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**Beyond the Market Advisory Committee:
Proceedings from a Workshop held at Stanford University,
January 15, 2008**

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Abstract

In 2006, California passed innovative legislation to create a “cap-and-trade” system for controlling greenhouse gas (GHG) emissions. In January 2008, SIEPR hosted a workshop on the problem of designing a workable market for GHG emissions that included scholars, business representatives, government officials, and leaders of environmental groups. Building from the report of the Governor’s Market Advisory Committee of June 2007, the workshop discussed four key issues: (1) linking the California market to other GHG markets and control policies, including those in other states, Europe, and possibly the federal government; (2) regulating emissions “upstream” (e.g., hydrocarbon fuel sales) or “downstream” (e.g., GHG emissions at the point fuel is burned); (3) initially distributing emissions permits by auctioning or giving away permits; and (4) the proper role and scope of “offsets” (reducing emissions from otherwise unregulated activities, such as replanting the rain forest, to create new permits). Although workshop participants did not achieve consensus on the details of how the market ought to be designed, there was considerable support for several important conclusions: (1) California should try to set an example for neighboring western states and the federal government; (2) a major and probably unsolvable problem is “leakage” (whereby emissions reductions by Californians simply lead to emissions increases in other states) unless neighboring states join the California program; (3) at least some permits should be allocated by auction to facilitate the creation of a market; and (4) offsets can play a useful role, but to do so must be regulated carefully to assure that emissions reductions are real.

1. Introduction

With the passage of the Global Warming Solutions Act of 2006,¹ California catapulted forward to become an international leader in taking steps to reduce its emissions of greenhouse gases leading to global warming and climate change. The Act (AB 32) stipulates that the state shall promulgate regulations which have the effect of reducing, by 2020, emissions of greenhouse gases to the level of emissions in the state in 1990. Considering the growth in population and income in the state that has and undoubtedly will occur during that thirty year period, this is clearly an ambitious undertaking.

The legislation assigns the regulatory authority for implementing the Act to the California Air Resources Board (CARB), the forty-year-old state agency (part of the California Environmental Protection Agency—Cal EPA) that has had responsibility in the state for regulating other types of air pollution, including pollution from cars. Because of the importance of managing the economic impacts on the state from the Act, the Governor directed Cal EPA to establish a Market Advisory Committee to advise CARB on developing a greenhouse gas reduction plan for the state.

On June 30, 2007, the Market Advisory Committee (MAC) tendered its final report to CARB, focusing on the design of a “cap-and-trade” system for reducing greenhouse gas emissions. The report is extensive and practical, offering recommendations on how to move from theory to practical implementation in setting up a cap-and-trade system to implement the goals of the Act. Some of the key recommendations of the report are:

¹ The Act is also known as Assembly Bill 32 (AB 32).

- The program should be broad, including all major greenhouse-gas emitting sectors
- Electricity, as a very significant sector, should be regulated at the point of generation (if generated within the state) or at the point the electricity is imported into the state (“first-seller” approach).
- Some allowances should be auctioned and some distributed at no cost; the fraction auctioned should increase over time.
- Offsets of emissions by entities outside of the California market should be allowed but stringent criteria should be imposed to ensure legitimacy of the offsets.
- California should encourage linkages between a California market and other mandatory cap-and trade systems (such as in the Northeast and in Europe).

Despite the practical nature of the MAC recommendations, not all issues or questions were resolved completely regarding using markets to reduce greenhouse gas emissions. In an order to resolve some of the unanswered market questions, a workshop was convened in Stanford, California on January 15, 2008. This one-day workshop involved leading academics, stakeholders and industry representatives – representatives of the key constituencies relevant to establishing market based solutions for regulating greenhouse gas emissions in California (refer to Appendix A for a list of participants). On January 18, 2008, a companion workshop on environmental justice and greenhouse gas regulation took place at the University of Southern California, from which a separate report is being prepared. Both workshops were sponsored by the *Bipartisan Center for*

Research and Policy in Sacramento, under the leadership of former Assemblyman Joe Nation.

The Stanford workshop was structured along four major themes (refer to Appendix B for an agenda):

- Market linkages: cap and trade beyond California
- Upstream versus downstream regulation: efficiency, environmental effectiveness, and fairness
- Allowances: auctioning versus free allocation
- Offsets

The organization of this report follows these four major themes. In each of the following four sections, we review what the MAC had to say about the topic, the sense of the discussion at the workshop, and any conclusions or consensus that may have emerged. It is important to emphasize that there were no unanimous conclusions of the workshop. In reporting a sense of the workshop discussion in this report, it is important not to construe the opinions as attaching to particular participants. In fact, on nearly every issue there was some divergence of opinion among the participants.

2. Market Linkages: Cap and Trade Beyond California

2.1. Introduction to Market Linkages

California is not alone in developing a market-based system to reduce greenhouse gas emissions. Such programs are under investigation by many other jurisdictions, including the Federal Government. There is significant support for California continuing its leadership role in environmental policy by providing an example of a successful emissions reduction program. Furthermore, the design of this system should recognize and be compatible with the future introduction of a national (or even international) market.

AB32 has broader goals than a reduction in Californian emissions. One other goal is to prompt other entities (including the Federal Government) to take action. Another goal is to position California as a leader in technology and industry that will prosper when greenhouse gas regulation becomes more widespread.

The challenge that this creates for market design arises from the potential incompatibility between policies that reduce emissions in the short-term, and policies that will be most influential on other jurisdictions. This conflict arises since many of the features of a program solely designed to reduce emissions in California—in particular, to control leakage of emissions from the electricity sector to nearby states—might be unnecessary within a broader system. A pure focus on reducing emissions in California could create a regulatory structure that no one else would want to adopt.

The increasing likelihood that a Federal emissions trading program will be implemented within the next few years creates a new set of design issues for the California program, many of which were not explicitly addressed in the Market Advisory

Committee (“MAC”) report. The MAC report envisaged a set of linkages from the California cap-and-trade market to other regional greenhouse gas initiatives. In contrast, workshop participants focused on the possibility that these regional markets, and the California market in particular, might be preempted by a future Federal (or even international) emissions trading system.

If a Federal program eventually replaces the California system, as seems likely, the risk for California is that its market will be seen as a transitional move and will not be taken seriously. Emitters of greenhouse gases might view the market as a short-term opportunity for profit-seeking rather than the foundation for a long-term commitment to develop and implement emissions-reduction technology. Alternatively, if California maintains a more stringent program once the federal system is in place, then it will effectively be subsidizing the rest of the country, since any additional reductions by California mean that other states require smaller reductions in order to meet the Federal cap.

These issues caused many participants in the workshop to favor strategies that emphasize achieving the broader goals of AB32. These strategies include policies to encourage the development of low-emissions technologies, to influence on the design of the Federal market, and to encourage other states and countries to implement market-based emissions reduction policies.

2.2. Summary of MAC findings on Market Linkages

The linkages section in the MAC report focused on the potential to link California’s emissions trading program with other existing programs. In evaluating potential linkages, the report considered the following three issues to be important:

- maintenance or expansion of the environmental benefits that would be achieved without linkages;
- potential improvement in economic efficiency by expansion of the market; and
- fairness to the participants in both programs, particularly where there are differences in the stringency of the cap between programs.

The report also discussed the challenges involved in linking to other programs.

These primarily arise from the unintended propagation of design elements from one program to any linked programs. For example, the provision for offsets, the existence of safety valves, or the presence of borrowing in a linked program will effectively be passed through to the California system.

Finally, the report evaluated the suitability of the Regional Greenhouse Gas Initiative (RGGI) and the European Union Emissions Trading System (EU ETS) for linkage with a California program. It concluded that linking to either of these systems would be possible, although differences in stringency, monitoring and enforcement would need to be addressed.

In terms of unresolved issues in the MAC report, the report focuses on the design issues involved in achieving the greatest emission reductions within California. There is no consideration of the potential tradeoff between the complexity of the program and its portability to other jurisdictions. In addition, the MAC report does not consider the design challenges involved in linking the California emissions trading program to a future national or international program. Many of the components of the program, such as credit banking, would be more problematic if the California system is envisaged as a transitional program until replaced by a broader Federal scheme.

2.3. Issues Addressed at Stanford Workshop

2.3.1 Leakage and Reshuffling

The leakage problem arises when regulation causes economic activity to move to less regulated (or unregulated) areas. For the emissions trading program implemented in California only, part of an emission reduction in the state will be offset by emission increases in neighboring states, as industrial activity relocates to less-regulated states. In particular, this could occur as a result of source-based regulation on the electricity sector. Regulating power plants in California, and not in Nevada or Arizona, could result in lower emissions in California but higher emissions in other states.

Empirical research has demonstrated that leakage is more than a theoretical possibility—it can be a major problem which significantly alters the anticipated benefits of regulation. Becker and Henderson (2000) studied the effect of the Clean Air Act on the location decisions of firms over a 30-year period. They showed that there was shift in economic activity from areas that were out of attainment (the regulated areas) to other areas that were in attainment (unregulated).

Fowle (2007) estimated the potential leakage under a scenario in which California implements regulations on emissions from power plants, but other states do not. Using a detailed numerical model of the wholesale electricity market and assuming a permit price of \$25/ton, she showed that over 60% of emissions reductions achieved by generators in California would be offset by the leakage of emissions to unregulated generators outside California.

To address the problem of leakage in electricity generation, California could adopt “downstream” regulation of greenhouse gas emissions by assigning responsibility for

emissions to electricity users, for instance requiring that electricity users acquire greenhouse gas permits in proportion to the electricity that they use.² A problem with downstream regulation is that it could lead to contract reshuffling. Reshuffling takes place when there is no change in the location of economic activity, but instead a change in transaction accounting. In this case, clean power that is now consumed elsewhere in the Western Electricity Coordinating Council can be diverted to California while other states buy more power from coal-fired generation. This reshuffling of the match between generators and consumers would undermine the objectives of the policy because in the end there would be no change in the electricity (and emissions) generated by any plant.

If one jurisdiction (California) seeks to control emissions while adjacent jurisdictions (nearby states) do not, a cap-and-trade system can not be designed to guarantee that both leakage and reshuffling will not occur. However, both leakage and reshuffling become less important as the size of the regulated jurisdiction expands. For example, a Federal program eliminates leakage and reshuffling within the US, but an international agreement is necessary to prevent leakage and reshuffling with respect to Canada and Mexico, close trading partners of the US. Because leakage and reshuffling are valid concerns, the California program is not likely to succeed in reducing greenhouse emissions as much as anticipated, and is more likely to harm the California economy, if other jurisdictions do not adopt similar policies. This argument is an important justification for joint programs such as the Western Climate Initiative.³

² Chapter 2 of MAC provides further information on the distinction between source-based and load-based regulation.

³ Bushnell, Peterman and Wolfram (2007) show that a five-state cap-and-trade program would result in greater displacement of existing carbon-intensive generation than a stand-alone California program.

Although there is short-term potential for significant leakage, it may be possible to design an elaborate scheme to minimize leakage and reshuffling problems. Chapter 5 of the MAC report, and Session 2 of the workshop, discuss some of the policy instruments that could be employed. However, such policies ultimately may be unnecessary. The dual problems of leakage and reshuffling within the US will be diminished under a Federal scheme. Leakage and reshuffling will be further diminished as a problem in the US with an international agreement that includes the United States, Canada and Mexico, since these problems are the result of differences in regulatory standards between jurisdictions that do or can engage in substantial trade in energy-intensive products. Therefore, the extent of this problem depends on how long it will take to implement a Federal program and then when an international program that includes the U.S. will be implemented.

If California adopts a complex market design to deal with leakage and reshuffling, its program will be less useful as a model for national or international policy. The market design depends on its intended scope. For a market within a single state, electricity is the most important source of leakage and reshuffling. However, for a national or international market, other products (such as extensively traded manufactured goods and hydrocarbon fuels) are more important. Consequently, a less-ambitious market design in California might be more influential as a policy model in other jurisdictions. Although short-term emissions reductions would be smaller, this might be more than compensated for by the greater long-term influence of the program on global climate change policy.

The opposing view expressed at the workshop was that emissions reductions in California are extremely important to prove to policy-makers in other jurisdictions that a

market-based mechanism can be effective in reducing emissions at a reasonable cost. The outcome in California will be watched closely by other states and countries, so it is vital to develop a system that works well. Other jurisdictions will be unlikely to adopt a California model that does not achieve the expected reduction in emissions or that does so at great cost to the California economy. Failure to achieve either goal is likely to reflect poorly on both greenhouse gas reductions and market mechanisms as a means to control them.

2.3.2. Linkages and Federal Preemption

An important issue in the design of the California program is its envisaged role once a Federal system is introduced. Creating a permanent scheme could lead to significant long-term costs for California if the program operates simultaneously with a Federal market. However, a scheme that is designed to transition smoothly to a broader program risks being seen as redundant, since firms will base their decisions on the future permanent program. Uncertainty about what will happen in California after the Federal system emerges could deter firms from making the necessary investments to reduce emissions. For example, if the Federal program allocates greenhouse gas emissions on the basis of a historical baseline for emissions that post-dates the implementation of the California program, California emitters effectively will be forced to reduce emissions twice – once for California, then again for the Federal government. Or, if emitters believe that the Federal emissions reduction standard is likely to be less rigorous than the California standard, they will be reluctant to make long-term investments in facilities that meet the California standard. Another important concern of California emitters is the status of banked Californian allowances after the California system is replaced. The MAC report

recommended that California issue allowances with no expiration date that may be banked for use in any subsequent compliance period. However, such allowances would become worthless if the California system is phased out. One possible solution is that the State of California provides a guarantee that any banked allowances under its system will be exchangeable for the equivalent number of Federal allowances. All of these factors are likely to encourage California emitters to focus on short-term strategies for reducing their own emissions or obtaining offsets from emitters that are not covered by the program, which will cause the short-term compliance cost of the program to be substantially higher than would be the case if emitters believed that the California system would apply to them for a long period of time, even after Federal pre-emption.

For these and other reasons, some participants in the workshop believe that the phase-out of the California market and its replacement by a Federal program will be much more difficult than is currently imagined. Constituencies for AB32 will inevitably emerge, both in the government as well as in the private sector, with considerable investment in maintaining the program. Under this view, California is likely to seek an exemption to continue its more stringent program. This is consistent with the long tradition of California being an early adopter of more stringent environmental policies than are subsequently implemented at a national level.

However, in the case of greenhouse gas emissions, some participants suggested there is little economic sense in continuing a more stringent California cap after the Federal system is implemented. Greenhouse gas emissions (unlike smog precursors) constitute an international issue; California's emissions are only a small fraction of the problem, so that a more stringent standard in California will produce little climate benefit

to the state while imposing substantial costs. A compelling argument, however, is that with a Federal cap, additional reductions in emissions by California would simply allow other states to emit more. California would subsidize the rest of the United States, paying higher costs for zero environmental benefit, since there would be full offset of the extra Californian reductions. In effect, the Federal emissions cap would be both a cap and a floor on emissions.

Although much of the workshop discussion presumed the inevitability of a Federal program, some participants perceive a high level of uncertainty surrounding its introduction. Until now there has been little political debate within the United States about a national emissions reduction program. Once the issue is debated seriously, citizens for the first time will face all of the arguments concerning the expected effects of global warming on the United States, the contribution of other nations to the problem and its solution, and the economic consequences of an effective control program. Once greenhouse gas policy becomes a salient national political issue, significant public opposition could emerge that would delay, perhaps indefinitely, any Federal policy, much less a cap-and-trade program. If this political assessment is correct, two aspects of the California program ascend to greater significance: the likelihood that the performance of the California program will influence assessments by others of the desirability of greenhouse gas reductions and the workability of the California program in the event that the Federal government does not act, but other nations and U. S. states do act..

2.3.3. Linkages with other programs

Workshop participants recognized the potential advantages of linkages with other existing systems, such as RGGI or EU ETS, which are discussed in detail in the MAC

report. These advantages include the opportunity for more cost-effective reductions in emissions. However, some participants highlighted the significant short-term risks from linkages with other systems.

One risk arises from the potential for significant emissions leakage from California in the electricity sector, which might drive down the price of permits. If the California market were linked with other systems, a glut of inexpensive permits from California would reduce the environmental benefits of the other systems as well. In effect, linkages with other systems could result in the widespread propagation of problems in the California market.

This effect could also work in the reverse direction. As discussed in the MAC report, market design elements that California considers undesirable could be unintentionally propagated through the market linkages. These might include safety valves, borrowing, or differences in monitoring, penalties and enforcement. Linkages with other systems could result in California losing control over these important design issues.

A potential short-term compromise could be indirect linkages among the trading schemes by each linking with an Emissions Credit Reduction system, such as the Clean Development Mechanism. For instance, if both the EU ETS and the California market use offsets from the Clean Development Mechanism under the Kyoto Protocol, prices of emission reductions would be related, since both systems may be competing at the margin for similar reduction projects. These indirect linkages would enable prices to equilibrate but without the unwanted transmission of design elements.⁴

⁴ For a detailed discussion of linkage issues, particularly in the international context, see Jaffe and Stavins (2007).

2.3.4. Alternatives to linkages

Participants in the workshop considered alternative ways in which California could play an influential role in the development of a Federal or international emissions trading program. Given the problems discussed above, many participants felt that an excessive focus on achieving the greatest short-term emissions reductions in California could make the broader aims of AB32 more difficult to achieve. Instead, there are other initiatives that could be considered to advance these goals, outside the framework of the cap-and-trade market. Furthermore, these initiatives might be less costly for California than implementing a complex market for emissions.

Many participants believe that the greatest contribution from California will be through the development of technologies or institutions that could be useful to the rest of the world. An example is the Renewable Portfolio Standard for electricity which favors renewable (not necessarily low-carbon) sources of electricity. Institutions such as the California Climate Action Registry could also be adapted by other jurisdictions.

Other participants discussed how the diplomatic efforts by California could play an influential role by encouraging other states and countries to pursue their own climate initiatives and this is certainly the hope of many proponents of AB32. Furthermore, the formation of alliances with other states can be an effective way to deal with leakage, which becomes less problematic as the number of states participating in the program increases. Given the potential importance of diplomacy in advancing the goals of AB32, an important role of the body of rules and regulations being developed could be to make these diplomatic efforts more credible. California can only play its desired role as a

global advocate for climate change reform if it is seen as implementing a politically, environmentally and economically attractive policy of its own.

2.3.5. Summary of MAC issues resolved & questions that remain

The workshop supported the general conclusion of the MAC report regarding potential linkages with other cap-and-trade programs. While they can improve cost-effectiveness, linkages would need to be carefully evaluated to ensure that undesirable design elements of other schemes are not transmitted to the California program. From this point of view, the best possible outcome is that California and other jurisdictions adopt the same program – emissions reduction goal, market design, and monitoring and enforcement system – and fully integrate emissions trading among them. To the extent that the programs diverge in any important dimension, the result will be a less cost-effective system for all.

Given the increasing likelihood that a Federal emissions trading scheme will emerge, the workshop highlighted a number of important new questions that are not included in the MAC report. These should be carefully considered in evaluating the design of any proposed California program:

- **Risk:** What are the short-term risks for achieving the desired amount of emissions reductions under the proposed model? How probable is it that the AB32 model will be perceived as a “failure,” possibly tainting the reputation of climate policies and market-based mechanisms in general?
- **Portability:** How portable is the proposed regulatory model to other jurisdictions? How much does its design reflect issues that will not be relevant in a broader market beyond California? How much does the program support

California's ongoing diplomatic efforts and its desire to be a global advocate for the climate change issue?

- **Integration:** How will the California program integrate with any future Federal market? Will the program be seen as transitional (and perhaps even irrelevant), or does it risk becoming a permanent source of additional costs for California, even after a Federal market is introduced? How does the program cope with the uncertainties surrounding the timetable and design of a Federal market?

After consideration of these issues, some workshop participants considered that the ideal market model would be one that is less ambitious in terms of capturing all of California's emissions, but able to be implemented quickly. Such a model would be more readily transferred to different jurisdictions, and so have a greater long-term impact by inducing other jurisdictions to curtail carbon emissions.

3. Upstream Versus Downstream Regulation

The second session of the Stanford Workshop focused on points of compliance under a cap-and-trade program in California. In particular, issues of efficiency, environmental effectiveness, and fairness⁵ were raised. Following the definitions in the MAC report, upstream regulation roughly refers to regulating at the point where carbon-based products are introduced into the economy, whereas downstream regulation refers to regulating at the point at which emissions actually occur. For example, should one

⁵ The distribution of costs is discussed in Section 4, as they pertain mostly to the allocation of allowances. Issues of co-pollutants were discussed briefly during this session, but the issue of fairness received more emphasis at the USC Workshop on environmental justice issues (on January 18, 2008).

account for CO₂ emissions by controlling mining or burning coal, or should one deal with emissions from agriculture by regulating the production of fertilizer or its use by farmers? (For more detail, see Figure 4-1 of the MAC report).

AB 32 calls for a reduction of California's greenhouse gas (GHG) emissions to 1990 levels by 2020. The net reduction in emissions must be enough to reach 1990 levels on a statewide basis. Therefore the reduction in GHG emissions for sectors covered by the cap-and-trade program must be enough to compensate for any possible increases outside the program. For this reason, the breadth of coverage is of critical importance. If fewer sources of GHG emissions are covered by the program, the reductions required by sources that are covered must be greater, which leads to higher compliance costs and greater distortions in the economy.

A cap-and-trade **program** for greenhouse gas emissions will provide a more cost-effective way of reaching emissions targets than traditional regulations, and **if** the cap is set at a sufficiently low level, the emission reductions from the program will be real and meaningful. However, choices must be made regarding the points of regulation, and these choices have important ramifications regarding the efficiency of the cap-and-trade program and subjective estimates of the likelihood that the cap will be binding. In particular, AB32 calls for a reduction of emissions from GHGs from the generation of electricity delivered to and consumed in California. This includes transmission and distribution losses, **regardless of** whether the electricity consumed in California was generated within the state's borders. This has important implications when designing the regulations and points of coverage.

As discussed in the MAC report, each type of regulation has its advantages and disadvantages. This section builds on the MAC report by first summarizing its main conclusions, and then discussing the findings of the Stanford Workshop.

3.1 Recommendations of the Market Advisory Committee

The MAC report outlined the major issues regarding the points of regulation. The main recommendations include the following:⁶

- In 2020, the emissions cap in a California GHG trading program should be set equal to total allowable emissions under the Global Warming Solutions Act minus projected emissions from sources and sectors not covered by the cap-and-trade program;
- In general, the California Air Resources Board (CARB) should seek to expand the cap-and-trade program over time so that it covers as many sectors, sources, and gases as practicable;
- As soon as possible, CARB should adopt mandatory reporting requirements for all sources likely to be covered by a GHG emissions cap;
- For non-combustion CO₂ emissions and for the non-CO₂ greenhouse gases, an emissions-based approach should be adopted where possible, with an upstream approach used for certain high global warming potential (GWP) gases;
- For CO₂ emissions from combustion, the Committee prefers a cap-and-trade program design in which (1) the program initially covers first sellers of

⁶ From page 38 of the MAC's final report (op. cit.).

electricity and large industrial emitters, and (2) the transportation and buildings sectors are added in subsequent phases as soon as CARB determines that emissions in those sectors can be monitored and that the administrative costs of extending coverage to those sectors are not prohibitive. However, a few members of the Committee prefer an upstream approach that imposes the compliance obligation on fuel suppliers upstream and thereby provides broad coverage from the outset;

- As a general matter, fugitive emissions and emissions from biological processes are too difficult to monitor and therefore should not be covered under the cap-and-trade program. The Committee encourages CARB to examine ways to improve monitoring of fugitive and biological process emissions, as a first step toward incorporating certain emissions of those types in a cap-and-trade system.

And for the Electricity Sector,⁷

- The Committee recommends a first-seller approach to regulating emissions associated with all electricity delivered in the state;
- The cap-and-trade program should be separate from and complement, not replace, other regulatory efforts aimed at developing an efficient and less carbon-intensive electricity system;
- State agencies should continue to develop policies that reward and, to the extent possible, require emissions accounting for out-of-state generation;

⁷ Page 54, MAC Final Report.

- A portion of the allowance value created under a cap-and-trade program (either from auctioned allowances or through allocation to load serving entities -- LSEs) should be directed to investments in end-use efficiency improvements;
- A portion of the allowance value created under a cap-and-trade program should be used to keep the net cost of electricity to consumers from rising too far in the early stages of the program. This could be done by allocating allowances to regulated LSEs or through direct consumer rebates.

There were some questions remaining as to specific policy recommendations from the MAC report. These issues include a more detailed description of the points of regulation (i.e., upstream vs. downstream); additional incentives for emissions reductions if an upstream system is used; linkages with other systems;⁸ and whether transportation should be included and how this would affect upstream/downstream choices.

3.2 Issues Addressed at Stanford Workshop

The issues discussed in this session of the workshop largely overlapped with recommendations of the MAC, but with some subtle differences.

3.2.1 Upstream vs. Downstream Regulation

Where greenhouse gases are regulated remains an important question for the regulator to resolve. There are two basic alternatives that were discussed in the final

⁸ The Report notes that linking the California program with others will be easier if the points of regulation are similar. In addition, a California program could try to influence or mirror an emerging Federal system or other regional efforts.

MAC report: upstream vs. downstream regulations. The workshop focused on these two alternatives in further detail.

Greenhouse gases are emitted at the point at which a production process chemically transforms mass so that some of the input matter is released as a gas that produces the greenhouse effect. Thus, ideally a regulatory system would focus on the production of GHG, not the inputs to the production process, which means engaging in “downstream” regulation. In general, the sources of inputs to GHG production are fewer and the quantity of inputs is easier to monitor than the actual emissions of GHG, which implies that administrative costs are lower for “upstream” regulation. Whether upstream and downstream regulation produce the same compliance cost depends on whether some processes that produce GHG can be redesigned at reasonable cost to reduce the amount of emissions arising from a given amount of inputs. Sequestration is a potential option for reducing greenhouse gas emissions while keeping inputs constant. The magnitude and distribution of the costs of achieving a given reduction in emissions depends upon whether sequestration is a realistic alternative to curtailing use of inputs.

The choice between upstream and downstream regulation for hydrocarbon fuels depends primarily on the comparative administrative costs of effective regulation at different points in the distribution and use of fuels. Sequestration of CO₂ emissions from burning hydrocarbon fuels is not currently economically attractive (nor likely to be attractive in the near future), so that the efficiency of the methods for curtailing CO₂ emissions from combustion is not affected by the decision between upstream and downstream control. Upstream regulation creates a point of enforcement at the level of fossil fuel producers. Suppliers of fossil fuels would need allowances to sell in California,

and their allowance requirements would be based on the carbon content of the fuel. If the number of allowances is less than current fuel use, the retail price of fossil fuels sold in California will rise, although the full price of permits may not be fully passed on to consumers if fossil fuel has rising supply costs or is not sold in fully competitive markets.

Downstream regulation would implement a GHG cap at the point of consumption. In this case, allowances still could be based on the carbon content of the fuel, although in the future allowances could be based on actual emissions if sequestration strategies become sufficiently attractive to justify the additional administrative complexity of monitoring actual CO₂ emissions rather than fuel use. Allowances would be needed to consume fossil fuel. In this case, the total cost of using fossil fuels – fuel plus allowances – will not differ from the total costs under upstream regulation. The price of allowances will be the same in both cases (the amount necessary to curtail demand to the emissions cap), as will be the price of fuel (the market price if demand is curtailed by the target amount).

3.2.2 Past Experiences: Upstream vs. Downstream

An upstream approach was used in phasing out lead emissions from automobiles by limiting the amount of tetraethyl lead oil refineries could add to gasoline to achieve better performance. Similarly, emissions of ozone-depleting substances (chlorofluorocarbons, or CFCs, which were used in refrigeration and also are greenhouse gases) were phased out through limits on their production rather than their use. Compared to GHG emissions, there are important differences that should be understood about past regulatory experiences.

In both of these cases, producers of leaded fuels and refrigeration systems were able to find substitutes for these inputs that enabled them to achieve the emissions cap without causing a substantial change in either their production technologies, the prices of the downstream products, or the way these products were used by purchasers. As a result, these programs did not require a substantial behavioral change by users of the products that caused the emissions. That is, the final product that caused emissions was changed in such a manner that downstream users were not required either to pay much higher prices, to switch to a much different product, or reduce product use. After the upstream cap was put in place, only minimal technological and economic adjustments were necessary—regulations were largely invisible to users.

The strategies for reducing the use of lead and CFCs all relied primarily on alternative technologies, and not conservation, demand management, or new end-use technologies. Moreover, there was no adjustment required by the consumer because the effect of each program on the price and performance of final goods was minimal.

In the case of GHG emissions, upstream suppliers of hydrocarbon fuels do not have the flexibility to produce alternative fuels that produce lower GHG emissions (with the exception of the introduction of biofuels). Moreover, there is currently no cost-effective scrubber that can remove CO₂ from the combustion of hydrocarbon fuels. Carbon capture and sequestration is a possible option in the future, but retrofitting older plants will undoubtedly be more difficult. Reduction of emissions from existing combustion processes requires designing, building and using new plants, automobiles, and other investments that burn hydrocarbon fuel with higher thermal efficiency,⁹ that rely

⁹ This can be done through technologies such as supercritical combustion or Integrated Gasification and Combined Cycle (IGCC).

on another source of power, or that can undertake carbon capture and sequestration. Consequently, the adjustment to a world that emits substantially less GHG will likely be more costly, disruptive and protracted than the adjustments to a world with fewer emissions of lead and CFCs. The implication for designing a cap-and-trade program for GHG is that getting the institutions to work is a higher short-term priority than achieving dramatic reductions in GHG emissions; the latter should be achieved over a long period of time so that accommodating innovations and investments can be planned long in advance.

3.2.3 Upstream Regulation

3.2.3.1. Advantages of Upstream Approach

Upstream regulation has several advantages. It allows California to meet its short-term goals with greater certainty and to achieve a greater breadth of coverage. Furthermore, the administrative cost of an upstream program would be significantly lower because there are far fewer producers than consumers of fossil fuel and other inputs to processes that emit GHG.

Most participants agreed that care should be taken when combining a low-carbon fuel standard to regulate emissions in the transportation sector with an upstream-regulated cap-and-trade program.¹⁰ This can yield overlapping regulation that would result in higher abatement costs in the transportation sector than in other sectors. A

¹⁰ Some argued that a low-carbon fuel standard, in addition to an upstream cap, would not be cost effective. They advocated not focusing on transportation because of the high marginal costs of abatement in that sector.

major concern by industry representatives and some economists was that this would be inefficient unless the price of carbon was very high.

In terms of the possibility of linkages with a regional or Federal cap-and-trade system, upstream regulation probably is preferable. Most proposed Federal legislation¹¹ has envisioned upstream regulation.¹²

3.2.3.2. Disadvantages of Upstream Approach

There are also drawbacks to upstream regulation. In the long run, several actors reliably can be predicted to respond to a significant price for CO₂ emissions: producers of fossil-fuel based electricity, manufacturers of equipment that uses either fossil fuels or electricity (that is generated from fossil-fuel plants), and end users of energy. However, most of this response may not occur immediately. Instead, there will be time lags for investment, turnover of capital stock, and innovation. The question also remains as to whether a downstream price signal from an upstream cap will be adequate, by itself, to trigger the needed technological innovations and behavioral changes.

Cost-effective GHG emissions reductions will require technological innovation and downstream behavioral adjustments by users of energy and suppliers of energy-using equipment.¹³ Many participants in the workshop suggested that an upstream cap is not, by itself, adequate to trigger the needed amount of innovation,¹⁴ even if the right behavioral signals are sent. If a price signal from a cap-and-trade program with upstream

¹¹ A discussion of US congressional proposals can be found in Paltsev, et al (2007).

¹² One industry representative suggested that an upstream regulation would be politically difficult in California, and suggested that such an approach is better taken by the Federal government.

¹³ Some of these changes can be cost-effective; emissions reductions could be made downstream by focusing on conservation, energy efficient appliances, and renewable electricity generation.

¹⁴ Some participants expressed concern that an upstream approach may place such a heavy burden on the efficacy of a carbon price signal that a modest cap will be chosen.

regulation is not enough to induce changes in technology and end user behavior, then it may be necessary for the state to couple regulation with other policies.

Price signals can trigger the diffusion of existing technologies, but there is general agreement that price signals alone are not necessarily an effective means for inducing innovation. Many participants advocated a broader effort to intensify the downstream behavioral response to an increase in the price of carbon. A broader program could include, for example, directly financing the development and diffusion of new technologies.¹⁵

Once a new technology is available, most participants agreed that a price signal normally is sufficient to induce the diffusion of an efficient technology downstream. They argue that whether a price signal is sufficient to induce adoption by a particular downstream user is irrelevant; to succeed, a cap-and-trade program should induce only technologies that reduce the social cost of achieving GHG emissions targets, and if price signals incorporate true social costs, private actors have an incentive to minimize the social costs of their actions. This is the view taken by the MAC. A correctly-chosen cap gives the market a signal of the price of GHG emissions, which is meant to correct for market failure and the externalities present.

While price signals may be sufficient to assure proper diffusion of a new technology, most conference participants also believe that the price signals created by cap-and-trade can not be relied upon to provide a sufficient incentive for producing new technologies. A fundamental reason is that investors in new technology are not able fully to capture the social benefits of their discoveries. For this reason,

¹⁵ If allowances are partially (or fully) auctioned, revenues could be used to assist firms with developing new technologies or as tax credits. See Section 4 for more on the allocation process.

government subsidization and other indirect support of the development of new technology can produce net social benefits. For example, to provide an incentive for carbon capture and sequestration in a system of upstream regulation, the offset program could create and distribute allowances to firms that develop and produce these technologies. These allowances could then be sold in the cap-and-trade market, thereby increasing the financial return to the innovator.

3.2.4 Downstream Regulation

3.2.4.1. Advantages

Downstream regulations may offer greater incentives for stationary sources to take steps toward emissions reductions. Because stationary sources would need to cover their actual emissions with allowances, there would be a strong incentive to sequester carbon on site. Moreover, this may trigger investments in new technologies and alternative energy sources in California.

3.2.4.2. Disadvantages

To reduce the administrative burden of enforcing emissions limits on numerous small sources of GHG, downstream regulation is likely to require limiting the coverage of the cap to large point sources of emissions, thereby reducing the fraction of emissions that are covered by the program. In order to determine the cap on total emissions, the regulator first must determine baseline emissions from the capped sources. Downstream regulation requires information from all the facilities that are covered by the program, and firms have incentives not to reveal (or even to overstate) their true historical emissions

when determining a baseline. Thus, in addition to requiring observations on many more participants in the program, downstream regulation requires more intensive monitoring to assure that actual emissions are accurately measured.

As one economist pointed out, it is also important to distinguish between relocation (within the regulatory regime) and leakage. That is, if all jurisdictions adopt the same overall policy, the distribution of emissions cuts by type of economic activity will differ depending on the structures of the economies in each jurisdiction. A particular danger of downstream regulation is that it is much more vulnerable to protectionist manipulation by a particular jurisdiction to benefit its local industries in the guise of the leakage argument, when in fact there is no leakage, but instead relocation.

3.2.5 Hybrid Upstream-Downstream System

Some participants advocated a hybrid approach, where a combination of upstream and downstream regulation is used. Under such an approach, upstream regulations would be put in place for broad coverage, but downstream regulations would be implemented for large stationary sources. Under such a system, the point of compliance would be on fossil fuel producers or distributors. To create a greater incentive for reductions at the large point sources, these stationary fossil fuel consumers would be able to sell allowances based on the GHG content of the fossil fuel that they do not emit because of carbon capture and sequestration.

There are at least two significant problems with a hybrid approach to regulation. First, it may fail to provide complete coverage of emitting sectors. Second, there is increased administrative complexity inherent in such an approach, which may be more

costly than a purely upstream approach. Regulatory measures, when used, should focus on performance standards when possible (rather than technology standards).

Furthermore, if possible they should be fashioned as a downstream cap, such as the low-emissions standards set forth in AB 1493.¹⁶

3.2.6 Electricity Sector: Load-Based vs. Source-Based

As outlined in the MAC report, the electricity sector in California poses special challenges to a cap-and-trade program for GHG emissions. The workshop focused on special considerations for the electricity sector when considering whether an upstream or downstream cap should be implemented.

California is part of the Western Electricity Coordinating Council (WECC), which links it to a network of suppliers in the Western United States and Canada. Roughly 25 percent of California's electricity is imported from other Western states. At the workshop, the electricity grid was compared to a bathtub into which producers pour electricity and from which consumers drain electricity. Because imported electricity is simply injected into a looped transmission network, where energy flows on the path of least resistance, it is impossible to determine the source of the electricity that is used by any end user or even of imported electricity entering the state.¹⁷

In theory, GHG emissions can be regulated at several points along the process of producing and using electricity. The most upstream point is the supplier of hydrocarbon fuels to electrical generators. Because so much of the electricity that is used in California

¹⁶ AB 1493 (Pavley) focuses on GHG emissions from motor vehicles

¹⁷ Some participants argue that we should focus on providing incentives for CCS, behavioral changes, and voluntary action rather than how to deal with out of state electricity generation.

is not produced within the state, California lacks jurisdiction to impose an allowance requirement on all relevant suppliers of fuel; however, this would be feasible for a Federal program or even a program involving all WECC members (including Canada). The next stage, still upstream, is the sale of electricity in California by generation companies. Placing responsibility for compliance with generators is a source-based cap-and-trade mechanism. The trouble with this approach is the problem of leakage. Alternatively, downstream regulation, where the point of regulation is the point of consumption, is a load-based system, which has the attendant problem of reshuffling.

The workshop participants agreed that leakage and contract reshuffling, as discussed in section 2, poses a significant problem in the electricity sector. Either a load-based or a source-based mechanism with significant imports would have little, if any, impact on how electricity from outside California is actually produced if California acts alone in implementing a carbon cap. For this reason, the participants in the workshop agreed an effective California cap-and-trade program requires bringing more Western states into the system, as is contemplated in the Western Climate Initiative.

One alternative put forth by some participants in the workshop is to create forward financial contracts with out-of-state suppliers of cleaner sources of energy. For example, a contract could be written to buy 200 MWh from a specific generation unit, and then verify that at least 200 megawatts is produced during that hour. Although one cannot guarantee that the electricity consumed in California was from that source, it is one way to ensure that clean out-of-state sources are producing sufficient electricity.

The approach set forth by the MAC, which was also discussed in the workshop, was to take a “first seller” approach for implementing a cap in the electricity sector. For

sources in California, a source-based approach could be taken, whereas imported electricity would be regulated under a load-based approach. Under such an approach, California could consider assigning an “emissions intensity” to imported electricity based on a simple rule. It could, for example, be the average emissions intensity of power produced outside the state of California (within the WSCC) during that timeframe. Any such rule would need to be simple and transparent to avoid legal challenges and to ensure that the price of allowances is stable.

Even if implemented in the best way possible, this approach does not create an adequate incentive to build new sources of energy that do not use hydrocarbon fuel. The reason is that if such a facility is built, it reduces the allowances required for all imported electricity, not just the electricity that is generated by the new facility. Incentives for creating generation facilities that do not use carbon fuel could be created only by including electricity from such facilities in an offset program, while excluding them from calculating the clean electricity proportion from out of state generators.

3.2.7 Compliance Costs, Permit Prices, and Safeguards

When the price of permits is close to zero, there is little incentive not to comply with an emissions cap because it is not costly to purchase additional permits. As the cap becomes binding, however, the permit price increases, which in turn increases the incentive not to comply. The ultimate goal of a cap-and-trade program is to set a binding constraint on emissions, but the price may reach a point where it will be difficult to ensure compliance. Therefore, some participants in the workshop advocate implementing

safeguards and penalties early in the program and enforcing them consistently. The policy in place should ensure compliance with the highest conceivable allowance price.

Some participants favored a GHG fee – a carbon tax – because it creates price certainty.¹⁸ Predictability of future carbon use prices allows energy users to foresee the future cost of their emissions, and thereby to identify the cost-minimizing investments in control technologies. A cap-and-trade system substitutes certainty in emissions for certainty in price. As a result, allowance prices can be volatile for a variety of reasons, including changing market expectations, fossil fuel price volatility or changes market design in response to political changes. Allowance price volatility can dull the incentive to invest in GHG control technology that risks being ex-post unprofitable. In light of this, some participants in the workshop favored a rising floor and ceiling on the price of allowances in a cap-and-trade program. One suggestion is to set the nominal price floor such that it increases with the rate of price inflation, and set a nominal price ceiling that increases at a higher rate.¹⁹ This provides certainty to producers of GHGs that justifies investment at GHG-reducing technologies; however, it does so by sacrificing the certainty of the emissions cap.

3.2.8 Renewable Portfolio Standards

Under renewable portfolio standards (RPS), a certain fraction of a jurisdiction's electricity must be produced from renewable sources. RPS serve as another mechanism to reduce GHG emissions in California, because they displace the production of

¹⁸ A counterargument put forth was that a GHG fee would not ensure that total emissions meet the goals set forth in AB32.

¹⁹ The price floor is the rate at which the state is standing by ready to purchase allowances, should the market price fall below the floor. The price ceiling is the rate at which the state is standing ready to issue permits at this price, should the market price of allowances reach that level.

electricity from fossil fuels.²⁰ High RPS standards will reduce the GHG allowance price. Similarly, a tighter (lower) cap on GHGs increases the price of allowance prices and reduces the effect of RPS. Some participants questioned whether an RPS and a cap-and-trade program are compatible. They argued that there is little need for RPS if the cap-and-trade program is scaled to a sufficiently large geographic area. However, in the absence of a Federal (or Western) program, RPS could be used in the initial stages of the cap-and-trade program when the level of leakage is expected to be high. In any case, RPS would only be effective at reducing GHG emissions if it displaces the construction of fuel-burning units.

3.3 Summary of MAC issues resolved & questions that remain

There are several questions that remain and should be addressed.

- The workshop participants recommend that ARB consider different methods to directly address the development and diffusion of technologies for GHG reductions.
- An industry representative pointed out that incentives should exist for out-of-state suppliers of electricity to implement CCS. Because it is impossible to determine the source of imported electricity, one recommendation involved assigning an emissions-intensity (e.g., based on average intensities for electricity produced out-of-state). While an overall emission-intensity index for all out-of-state electricity will not provide an adequate incentive for out-of-state plants to take emissions-reducing steps, the

²⁰ Under SB 1078, by the year 2010, 20% of California's electricity must come from renewable resources. By the year 2020, the fraction increases to 33%.

incentive for a state to participate in a regional program would be increased if the index were calculated separately for each state. Other means of increasing the incentive for other states to reduce GHG should be identified and considered.

- Whether an upstream regulation induces sufficient behavioral changes and/or downstream investment is an empirical question, one which could be studied. Other policies could be coupled with a cap-and-trade program to induce these changes if that is a goal.

3.4 Summary/Conclusion

The workshop participants agreed that in order for a cap-and-trade program to be successful, it should create the incentive for the private sector to generate solutions to the problem of reducing GHG emissions. Perhaps the most important goal of a GHG emissions permit market is a credible and predictable price for carbon into the future. As the MAC report also discussed, workshop participants agreed that it is critical for a cap-and-trade program to produce a clear price signal, because future investments in the private sector will respond to the price signal created by the market.²¹ If the forward price of allowances is stable, private sector investments will correctly respond to price signals. Noisy price signals, which can come about from a poorly managed system, will reduce investments in cost-effective low-emissions technologies. Too much price volatility dulls the incentive to invest in GHG control technology. Therefore, participants of the

²¹ One participant noted that trading among firms began prior to the first auctions in the SO₂ market. This underscores the weight that firms place on upcoming regulations in making their investment decisions.

workshop suggest that steps be taken to insure that there is confidence in the stringency of the cap and forward prices of carbon emissions.

Participants generally agreed that the success of a state-level program should be judged by its ability to demonstrate that trading GHG permits results in lower costs of achieving market-wide GHG reduction goals. If California can demonstrate that it can achieve reductions at low cost, with relatively stable prices of allowances, other states and countries may be encouraged to take similar steps.²² Alternatively, a high initial cost of compliance (or high price volatility) will only discourage other jurisdictions from participating, and may result in an increase in GHGs globally. Most importantly, however, the program should focus on building in compliance mechanisms to ensure the integrity of the cap-and-trade program.

Many workshop participants felt that the 2050 goal, involving a more profound technological transformation, will require the use of multiple instruments. A cap-and-trade program will be essential, but the use of additional regulatory measures, best management practices, incentive programs, and technology advancement programs will also be critical.

Many participants believe that for a cap-and-trade program to induce investments, the program should make clear all guidelines and rules as early as practicable in order to allow managers and investors to plan into the future. Any penalties for noncompliance, as well as any safeguards (such as allowance price floors and/or ceilings), should be implemented as early as possible to allow investors to optimally respond with long-term investments in new technologies. This will help establish a stable, predictable price for

²² Some participants argued that the environmental goals of a California cap-and-trade program are less important than providing evidence that a cap-and-trade program can be successfully implemented and that such a program can produce real reductions in emissions.

allowances. Furthermore, if a first-seller approach is adapted to deal with imported electricity, it is critical that any rule assigning an emissions-intensity be simple, transparent, and consistent.

4. Allowances: Auctioning vs. Free Allocation

Under a cap-and-trade system firms must hold allowances for emissions they produce; consequently, an important element of any cap-and-trade program is the process by which those allowances are distributed. Allowances can be distributed to firms from the regulatory body in two ways: giving away emissions permits for free or selling permits through an auction. Free distribution typically gives each firm emission allowances based on its historical emissions. Firms are then free to use these allowances themselves, or to sell them to other firms. In an auction allocation, firms submit bids expressing their willingness to pay for different amounts of allowances, and the bids of all firms are then used to calculate the price at which the demand for allowances exactly equals the supply. Firms then receive allowances equal to their bids at the market-clearing price, and are required to pay for the allowances that they receive.

These approaches are not mutually exclusive. A cap-and-trade system can distribute some allowances for free, while auctioning the rest. The advantage of an auction allocation mechanism is that it immediately creates a working market institution that communicates the price of allowances to firms, thereby facilitating efficient planning by firms regarding emissions reduction investments. Under free allocation, firms that seek to buy or sell allowances must create this market institution themselves. An auction mechanism also facilitates entry by new firms by easing their problem of obtaining

allowances. But an auction mechanism imposes added costs on firms in the form of payments to the government. To obtain the benefits of both approaches, the government can create a mixed system – a substantial number of free allowances combined with a substantial number of allowances sold through an auction. Or it can create a non-revenue-generating auction, in which firms receive free allocations, but are required to sell some of those allowances in an auction.

An allowance is a valuable economic good, and how that good is transferred to firms (and at what price) affects the relative costs incurred by participants in a cap-and-trade system. The allocation method may also affect the costs borne by consumers. Nevertheless, the choice of free allocation or auctioning will not affect the *environmental effectiveness* of a cap-and-trade program.

Most participants at the Stanford Workshop agreed with the findings of the Market Advisory Committee (MAC) Report that it is desirable to transition from a system in which *some* or *all* allowances are allocated for free to a system in which *most* or *all* allowances are auctioned. Further information is needed to determine (1) the most desirable number of allowances to auction and when, (2) the pace at which a transition should proceed, and (3) how to balance the relative costs incurred by firms and consumers.

4.1 Summary of MAC findings on Allowance Allocation

The MAC report focused on the distinction between free allocation and auctioning and identified the tradeoffs involved when designing an allocation system in a cap-and-trade program. The authors recommend that a set of principles²³ focused on cost-

²³ For the detailed list of principles, see page 55 of the MAC report.

effectiveness, fairness, and simplicity be used to guide programmatic decisions; they also focus on two specific issues regarding allocation.

4.1.1 MAC Recommendations

First, the Report notes that freely allocated allowances are a transfer of wealth from the regulator to the regulated entity. Transferring more allowances to a firm than it needs leads to immediate windfall profits for the firm, since the firm can sell excess allowances. Similarly, freely allocated allowances do not avoid energy price increases for consumers: because allowances are valuable, the firm incurs an “opportunity cost” if it uses the allowance (instead of selling it). Firms are expected to increase prices to account for the opportunity cost.²⁴ The MAC report also noted that it may be possible to tie free allocation of allowances to climate-friendly investments by firms that receive those allowances. If allowances are freely allocated, the MAC recommended that it be based on historical benchmarks, not on use.

The MAC report also addressed the point that auctioning allowances generates revenue. This revenue could be used to support investment in low greenhouse gas technologies, promote end-use efficiency and adaptation, and reduce costs to low-income communities.²⁵

On balance, the MAC recommends a mixed approach to allocating allowances in which a portion of allowances are auctioned initially (and a portion allocated freely) with

²⁴ A firm holding an allowance has the opportunity to sell that allowance at market prices, but if the firm uses the allowance to generate emissions it incurs a cost: the revenue lost by *not selling* the allowance. Much like a “real” cost, the firm will pass this opportunity cost onto consumers in the form of higher prices. One exception is firms whose prices are controlled by a regulator, since the regulator might prevent the firm from raising prices.

²⁵ For a complete list of MAC-recommended revenue uses, see pages 56-57 of the MAC report.

the proportion of auctioned allowances increasing over time. The MAC recognizes that although auctioning is preferable for many reasons, we have less real-world experience with auctioning allowances, and some free allocation may increase political feasibility in the short-run.

4.1.2 Unresolved Issues Regarding Allocation in the MAC report

The MAC report outlined (1) the advantages and disadvantages of both auctioning and free allocation and (2) made general recommendations about how California's cap-and-trade program should incorporate the two approaches. However, a number of remaining issues need to be addressed:

- If a transition system is adopted in which auctioning is gradually phased-in, what should be the initial percentage of auctioned allowances and at what rate should that percentage increase over time?
- What form should the specific structure of auctions take?
- How much auctioning is feasible (as a percentage of total allowances)?
- How can any legal or institutional challenges to auctioning be overcome?
- How does the choice of the split between auctioned and free allowances affect linkages to potential Federal or regional program?
- How would the revenue from auctions be used? Is it possible to effectively target revenue to greenhouse gas reducing activities? Would this revenue create political problems related to windfall revenue accruing to the general fund?

4.2. Issues Addressed at Stanford Workshop

The formal presentations focused on allowance system design: auctioning vs. free distribution, experience with the New England RGGI system and the EU ETS, and the use of safety valves and reserve prices.

In comparing auctioned allowances with free distribution, free allowances have some advantages: improving the likelihood a program will get approved; easing the implementation of a cap-and-trade program for heavy emitters; protecting prior investments; and transferring value to emitters. On the other hand, auctioned allowances: create liquidity and transparency; encourage earlier investments; level the playing field for new and old players; reduce rent-seeking by regulated entities; and transfer value to tax payers

Real-world examples of cap-and-trade programs can inform how to best allocate allowances under a cap-and-trade program in California. In particular, the Regional Greenhouse Gas Initiative (RGGI) may provide a basis for California's allocation decision process. Features of RGGI—especially regarding auctions—that may be worth adopting in California include: frequent (quarterly) auctions; allowances that are available four years in advance (futures); auctions that are open to all entities (with a cap of 33 percent for any one entity); a single-round, sealed-bid, uniform price auction system²⁶; both buy

²⁶ This is a multi-item auction in which bidders submit a private (“sealed”) bid to the auctioneer that includes the price they are willing to pay and the number of units they desire. The auctioneer allocates items (here: allowances) to the highest bidder first, then the second highest, and so forth until all items are allocated. The price all bidders pay—for all items they receive—is equal to the lowest winning bid (the actual bid of the last bidder to receive an item in the allocation process).

and sell orders are permitted, allowing participating entities to sell off owned allowances; and prices and winners are publicized but not bids or quantities²⁷

On the other hand, and as discussed at the workshop, some features of RGGI that California might not want to adopt include: the use of reserve prices and safety valves²⁸; and separate auctions for each allowance ‘vintage’.

It was noted that there are relatively few examples of programs that use auctions under a carbon trading system, and those that do, such as the European Union Emissions Trading System (EU ETS), auction a small percentage of total allowances.²⁹ Consequently, we have little evidence that auctioning a substantial percentage of allowances is feasible. More generally, although auctions are presumed to provide a relatively efficient revenue stream, this assumption may not hold when that revenue is subject to political control.

There was some support for safety valves and freely allocated allowances, at least at the beginning of the cap-and-trade program. This is motivated by the implicit tradeoff between the stringency of the program and the costs to industry, which are effectively controlled by the percentage of auctioned allowances and limiting uncertainty through a safety valve.³⁰

²⁷ This point raised a general concern over how much information on auction sales should be provided given that divulging too much information could undermine a firm’s competitiveness and private information. A suggestion was made that less information (specifically the names of winners) should be made public than under RGGI.

²⁸ A reserve price provides a ‘floor’ below which allowance prices cannot fall, which increases revenue but reduces efficiency. This is the opposite of a safety value, which prevents allowance prices from rising above a specified point.

²⁹ The EU ETS has recently announced plans to increase significantly the use of auctioning to allocate permits. Recent changes in the program project that 60 percent of allowances will be auctioned by 2013, and that percentage will increase over time. For more information on the changes to EU ETS, see: <http://tinyurl.com/2yhbh3>.

³⁰ A related issue is that of leakage. One of the economic experts suggested that free allowances could reduce leakage early in the program, as regulated entities would have less incentive to shift emission-intensive activities in order to avoid the cap.

The discussion following the presentations revolved around a few central issues, including:

- the revenue generated by auctions and its use
- the distributional effects of either allocation strategy
- the costs of an auction approach (especially to consumers)
- what percent of allowances to auction initially
- the rate at which a transition from free allowances to auctions should occur

4.2.1 Revenue from Auctions

Auctioning is a more efficient allocation mechanism than free distribution only if the revenue from the auction is used for purposes that generate at least as much social value as the amount that is spent.³¹ If these revenues are spent frivolously, the waste arising from these expenditures undermines the efficiency of the auction. Participants raised the concern that the revenue from an allowances auction might not be put to “good use.” Some participants fear that elected officials will treat the auction revenues as a financial windfall, and so spend the revenues in an undisciplined way. Others agreed that the disposition of the auction revenues is a legitimate concern, but that the problem can be dealt with by legislating how the revenues will be spent before the auction is held. For example, some funds could be used to reduce taxes or allocated for specific purposes, such as paying for California’s recently authorized new indebtedness for infrastructure investments. Many participants believed that because an allowance auction is one of the

³¹ For example, in studies summarized by Burtraw (2001) revenues are returned directly to households, resulting in moderate efficiency. A more efficient approach would be to use revenues to lower other distortionary taxes (such as income taxes). Another alternative use for revenues is to promote greenhouse gas-reducing investment.

very few mechanisms available to government for raising revenues in a manner that does not create distortions and inefficiency, the state would be foolish not to take advantage of this once-in-a-lifetime opportunity by finding a suitable way to assure that the revenues from the auction are used for purposes that enhance the state's welfare.

A related issue concerns "advance" allowances. The first presenter pointed out that RGGI makes allowances available four years in advance, which is likely to increase the revenue generated by the auction. Those who expect that the state will spend the auction revenue unwisely believe that an advance auction, therefore, would be undesirable. The commenter also noted that a yearly auction—which limits revenue—could suffice if the market was sufficiently large, since a futures market will develop automatically to allow inter-year trading of allowances. Others felt that making future allowances available further out—greater than four years in advance—is desirable. This choice could affect whether and how an independent futures market develops.

From an economic perspective, research suggests that allocating allowances by auctioning will have lower cost (higher efficiency) than allocating allowances freely (Burtraw 2001). However, some participants raised the concern—which the presenters acknowledged—that the "real world" costs of auctions could be higher than anticipated and are relatively unknown. One obvious implication of this discussion is that to assure that a cap-and-trade system is as efficient as practicable, decisions about how to use the revenue should be decided before the auction is held. Another implication is that any auction system should be designed to generate a reasonably stable and predictable stream of revenues, rather than one or occasional revenue windfalls. Just as allowances

markets facilitate long-term planning by firms that emit GHGs, steady and predictable revenue flows facilitate rationale long-term budget decisions by the government.

4.2.2. Distributional Effects

Participants generally agreed that allowance allocation is contentious largely because it has important implications for the distribution of wealth. Participants broadly agreed that the choice among methods for allocation of allowances will have little impact on the overall environmental effectiveness of a cap-and-trade program. The allocation mechanism will, however, affect whether large benefits (from the sale or transfer of allowances) accrue to regulated entities, taxpayers, other constituencies, or some combination of all. The allocation rule will also affect whether an individual regulated entity is a net gainer or loser under a cap-and-trade policy. For this reason, the proposed allocation method will likely affect industry support for a cap-and-trade program, with firms more likely to support freely allocated allowances.

Beyond these broad-level concerns there was little additional discussion of how auctioning versus free allowances would impact distribution, especially among different consumer income groups.

4.2.3 Costs of Auctioning

Related to distribution, some participants were concerned about auctioning allowances insofar as firms will pass the auction-related costs on to consumers, thus

raising energy prices.³² Participants debated whether the actual allowance cost arising from an auction and the opportunity cost of allowances arising from retained free allocations would be passed on equally to consumers. Non-economists frequently find the economic argument about the equivalence between direct cash and opportunity costs to be implausible. Nevertheless, few propositions in economics are as firmly established, theoretically and empirically, as this equivalency. The debate instead should focus on whether free allowances will cause an efficient secondary market in allowances to emerge. If trading free allowances is cumbersome and expensive, the cap-and-trade system will be as efficient as it could be, and the total cost among all firms of meeting the emissions cap will be higher than otherwise would be the case. Whereas these higher costs will be passed on to consumers, the magnitude of the pass-through will reflect the differences in costs of compliance among firms and industries. Thus, if the state does decide to adopt a free allocation mechanism, it is essential that the state also take action to facilitate the development of a secondary allowances market.

One of the presenters suggested that an indirect “cost” of auctioning allowances could be relatively weaker program stringency. If auctioning places additional cost burdens on emitters of GHGs, political opposition to a stringent cap is likely to be more intense. By contrast, if some firms can profit from selling allowances under a free allocation system, emitting firms may even be divided about the desirability of a stringent cap.. Finding a balance between stringency and allocation strategy may be an important political/regulatory issue.

³² This also has important distributional considerations, as energy takes up a large percentage of low-income individuals’ budgets. Therefore, the distribution of costs due to policies that increase energy costs is generally regressive.

4.2.4. The Percentage of Allowances Auctioned

Participants did not attempt to make a specific recommendation about the percentage of allowances that should be auctioned. Instead, they focused on identifying the trade-offs that should be taken into account in making that decision. A greater number of auctioned allowances will increase revenue and reduce total abatement costs for meeting a specific emissions target, but it will also increase the total financial costs to regulated entities. In addition to increasing political resistance to an emissions cap, the higher financial costs of an auction allocation can lead to short-term financial disruptions in some industries. Firms that can not survive financially if they are required to pay for their allowances in an auction must close down immediately. Under free allocation, these firms still will cease operating, but they can partially offset their exit costs by selling their allowances. And, in any case, all firms lose less value if they do not have to pay for at least some of their allowances.

Research on electricity generating firms in the RGGI program concludes that in order to ensure that firms did not lose significant value under a cap-and-trade system, between 34 and 77 percent of allowances would need to be freely allocated (Palmer, Burtraw, and Kahn 2006).³³ These numbers do not apply directly to a California program, but they do provide a guide. A similar analysis could be conducted specific to California.

4.2.5. Transitioning to More Auctioning

³³ The variation in percentage freely allocated depends on assumptions about whether the regulator can accurately identify the “winner and losers” of the climate policy. The more information the regulators have, the more allowances can be auctioned without unduly affecting firm costs.

While many participants agreed that it is desirable to transition to a greater percentage of auctioned allowances, the speed at which this transition should take place was an open question. The underlying economic issue in choosing the duration of the transition period is that it should be long enough to avoid short-term financial disruption of industries that will bear a large cost burden, but short enough to induce firms to make efficient technology choices in all future new or renovated facilities. Because industries and even firms within an industry differ in their investment planning horizons, they also will differ according to the socially desirable transition period for that particular firm/industry. One of the presenters, emphasizing the importance of inducing more efficient investments quickly, suggested that historical-based freely-allocated allowances could be phased out in four or five years. Others argued in favor of a longer transition period, perhaps as long as 20 to 25 years. Regardless of the transition rate, argued one presenter, the transition path should be stated “up front” to give regulated entities clear expectations of the program’s evolution.

For comparison, EU ETS Phase 1 (2005-2007) freely allocated 99 percent of allowances, and Phase 2 (2008-2012) decreased that percentage only to 96 percent. Recognizing the drawbacks of free allocation, the EU ETS has recently announced plans to reduce free allocation to 40 percent by 2013.³⁴

4.2.6. Other Issues Raised

A few other, less significant issues emerged during the discussion. One participant noted that the California Air Resources Board (CARB) has the authority to

³⁴ For more information on EU ETS and how it structures auctioning, see Ellerman and Buchner (2007) and <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/35&format=HTML&aged=0&language=EN&quiLanguage=en>.

deviate above or below the 1990 reduction levels and asked whether this would affect market performance or volatility. The first presenter felt that this would not pose a significant challenge. Another concern was the “obligated parties” (regulated entities) participating in the cap-and-trade program might have less flexibility than “non-regulated” entities (e.g., traders) and that this might have adverse effects. However, all parties will be responding to the same economic incentives; thus, a trader holding allowances will face the same price per allowances—and opportunity cost of holding an allowance—as generating facility or energy firm.

4.3. Summary of MAC issues resolved & questions that remain

The workshop reinforced many of the ideas presented in the MAC report, but it did not provide concrete resolution regarding how a California cap-and-trade program should approach allowance allocation. One of the clearest signals from the workshop was that although auctioning allowances is preferable on many levels, it is likely that a moderate to substantial portion of allowances will need to be freely allocated at the start of the program. The reason that free allowances are likely to be part of the program at the beginning are uncertainty about effectiveness of the auction and the efficiency of the uses of auction revenue as well as the political necessity of ‘buy-in’ for meaningfully strict standards from regulated entities. At the same time, many participants—and economic research—indicates that auctioning a significant portion of allowances from the outset of the program is likely to improve the efficiency of the program. Moreover, economic research favors a transition to a program in which most allowances are auctioned. Although there is no consensus about the appropriate duration of the transition within the

range of 5 to 25 years, economic research argues for firmly announcing the duration in advance.

On the issue of revenue generated from auctions, economic research and many participants support using revenue to reduce taxes or promote climate-related investment. Many participants expressed little confidence that the revenue would be used effectively. The intensity of this debate emphasizes the desirability of having a concrete plan for using the revenues before the first auction is held.

Whereas participants did not reach consensus about the fraction of allowances to be auctioned initially, many of the economists expressed a preference for at least *some* auctioning from the beginning of the program. Possible sources of ideas for what this percentage could be include other CO₂ trading programs like RGGI and EU ETS.

Because a federal climate policy—should there be one—may draw on California's cap-and-trade system as an example, the choice of auctioned versus historically-based allocation may affect the long-term national climate change mitigation strategy. The issue of how the state program might influence design at the federal level was not discussed directly at the workshop, but this issue was raised more generally. Even if California's approach includes freely allocated allowances early on, the state can encourage other state or federal cap-and-trade programs to use auctioning by defining a transition program—from allowances to auctioned allowances—from the outset. In this way a California cap-and-trade would serve as a template as well as a proving ground.³⁵

4.4 Summary/Conclusion

³⁵ One of the presenters felt that an important feature of California's program is that it provides the opportunity for a real world "experiment". It can provide useful information about climate policy design and implementation, in addition to any realized carbon-reducing benefits.

The third session at the workshop reinforced the idea that allocation is a contentious issue and is unlikely to have a black and white solution. In other words, although auctioning is generally thought to be preferable from an economic standpoint, there are a number of reasons why some allowances will likely need to be allocated for free, especially in the early stages of the program. Highlights of the discussion include:

- Auctioning allowances is desirable, but some free allocation may be necessary to ensure (a) stakeholder buy-in and (b) sufficiently stringent targets.
- There is little real world evidence regarding CO₂ auctions, but programs like RGGI and EU ETS can provide guidance on how to design an allocation system.
- A common concern is that auctioning allowances will cause firms to pass costs along to consumers; however, most economists believe this will occur regardless of allocation strategy.³⁶
- One of the benefits of auctioning allowances is the revenue it provides; however, any cap-and-trade system should recognize and address concerns over how this revenue will be used.
- No specific guidance was provided regarding the percentage of allowances to auction initially; this is an issue that will require further analysis. Options include modeling the program off existing carbon trading systems, such as EU ETS (which has a goal of 60 percent auctioned allowances eight years into active trading).
- Following the MAC report, the percentage of auctioned allowances should increase over a transition period. Participants indicated that this transition period

³⁶ Again, by freely allocating valuable assets, a firm that chooses to use allowances foregoes revenues from selling these allowances. Economic research suggests that these “opportunity costs” are also passed on to consumers (except where prices are regulated).

should be at least 4 or 5 years but not longer than 25 years.³⁷

³⁷ This range is based on expert opinion, but little evidence exists to support (or refute) the proposed timeframe. For reference, the EU ETS is planning to transition from 99 percent free allocation to 40 percent free allocation in approximately eight years.

5. Offsets

An important consideration is the degree to which offsets should be included as an alternative compliance mechanism. In the context of a cap-and-trade program, offsets are emission reductions that take place outside the regulated jurisdiction (outside the industries or geographic areas that are included in the emissions cap), but count towards the reduction obligations of the regulated entities. As a result, emissions within the cap are allowed to increase beyond the limits of the regulation as long as compensating reductions are completed outside the cap. Frequently discussed offset types include biological sequestration of carbon (for example through afforestation or ocean fertilization), geological sequestration of carbon (for example through storage of carbon dioxide in underground reservoirs), or destruction of methane and other greenhouse gases from landfills, coal beds, or industrial processes.

In theory, any project that results in a certified reduction in greenhouse gas emissions relative to a “business as usual” baseline can be considered for inclusion as an offset. In practice, the process of determining baselines and certifying credible reductions has proven to be complex and may ultimately limit the practical benefits of such offsets. Specifically, it is difficult to ensure that offsets are real, result in additional reductions relative to business as usual baselines, are permanent, and can be verified and monitored in a transparent fashion. Beyond these difficulties, the inclusion of offsets may hinder future attempts to expand the scope of regulation, either to new industries or new states or nations. This is because the market for offsets creates constituencies who benefit significantly financially due to their exclusion from regulation (Wara, 2007).

Estimates from the World Bank put the international offset market at nearly US\$ 5.5 billion in 2006³⁸ (World Bank 2007). This market is expected to grow significantly in coming years as the level of global regulation is expected to become more stringent. It is likely that these constituencies will resist losing their current status, making expansion of regulation difficult.

Despite these difficulties, offsets are seen as a way to lower compliance costs by allowing the regulated entities to achieve lower cost emission reductions that may be unrelated to their own operations. A number of recent studies have demonstrated the potential cost-savings of offsets in meeting compliance targets for regulated entities (see for example EIA 2007). Offsets are also a means of achieving emission reductions in sectors that are difficult to regulate (Arimuar et al, 2007). As will be elaborated below, offsets can also be a potentially valuable method of enabling broad-based participation in emission reductions and technological innovation in developing countries where regulations for emissions reduction may not yet exist. In theory, total global emission reductions should be the same whether or not offsets are used within a cap-and-trade program, though the overall costs and distribution of emissions will be different depending on the location of actual reductions.

In addressing the various dimensions and likely impacts of offset policies, it is important to remember that in a cap-and-trade system with offsets, there are two distinct markets to consider. One market relates to what is regulated under the cap. In the case of California, this would include the electric power industry, the transport industry, and other industrial segments included within the scope of the regulation. The second is the

³⁸ This is almost exclusively Clean Development Mechanism (CDM) and to a much lesser extent Joint Implementation (JI) projects.

offset market, which encompasses sectors and locations outside the cap. The final design and implementation of California's climate policies will ultimately determine the degree and distribution of emissions, technological innovation, and overall share of economic costs and benefits accrued to the various groups comprising these two markets.

5.1. Summary of MAC Recommendations and Unresolved Issues

5.1.1 Recommendations

The Market Advisory Committee's final report made the following summary recommendations regarding the inclusion of offsets in a California cap-and-trade program (MAC 2007, pgs. 62-65)

- Offsets should be included as part of the overall cap-and-trade program.
- Offsets should be real, additional, independently verifiable, permanent, enforceable, and transparent.³⁹
- California should use a standards-based approach rather than a case-by-case review of potential offset projects in order to assign offset credits. In doing so, California should identify specific types of eligible projects, and adopt a more conservative approach towards verifying the integrity of the emission reductions in order to maximize the environmental benefit of using offsets.
 - The MAC suggested that project types already identified under the Regional Greenhouse Gas Initiative (RGGI) could serve as a starting point for acceptable offset projects.⁴⁰

³⁹ The MAC Report acknowledges the difficulties involved with ensuring these characteristics are indeed met in an offsets program.

- Most MAC members were in favor of allowing offset credits certified under the Kyoto Protocol's Clean Development Mechanism (CDM) to be used to meet compliance in California.
- In terms of geographic or quantitative restrictions on the use of offsets, the Committee did not reach complete agreement.
 - The broad sense of the MAC was that such limits should be rejected in order to maximize the opportunity for least-cost emissions reductions.
 - However, some members expressed the view that in light of legitimate policy considerations—such as social equity, air quality, and price stability/predictability for participants—quantitative and/or geographic limits on offset usage are warranted. Such limitations should be introduced in the initial stages of the cap-and-trade program, and gradually relaxed or phased out once these policy concerns were addressed adequately.
 - Furthermore, the MAC recommended that California should only accept offsets from other jurisdictions where a similar stringent standard is used to certify the environmental integrity of the offsets. In practice, this may require a formal Memorandum of Understanding with the contracting offset originator.

⁴⁰ Approved projects initially include only projects in the United States covering the following categories: methane capture from landfills or from leaking natural gas infrastructure, the implementation of end-use natural gas or heating oil energy efficiency, afforestation, and the capture of sulfur hexafluoride (SF₆) emissions from electricity transmission and distribution equipment. Other eligible offset types may be added in the future. If allowance prices rise above \$10 per ton, international offsets from the European Union ETS as well as the Kyoto market's Clean Development Mechanism will be included as well (Pew Center, 2008).

- To limit the risks associated with long term projects, the MAC recommended excluding the distribution of offset credits for expected future reductions, only certifying credits for emissions reductions once the reductions have been realized.

5.1.2 Unresolved Questions in MAC Report

While the MAC report provided a thoughtful assessment of the important design and implementation dimensions of an offsets program, a number of unresolved questions remain. It should be noted that the MAC intentionally allowed for non-consensus recommendations to be included in the final report -- to allow for a more open and transparent discussion of the issues. As a result, specific recommendations for a few design dimensions (for example, those involving geographic and quantity limitations, and the inclusion of CDM and Joint Implementation credits) were not finalized. Additional practical implementation questions were also left unresolved. Although acknowledging the need for appropriate quantification protocols to ensure offsets are “real” and not merely due to incomplete accounting, the specifics of developing and implementing these protocols was not finalized. Broader concerns involving the role of offsets in inducing or hindering technological innovation both within and outside “the cap” were not mentioned, but left unresolved. Finally, concerns about the potential for strategic manipulation of offset origination, or the long-term implications of creating regulated and unregulated constituencies were similarly unaddressed or unresolved.

5.2. Issues Addressed at Stanford Workshop

Workshop participants addressed a wide range of considerations for including offsets in a California cap-and-trade program. Discussion centered around two broad types of issues:

- Practical issues related to the effective implementation of offset projects to ensure environmental integrity.
 - Discussion topics included challenges of credit certification and monitoring to ensure additionality, and limits on strategic behavior in establishing baselines.
- Structural issues concerning offset markets unrelated to environmental integrity concerns.
 - Discussion topics included the implications of allowing offsets in California on other greenhouse gas markets, the impact of offsets on incentives for technological innovation, and the impact of offsets on the likelihood of broader regulations in the future.
 - These structural concerns exist independently of the implementation realities, and must be addressed even under a perfect system where there were no questions about environmental integrity (for example, where offsets are 100% real and additional, with perfect monitoring and enforcement).

Although a consensus was not reached among conference participants regarding concrete and definitive solutions to these issues, the general feeling among most participants was that while these issues are important and challenging, they are outweighed by the positive benefits associated with including offsets in California's program, and are likely to be resolved satisfactorily by interested parties.

5.2.1. Environmental Integrity Issues

There was a general consensus among participants that an offsets program will reduce the overall compliance costs of a cap-and-trade program. Data presented at the workshop analyzing the impact of offsets on a federal cap-and-trade system (EIA 2007) projected that 30% of the total emission reductions to be achieved between 2012-2030 would be met by domestic offsets. If international offsets are permitted, total offsets would account for 61% of the reductions, with international offsets making up over three-quarters of the offsets used. Allowing international offsets greatly reduces the allowance price to \$25⁴¹ in 2030, compared with a domestic allowance price of \$58 if international credits are not allowed.

5.2.1.1. Certification, Additionality, and Offset Quality

In light of these cost savings, it was acknowledged that due to the difficulties in ensuring the validity of some offsets, there is an inherent tradeoff between achieving least-cost compliance of the emissions cap, and ensuring that all offsets indeed result in additional emissions cuts beyond the baseline that would have existed absent the offsets. On this topic, there was a great deal of discussion. Representatives from the offsets industry acknowledged that over the past year the focus on ensuring offset quality/validity has intensified among their customers who buy such offsets. Specifically, the point was made that purchasers of offsets are increasingly demanding higher quality offsets, and as a result, this demand is imposing significant discipline on the domestic offsets market in the United States. The view is that domestic markets are becoming more robust and

⁴¹ Prices are measured in \$2005 (EIA 2007)

stringent in order to counteract perceptions of dubious offsets arising from the Kyoto Clean Development Mechanism market in developing countries.

A number of ideas were offered to address the additionality concerns. There was some discussion as to the desirability of stringent standards for offset projects. In particular, the MAC Report recommended that offset projects be limited (at least initially) to a set of established project types, such as those already approved for the RGGI program. Some participants acknowledged the appeal of such conservative standards in promoting a high level of confidence in the environmental integrity of the resulting offsets. Limiting the potential offset project types may also increase the regulatory certainty involved with the certification process of offsets, which should further reduce the administrative and transaction costs associated with project origination.

Conversely, other participants emphasized that very strict limits on offset project types may be counter-productive, in that such limits may stifle innovation in the offset market and limit the proliferation of low-cost offsets. Citing recent recommendations from The Business Council for Sustainable Energy, industry participants suggested a hybrid approach that combines a standards-based certification approach with a case-by-case review process without pre-approved methodologies. Such a review process may promote technological innovation and result in emission reductions within new sectors and activities. Such an expansion would ultimately result in the development of new standards for project case sectors and activities (BCSE 2007). Although the inclusion of a case-by-case review process would add to the administrative cost of the program, some participants felt that this on net would result in better long term outcomes for the cap-and-trade program.

Overall, participants noted the important impact that the certification process will have on investor confidence in the offset market. Specifically, if offset project investors and developers perceive a high level risk or uncertainty associated with the certification process, this will decrease the number of new projects that are proposed because this uncertainty raises the cost of development, which results in costlier offset development. There was a general agreement by conference participants that regardless of the actual certification methodology to be used, it is important to ensure the process is transparent. Transparency will lessen the uncertainty for project developers, and increase confidence for offset purchasers that the emission reductions they purchase are credible.

5.2.1.2. Strategic Behavior and Additionality

Workshop participants also highlighted the potential for strategic behavior by offset market participants that may result in perverse economic and regulatory incentives. Specifically, there was some discussion regarding the impact that offsets under the Clean Development Mechanism may have on regulatory baselines in the developing world. For example, concerns were raised that the presence of profitable offset development may induce regulators in developing countries to forgo imposing stringent environmental regulations, or even roll back existing regulations, in order to create an artificially low regulatory baseline. By limiting domestic environmental regulation in this way, a higher baseline is established for what “business as usual” emissions would have been in the developing country. This creates a potentially profitable opportunity to remedy the environmental damages by selling the credits that are generated by the remediation. In this way, the incentive to generate credits from remediation projects creates a perverse incentive to limit the stringency of domestic environmental regulation.

Wara (2006) highlights these perverse incentives, noting that a regulator in the developing world faced with the choice of either 1) imposing costly domestic regulation in order to prevent emissions, or 2) allowing the domestic polluter to be paid a subsidy by a foreign entity to reduce the pollution, would have a political incentive to select the second choice. Demonstrating other forms of strategic behavior used to maximize profits at the expense of environmental outcomes, Wara shows how the offsets market appears to have induced some producers of a particular polluting gas (HFC-23) to greatly increase their production levels in order to establish an artificially high baseline for their emissions. By establishing high baselines, the scope of subsidized reductions increases. Note that absent the revenue stream generated by the sale of offsets, there does not appear to be an incentive for these firms to increase their production—and therefore their pollution—to the levels observed. Economists at the workshop noted that in the absence of additionality, the theoretical result is that offset policies act as targeted subsidies. This point has been confirmed by empirical evidence in some developing countries (Wara 2006, 2007). Researchers at the workshop suggested that some strategic behavior can be minimized if the incentives of the capped jurisdiction (e.g. the signatories to the Kyoto Protocol) are well aligned with those of the regulators in the offsets market, though in practice this can be very difficult when those jurisdictions do not overlap.

5.2.1.3. Additionality and Regulatory Waste

The actual fraction of “waste” associated with such strategic behavior and non-additionality is hard to quantify. Some conference participants noted the analogy between such environmental regulations and broader tax and subsidy policy. With tax and subsidy policy, one concern is that additional incentives do not necessarily have a

large effect on the margin, but rather provide windfall benefits to those who would have engaged in the activity even without the incentives (the infra-marginal participants). As a result, some of the costly incentives are “wasted,” in that they do not result in additional investment. Examples cited include tax incentives for research and development, as well as tax credits for the purchase of capital equipment. The concern for tax and subsidy policy is that additional incentives do not necessarily have a large effect on the margin, but rather provide windfall benefits to those who would have engaged in the activity even without the incentives (the infra-marginal participants). As a result, some of the costly incentives are “wasted.” But despite these well-understood inefficiencies in the public finance domain, the overall feeling is that some of this waste is acceptable as a second best solution as long as there is enough of an impact on the desired activity. Relating this analogy to emission reductions, some participants argued that a degree of non-additionality should be tolerated if the positive net result of lower-cost compliance is achieved. The difficult question of how much additionality is “enough” is in practice very difficult to determine.

Realizing the tremendous challenge of assuring additionality, there was some discussion around the notion that at least on one level, there is some positive change that results in having some absolute reductions take place via offset financing in developing countries, irrespective of the baseline. Because countries such as China and India currently are unwilling to take on binding targets and timetables, it was argued that in a sense, programs such as the Clean Development Mechanism serve as acceptable ways to channel funding and technology towards emission reductions in these countries. Thus despite its shortcomings, the Clean Development Mechanism may be preferable to the

alternative policy instruments such as foreign aid or direct government-to-government funding of environmental projects.

Finally, participants noted that although raising project standards is an important way to ensure environmental integrity, there is a danger of a “chilling effect” that could result if the standards are deemed too excessive or unrealistic from the standpoint of offset developers. Policies should be designed in a way to shift the balance towards higher levels of additionality in order to achieve the greatest amount of real reductions, taking into account practical concerns and limitations related to administrative and other implementation costs.

5.2.2 Structural and Market Issues

Beyond the concerns for additionality and environmental integrity, there was significant discussion at the Stanford Workshop regarding broader impact of offsets policies on technological innovation, as well as the longer term impacts that current offset policies may have on the likelihood of adding currently unregulated countries and sectors to a broader climate change regulatory framework in the future.

5.2.2.1. Participation of Developing Countries and Unregulated Sectors

There was broad agreement among workshop attendees that the participation of developing countries—especially India and China—is critical in achieving the necessary reductions in global emissions. And while developing countries are not obligated to make emissions cuts under the Kyoto protocol, the mechanisms in place under the Clean Development Mechanism and Joint Implementation create significant incentives and

opportunities for such participation. The creation of offsets in developing countries has traditionally been seen as a positive means by which to involve these countries and to carry out emission reductions there. More broadly, because offsets by definition take place outside the regulated cap, they can be an effective way to provide regulators with information on the reduction opportunities and costs associated with activities in unregulated sectors. Such information can perhaps be used to develop effective and low-cost future regulations for these currently unregulated sectors.

Conference participants also discussed some ways in which the participation by developing countries in the current system of offsets is problematic. In particular, the inclusion of offsets creates valuable financial assets for those who can generate them. Once strong constituencies form who benefit from these large asset valuations, it becomes harder to build the political will to bring these previously unregulated constituencies under a binding cap through later regulations. This concern applies both to offsets in unregulated developing countries as well as to offsets created in unregulated sectors in developed countries with cap-and-trade legislation in place.⁴² This can be especially problematic in light of existing additionality concerns in parts of the offset market in the developing world. As the regulatory regime expands in the future—both to new sectors and to new geographies in the developing world—these constituencies are likely to resist pressures to be included in the cap. Therefore it is important to create clear expectations from the beginning regarding the longer term evolution of the cap-and-

⁴² It was noted by one researcher at the workshop that we should look beyond offsets created via the Clean Development Mechanism and consider policies aimed at the offset markets in developed countries. The practical reality is that the constituencies in the developing world are unlikely to agree to significant binding reductions in their emissions for some time, irrespective of the additional incentives created by offset asset values.

trade program, and the need to increase the scope of the cap both to new geographies and new sectors.

5.2.2.2. Incentives for Technological Change

The final broader discussion topic at the workshop involves offsets and technological innovation. While there was agreement that technological improvement is needed to promote a low-carbon economy worldwide, it is less clear if the inclusion of offsets is likely to speed such development, or if instead offsets will hinder more fundamental technological change by providing lower-cost alternative compliance. As noted earlier, it is important to remember that there are two distinct markets to consider. In the context of California's cap-and-trade program, we must consider the impact offsets are likely to have on technological innovation both within the regulated cap, and also outside the cap in the offset marketplace. In practice, it is important to encourage technological innovation in both markets. A potential concern is that by providing an alternative compliance mechanism, regulated entities within the cap may find it more practical to purchase offsets rather than invest in fundamental technological improvements that could dramatically reduce their own emissions. While this decision ultimately depends on the relative compliance costs (purchasing offsets versus costly primary reductions in own emissions), California may have a desire to encourage direct reductions.⁴³ In particular, if there are positive externalities associated with technological innovation, then a market failure exists in the "innovation market" and private actors will under-invest relative to what would be ideal from a societal point of view. As a result, it is

⁴³ This appears to be the case under the Regional Greenhouse Gas Initiative (RGGI), where the total quantity of offsets allowed is limited to ensure that the majority of reductions take place within the regulated electric utility sector (Pew 2008).

desirable to encourage efforts to achieve primary reductions due to the likely innovation that may result from undertaking such reductions.

Workshop participants noted that to date, much of the experience with offsets has been in international markets. This is beginning to change as voluntary markets continue to grow in the United States. But in the offset markets in developing countries there has not been significant innovation. While there indeed has been technological deployment to areas where such technologies may not have existed, the degree of actual technological innovation has been limited. It was suggested that current projects may be addressing the “low hanging fruit,” and perhaps once the volume of offset generation projects expands to meet future demand beyond the existing compliance markets, there may be more innovation in these markets.

Regarding the possibility that offsets will limit innovation in regulated sectors under the cap, a representative from the energy industry present at the workshop expressed the view that although the availability of offsets may limit innovation within the cap, the positive benefits of encouraging innovation beyond the cap are significant. This is especially important if the groups involved outside the cap are parties who will play significant roles in global emission reductions, such as China. In addition, some private sector entities have already made large commitments to reduce their emissions over the next half-decade, and are therefore thinking much beyond the 2025 timeframes to the year 2050. The pressures to achieve these large reductions will create significant incentives for innovation. However, as was discussed in the Market Advisory Report, if California wants to capture any co-benefits associated with technology development and

innovation, policies must be in place to encourage local innovation within the capped sectors.

5.2.3. Remaining Questions

The discussion at the workshop certainly moved forward the important debate on the inclusion of offsets in California's proposed cap-and-trade program, though a number of outstanding issues remain that must be resolved for successful implementation.

In terms of environmental effectiveness of an offsets system, several issues dominated the discussion. Although the inclusion of offsets should result in significantly lower compliance costs, the difficulty of ensuring offset validity creates an inherent tradeoff between achieving least-cost compliance and ensuring additionality. While a standards-based approach for certifying projects is most likely to achieve these objectives, some industry participants favored some inclusion of case-by-case review in order to increase innovation and scope of offset project types. There are tangible concerns that strategic behavior on the part of offset project developers and local environmental regulators will create significant inefficiencies in the offset markets and further hinder additionality goals. In designing program rules for offsets, California must seek to minimize these perverse incentives in order to maximize additionality of reductions.

In terms of structural issues in designing an offsets system, several points dominated the discussion. The use of offsets is generally seen as a positive channel for increasing the participation of developing countries in attaining reductions in global emissions. However, it must be recognized that the offset market creates valuable

financial assets, with corresponding constituencies who are likely to resist being brought under the cap in future regulations. In designing current offset provisions, California needs to clarify expectations for future expansion of regulatory scope to new sectors in order to send appropriate signals to market participants. The likely impact of offsets on technological innovation is mixed. By providing lower-cost compliance options, offsets may limit technological innovation in regulated sectors, though they are likely to speed innovation in the offset markets.

How much flexibility beyond established standards should be incorporated in the methodology for approving future offset projects? More conservative standards for project approval provide greater confidence that real emission reductions are occurring, though ultimately this may limit the availability of offset projects and/or innovation in project types. How much uncertainty is acceptable when determining emissions baselines and additionality? The push for higher certainty increases environmental integrity outcomes, but increases monitoring and enforcement costs. Ultimately, the optimal tradeoff may vary by project. How will California's offsets policy choices affect other markets, and (how) should these effects be considered by California policy-makers? Specifically, how will decisions in California influence other states or federal policy-makers contemplating similar cap-and-trade programs? In addition, how will the supply of and demand for offsets in California affect prices in international offset markets?

5.3 Summary

The inclusion of offsets as an alternative compliance mechanism in California's proposed cap-and-trade system is likely to result in a mix of positive and negative, direct and indirect effects. On balance, offsets should improve the implementation of the program by adding flexibility, reducing costs, and increasing participation in emission reductions by developing countries. The shortcomings associated with an offsets policy can be minimized by recognizing and addressing a number of key design issues of the policy.

Linkages between sectors covered under the cap and those outside the cap are important and must be well understood by California regulators. Offsets can be a useful method for addressing what is outside the cap, but policies must be in place to ensure that offset reductions are real and do not undermine original policy goals of genuine emission reductions. Long term expectations for reductions by regulated and unregulated constituencies must be clear under any policy. In particular, attention must be paid to the economic and political consequences of current offset policies. California regulators need to clarify expectations for future expansion of regulatory scope to new sectors in order to send clear and early signals to market participants.

A standards-based approach for certification of offset projects is important for reducing program costs, but some flexibility is desirable to allow for innovation in project type and scope.

Offsets can create perverse economic and regulatory incentives that may undermine the environmental goals of the cap-and-trade program. For local/domestic offsets, such perversions can be minimized by aligning the policy goals of California's Air Resources Board with other local/domestic environmental regulators.

By providing lower-cost compliance options, offsets may limit technological innovation in regulated sectors, though they are likely to speed innovation in the offset markets. If ensuring substantial direct reductions in the regulated sectors is a priority for California regulators, direct technology policies may be needed to stimulate innovation within the capped sectors.

6. Summary and Conclusions

With the passage of the AB32 in 2006, California catapulted forward to become an international leader in taking steps to reduce its emissions of greenhouse gases leading to global warming and climate change. Because of the importance of managing the economic impacts on the state from the legislation, the Governor directed Cal EPA to establish a Market Advisory Committee to advise on developing a greenhouse gas reduction plan for the state.

On June 30, 2007, the Market Advisory Committee (MAC) tendered its final report, focusing on the design of a “cap-and-trade” system for reducing greenhouse gas emissions. The report is extensive and practical, offering recommendations on how to move from theory to practical implementation in setting up a cap-and-trade system to implement the goals of the Act. Some of the key recommendations of the report are: (1) the program should be broad, including all major greenhouse-gas emitting sectors; (2) electricity, as a very significant sector, should be regulated at the point of generation (if generated within the state) or at the point the electricity is imported into the state; (3) some allowances should be auctioned and some distributed at no cost; the fraction

auctioned should increase over time; (4) offsets of emissions by entities outside of the California market should be allowed but stringent criteria should be imposed to ensure legitimacy of the offsets; and (5) California should encourage linkages between a California market and other mandatory cap-and trade systems (such as in the Northeast and in Europe).

Despite the practical nature of the MAC recommendations, not all issues or questions were resolved completely regarding using markets to reduce greenhouse gas emissions. In an order to resolve some of the unanswered market questions, a one-day workshop was convened in Stanford, California on January 15, 2008, involved leading academics, stakeholders and industry representatives – representatives of the key constituencies relevant to establishing market based solutions for regulating greenhouse gas emissions in California.

The Stanford workshop was structured along four major themes: (1) market linkages: cap and trade beyond California; (2) upstream versus downstream regulation: efficiency, environmental effectiveness, and fairness; (3) allowances: auctioning versus free allocation; and (4) offsets.

No consensus emerged from the workshop; indeed on nearly all issues there was a diversity of opinion. Nevertheless, a number of themes, findings and unresolved questions emerged from the discussion:

- **Risk:** There is a risk that the AB32 model will be perceived as a “failure,” possibly tainting the reputation of climate policies and market-based mechanisms in general.

- **Portability:** In designing the implementing regulations for AB32, it is important to keep in mind the portability of the proposed regulatory model to other jurisdictions.
- **Integration:** How will the California program integrate with any future Federal market?
- **Technology Diffusion:** ARB should consider different methods to directly address the development and diffusion of technologies for GHG reductions.
- **Forward Price Stability:** A stable, predictable price for allowances is important.
- **Leakage:** Leakage, particularly for electricity, is a real problem. Other policies to encourage out-of-state emission reductions should be encouraged.
- **Upstream vs. Downstream:** Whether an upstream regulation induces sufficient behavioral changes and/or downstream investment is an empirical question.
- **Auctioning allowances:** Auctioning allowances is desirable, but some free allocation may be necessary to ensure (a) stakeholder buy-in and (b) sufficiently stringent targets.
- **Auction Design:** There is little real world evidence regarding CO₂ auctions, but programs like RGGI and EU ETS can provide guidance on how to design an allocation system.
- **Auction Revenue:** One of the benefits of auctioning allowances is the revenue it provides; however, any cap-and-trade system should recognize and address concerns over how this revenue will be used.

- **Transition to auctioned allowances:** The percentage of auctioned allowances should increase over a transition period.
- **Offsets:** Offsets should improve the implementation of the program by adding flexibility, reducing costs, and increasing participation in emission reductions by developing countries.
- **Are offsets real?** Policies must be in place to ensure that offset reductions are real and do not undermine original policy goals of genuine emission reductions.
- **Standards-based Offsets:** A standards-based approach for certification of offset projects is important for reducing program costs.
- **Offsets with Cap and Trade:** Offsets can create perverse economic and regulatory incentives that may undermine the environmental goals of the cap-and-trade program.
- **Innovation:** If ensuring substantial direct reductions in the regulated sectors is a priority for California regulators, direct technology policies may be needed to stimulate innovation within the capped sector

The workshop brought together a diverse set of specialists concerned with the emerging regulatory structure for greenhouse gas regulations in California. Building on the important and valuable report of the Market Advisory Committee, the workshop discussion advanced important knowledge on regulating greenhouse gases, knowledge that will be critical in achieving the goals of AB32 and ensuring the success of California's path breaking venture into regulating greenhouse gas emissions.

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Appendix A: Workshop Agenda

Stanford University/University of Southern California/
Bipartisan Center for Research and Policy (BCRP)

*“Implementing Cap and Trade:
Designing a Potential Market for Greenhouse Gases in California”*

*January 15, 2008
9AM-4PM*

8:30 Breakfast and Sign-in

9:00 Welcome and Introductions (Joe Nation)

9:20 – 10:35 Session 1: Market Linkages: Cap and Trade Beyond California
Discussion Leader: Catherine Wolfram, University of California, Berkeley
Respondent: Nancy Ryan, CPUC

Discussion Focus

- **How to link California's market design to an emerging federal system**
- **California's design and possible federal pre-emption**
- **Leakage, contract-shuffling, and the choice among potential California climate policies.**

10:35 – 10:45 Break

10:45 – 12:00 Session 2: Upstream Versus Downstream Regulation: Efficiency, Environmental Effectiveness, and Fairness

Discussion Leader: Frank Wolak, Stanford University
Respondent: Michael Hanemann, University of California, Berkeley

Discussion Focus

- **Point of regulation and its implications for program coverage, incentives for emission abatement, and the distribution of the economic burden**
- **Monitoring and enforcement costs**
- **Regulatory experience and reliability.**

12:00 – 12:50 Lunch will be Served

**Comments by Secretary Linda Adams,
California Environmental Protection Agency**

12:50 – 2:05 Session 3: Auctioning versus Free Allocation of Allowances

Discussion Leader: John Ledyard, Caltech

Respondent: Bob Hahn, AEI-Brookings Joint Center

Discussion Focus

- **Auction mechanics, including the transition from free allocation to 100% auction**
- **Legal and institutional challenges to auctioning**
- **Potential effects of auctioning on specific industries/sectors.**

2:05 – 2:15 Break (cookies & drinks!)

2:15 – 3:30 Session 4: Offsets: Their Role and Appropriateness

Discussion Leader: Robert Stavins, Harvard University

Respondent: Michael Wara, Stanford University

Discussion Focus

- **Ensuring offset quality**
- **Offset standards**
- **The additionality challenge; alternatives to additionality.**

3:30 – 4:00 Summary and Wrap-Up

Thank you for participating please travel safely!

Appendix B: Confirmed Workshop Participants

Joe Nation
Bipartisan Center for Research & Policy

Larry Goulder
Stanford Institute for Economic Policy Research

Charles Kolstad
University of California, Santa Barbara

Roger Noll
Stanford Institute for Economic Policy Research

Linda Adams
California Environmental Protection Agency

Nancy Ryan
California Public Utilities Commission

Catherine Wolfram
University of California, Berkeley

Frank Wolak
Stanford University

Michael Wara
Stanford University

Rob Stavins
Harvard University

John Ledyard
California Institute of Technology

Michael Hanemann
University of California, Berkeley

Robert Hahn
AEI-Brookings Joint Center

Adam Rose
Energy Institute, USC

Shaun McRae
Stanford University

Corbett Grainger
University of California, Santa Barbara

Nick Burger
University of California, Santa Barbara

Oren Ahoobim
Stanford University

Wes Miller
Evolution Markets

John Braeutigam
Valero Energy Corporation/WSPA

Kurt Schuparra
California Strategies & Advocacy

Aimee Barnes
EcoSecurities

Dan Whaley
Climos

Kevin Whilden
Climos

Ralph Moran
BP America, Inc.

Josh Bushinsky
California Air Resources Board

Niki Calastas
Stanford University

Judi Joseph
Bipartisan Center for Research & Policy

Marcus Schneider
Energy Foundation

Catherine Reheis-Boyd
Western States Petroleum Association

Rafael Aguilera
Verde Group

K.C. Bishop
Chevron Corporation

Jim Sweeney
Stanford University

Mike Reynolds
The CarbonNeutral Company