustments (at known frequency and with transparent rules) could potentially improve the precision of this approach, it could also slow the speed of market adjustment and even add to market volatility and price uncertainty due to underlying uncertainty about how offset limits would be relaxed in the future. Moreover, because price relief would depend upon offset market conditions, such as the depth of existing supply, the extent and timing of the market relief provided by relaxing offset use caps would be fundamentally uncertain.

Another approach to limiting allowance prices is the use of an allowance reserve that expands the allowance supply through sales of allowances from the reserve when prices rise to pre-determined triggers. This approach can be designed to expand

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[24] While lowering costs, expanding reliance on offset markets could increase price volatility if offset markets or other trading systems indirectly linked through offset markets are particularly volatile or if the supply of offsets decreases in periods when the demand is greatest (i.e., supply and demand are correlated). For example, *see*, Fell, Harrison, Dallas Burtraw, Richard Morgenstern and Karen Palmer, "Climate Policy Design with Correlated Uncertainties in Offset Supply and Abatement Cost," RFF Discussion paper 10-1, January 2010.

allowance supply while maintaining the integrity of the emission targets. The reserve can be stocked with allowances that are retired if not used, allowances borrowed from future compliance periods, or an initial allocation that is replenished through offsets purchased with the sale of allowances from the reserve.

The choice between these options involves a number of tradeoffs, particularly with regard to cumulative emissions during the period 2012 to 2020. Stocking the reserve with allowances that are retired if not used would lead to a range of cumulative emissions depending on the extent to which the reserve is utilized. If allowance prices remain at reasonable levels (below price triggers), then the reserve would not be used and allowances in reserve would be retired. However, if prices are higher than anticipated, then the reserve will be drawn upon to provide allowances, thus increasing emissions. As discussed earlier, AB 32 appears to provide sufficient flexibility to permit policies designed to achieve a range of cumulative emissions.

Stocking the reserve through borrowing presents several options. Relying solely on allowances borrowed from cumulative targets over the period 2012 to 2020 may limit the economic relief provided by the reserve, since any use of reserve allowances could cause shortages in subsequent years. Alternatively, borrowing could be made from periods after 2020, consistent with the cumulative, long-term nature of meaningful action to address climate change.

The effectiveness of each of these options in lowering and/or limiting costs depends upon the level of the trigger price (relative to expected allowance prices), the size of the allowance reserve, and whether and how the reserve is replenished once used. While trigger prices that are much higher than expected prices would, all things being equal, require a smaller reserve in order to maintain prices near price triggers, any reserve with a limited quantity of allowances faces some risk of being unable to keep prices from rising above price triggers. Given uncertainty about the sufficiency of the reserve and market adjustments to supplies released from the reserve, market volatility could even increase for a period until the market reaches its new equilibrium price. Further, depending upon how the reserve is replenished, its ability to provide price relief in the later years of the program may be limited.

Providing a liquid supply of allowances to replenish the reserve can address many of these problems. For example, after providing a reserve with an initial stock of allowances, the reserve can be replenished with offsets purchased with revenues from the sale of allowances from the reserve. This mechanism provides a sustainable supply of allowances sufficient to keep prices below the higher of price triggers and offset prices.[25] The approach essentially allows sufficient offsets into the market to bring prices down to the higher of price triggers and offset market prices. The mechanism also achieves the

[25] If offset prices are below price triggers, then revenues from the sale of reserve allowances will be sufficient to fully restock the reserve, and allowances prices will converge to the trigger price, so long as access to the reserve is not constrained. If offset prices are above price triggers, prices would settle somewhere between the offset price and price trigger.

same quantity of GHG reductions regardless of how much the reserve is utilized, although the quantity of emission reductions from sources under the cap (as opposed to those outside the cap) will depend upon how costly are reductions.

Finally, allowance borrowing can both lower costs and reduce price volatility, although the extent of mitigation in the context of AB 32 may be limited. Because AB 32 does not specify emission targets beyond 2020, this limits the scope of potential gains from borrowing. Further, modeling suggests that targets near to 2020 are more stringent than targets in 2012, so banking, rather than borrowing, may be more likely to lower costs.[26]

Given the tradeoffs among its options and their ability to affect different aspects of costs and cost uncertainty, ARB may consider implementing a combination these mechanisms. For example, ARB could reduce or eliminate restrictions on offset use to lower *expected* costs of achieving AB 32 targets, while also implementing a price cap to *limit* prices to acceptable levels.

Conclusion

As California begins implementation of AB 32 policies, it faces a number of uncertainties that potentially affect the environmental and economic consequences of reducing GHG emissions. Along with uncertainties in the effectiveness of AB 32 policies and their likely costs (and the normal uncertainties facing implementation of any policy), it is unknown whether California will be able to take advantage of the environmental and economic benefits that would come from participation in a broad regional or national climate policy. Without such integration, the magnitude and nature of the economic and environmental consequences facing ARB as it designs AB 32 policies will likely be altered significantly.

Cost containment provides a means of addressing such cost uncertainties. The PDR includes provisions that are likely to achieve some reduction in cost and price volatility. However, further supplementing these provisions, as is being considered by ARB, can provide greater assurance that GHG reduction goals can be accomplished while reducing the likelihood of significant adverse consequences to the state's economy. Moreover, cost containment (along with measures to address energy intensive trade exposed industries), can also improve environmental outcomes by reducing emission leakage while also reducing economic risks.

An important rationale in pursuing AB 32's goals was to show leadership not only with regard to the need for meaningful commitments to GHG emission reduction, but also regarding the design of effective policies to achieve these goals. Given the current hesitancy of many states, provinces and the federal government to take on such commitments, leadership on the design of California policies that achieve GHG goals

[26] For example, *see*, ARB, March 2010.

while avoiding significant economic risks is all the more important. Such policies may increase the willingness of other governments to take on commitments to reducing GHG emissions, which may lead to the envisioned broad regional or national cap-and-trade systems that can achieve these goals with a lower economic impact to California and other regions' economies.