Memorandum

To: Economic and Allocation Advisory Committee
From: Andy Van Horn
Date: November 12, 2009
Re: Bringing California and China Together Using “Best-in-Class” Output-based Emission Rates for GHG Allowance Allocation

In October 2008, the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) recommended fuel-differentiated allowance allocations during a transition to full auctioning of greenhouse gas (GHG) allowances.¹ For over three decades the U.S. has applied fuel and technology-differentiated emission performance standards, such as EPA’s New Source Performance Standards. In addition, the Japanese have successfully applied a Top Runner program to energy efficiency. More recently greenhouse gas (GHG) offset project approvals have moved toward the use of performance standards in protocols.

Hence, the adoption of Best-in-Class (BIC) emission rates for GHG allowance allocation would not only indicate the capabilities of today’s best performers and reward firms with lower emission rates within each class, but it would also provide a benchmark for future improvements and send a signal to other countries regarding fuel and technology emission targets for specific industrial processes, like power generation.² Because classes would be fuel-differentiated, coal-fired facilities or Local Distribution Companies (LDCs) purchasing electricity from coal plants would receive BIC allocations that will ease the transition to auctioning and during the initial years of a cap-and-trade program will avoid undue penalization for their prior choices.

If California wants to demonstrate leadership, setting up our initial GHG allowance allocations and industry sector targets based on BIC emission rates could assist international negotiators and, perhaps, the U.S. Congress in its deliberations. As the Copenhagen COP approaches, China is more willing to discuss performance standards and benchmarking of industrial processes than overall caps. Intensity-based emission targets, previously measured in terms of GDP, could be negotiated in terms of GHG emitted per unit of output. However, actual examples of the implementation of output-based standards for GHG would present a much stronger case, as well as providing equitable incentives in our own cap-and-trade market for GHG.³

¹ CEC-100-2008-007, “Final Opinion and Recommendations on Greenhouse Regulatory Strategies, October 2008.” p 198. However, annual updating under the CEC and CPUC’s fuel-differentiated approach would introduce allocation uncertainties into the market that would be detrimental to allowance trading. Because free allocations would decline during a transition period as auctioning increases, updating is an unwarranted complication with the perverse incentive that it subsidizes higher levels of GHG production.
² Plants emitting at BIC rates are more efficient and are also likely to have lower emission rates for co-pollutants.
³ Potential effects of the BIC method on the percentages of CO₂ allowances allocated or auctioned to natural gas and coal-fired electric generators in the west and in the contiguous U.S. are illustrated in the Appendix.
In the U.S., BIC emission rates can provide a straightforward means for equitable allowance allocations and/or revenue distributions. BIC emission rates for fuel and/or technology-differentiated classes can be calculated by ranking GHG emitters from lowest to highest amounts of CO₂ emitted per unit of output (e.g., lbs. CO₂/MWh) and then determining the historical BIC emission rate that would be used for allocating allowances. The percentage of total annual class output, P, which would be used to set the historical BIC rate for allocations in the first year of the program, would be the same for all facilities that produce the same product; e.g., P would be the same for both coal and natural gas-fired power plants. Because the BIC rate is output-based, BIC allocations would reward more efficient sources in each class. For example, the lowest CO₂ emitting coal-fired sources would not be penalized during first-year of the transition period, easing the transition within each class as total allowances ramp down.

If allowance allocations were to be made directly to LDCs, rather than to emitters, each LDC’s historical MWh mix would be multiplied by the selected regional or national BIC rate for each fuel-differentiated class contributing to its sales. For revenue distributions to LDCs or for dividends to ultimate customers under “cap-and-dividend,” the allocated dollars could be calculated using the market value of allowances.

Each year, the BIC rate for allocations would decline to match the decline in the overall GHG cap or the decline in the specific sector’s cap or to match the anticipated improvement in the emission rate for that class, or decline at a pace to phase-out allocations by a particular year – whichever decline rate is determined in advance to be constraining. As can be seen in the Appendix, the percentage of unallocated allowances available for auction or for set asides depends on the choice of the single parameter, P. P is the percentage of total class output produced by the lowest emitters. Their average emissions rate in each class constitutes the best-in-class emission rate for that class.

From a global perspective, adopting BIC emission rates as a starting point for allowance allocations or for revenue distribution would provide benchmarks for negotiations in addition to providing incentives to reduce emissions below the BIC rate. The U.S. electric utility industry is well-suited for adopting this method, since historical BIC rates are easily derived for individual sources and for LDCs.

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4 Alternatively, a BIC rate could be mandated based on factors other than measured, historical emissions.
5 One basic purpose of allocating allowances for free and having a transition period to full auctioning is to avoid penalizing companies for investment and procurement decisions made prior to GHG regulation. Another, largely unrecognized reason is to build a bank of allowances early in the program to avoid non-compliance and reduce price volatility.
6 Such an allocation or distribution calculation would be more transparent and significantly simplified from the case where emissions from each historical MWh delivered to customers must be tracked, in order to allocate allowances or revenues to LDCs.
7 A similar approach could be applied to petroleum refineries, cement manufacturing and industrial facilities that produce comparable products within each designated class of facilities.
In addition to affecting efficiency and equity, allowance allocations need to be simple, understandable and minimize uncertainty. Greater certainty can be provided to the energy and allowance trading markets by specifying allocations during the entire transition period, in order to develop an active trading market for all vintages of allowances.

There are many inter-related, moving parts to energy and emissions markets that will be highly influenced by the choice of allocation and auction methods. A successful market will need to:

- finance long-lived, low-emitting, capital intensive infrastructure with contracts of 10 or more years’ duration,
- keep transaction costs at an acceptable level,
- create market liquidity by enabling forward transactions for allowances of all vintages,
- maintain price stability,
- accommodate large differences in the abilities of affected parties to simultaneously invest to reduce emissions, participate in auctions and reduce compliance costs by trading allowances,
- enable companies to profit from reducing their emissions,
- align industry-specific allocations with technological capabilities and progress,
- provide benchmarks for domestic and international negotiations,
- implement a market framework compatible with global cap-and-trade schemes, and
- avoid unintended consequences.

While it is necessary to understand the equity and efficiency trade-offs, it is also critical to understand how markets actually function. The EAAC should try to understand the effects of potential market rules and allowance allocations on the transaction costs and decisions of firms, including brokers and traders, that participate in interlinked energy, industrial and emissions markets.

In the end, California’s considerable efforts to implement AB 32 will only be meaningful, if our efforts contribute to the creation of nationwide and international cap-and-trade markets, rather than creating California-centric or WCI-only markets, which will not function at all, if they are encumbered with too many ancillary goals and unwarranted complexities.
APPENDIX

A Simple, Best-in-Class GHG Allowance Allocation Method

The first-year allocations for each generating plant would be based on historical, best-in-class emission rates measured in lbs.CO$_2$/MWh. The allocations would be reduced pro-rata each year during a transition period to satisfy the declining national carbon cap and to phase-in increased auctioning of allowances. The BIC method:

- is straightforward and easily understood,
- utilizes available data,
- could be based on only two, fuel-differentiated classes, coal and natural gas, or, if preferred, on more diverse classes based on fuel, combustion and control technologies analogous to those used successfully for EPA’s New Source Performance Standards (NSPS),
- requires the specification of only one parameter, $P$, that would be applied to all similar products in an industrial sector, such as MWh produced from fuel-differentiated classes of fossil-fired power plants,
- calculates annual allocations to each source or LDC that would be known in advance,
- is equitable for both coal and natural gas fossil fuels,
- rewards low emitters in each class,
- could apply declining annual BIC rates to allocate allowances to future market entrants during the transition period,
- will encourage emission reductions, and
- aid existing emission sources in making the transition to full auctioning.

Each year, allowance allocations will decline and allowance auctioning will increase pro-rata, subject to satisfying the overall cap. Allowance allocations to existing sources would be known for each year, greatly reducing market uncertainty and eliminating perverse incentives to increase allocations that would be created by annual updating proposals, which would update each year’s allocations based on each source’s prior year’s output.

As an example of the BIC approach, electric sector emission sources could be ranked in an historical year or across several base years from lowest to highest CO$_2$ emission rates in each of two classes: coal-fired and natural gas-fired generating units. Cumulative tons of CO$_2$ emitted would be calculated in each class until the cumulative output generation from the lowest emission rate sources exceeds $P$ percent of the total generation in MWh from all sources in the class. For example, if $P = 100$, the BIC rate equals the average emissions rate in (lbs.CO$_2$/MWh) for all coal or, separately, for all natural gas generators. If $P = 20$, which would be a more appropriate percentage to define a best-in-class rate for existing sources, the BIC rates would be the average rates for the lowest emission rate sources that cumulatively produced 20 percent of the total coal generation and 20 percent of the total natural gas generation in the base-year, respectively.

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8 The output-based BIC method described here for the electric generation industry might also be applied to emissions associated with products in other industrial sectors.

9 The single parameter, $P$, is the percentage of total class output included in calculating the first-year best-in-class CO$_2$ emission rates. A single value of $P$ is applied to all classes of emission sources making the same product.

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Each source’s first-year GHG allowance allocation is calculated by multiplying its class BIC rate by each source’s base year output in MWh or by its average output during several historical base years. In subsequent years of the cap-and-trade program, the BIC rates would decline pro-rata, as the overall GHG cap is ramped down and as the percentage of auctioned allowances increases. The allocations would be specified in advance throughout the transition period.¹⁰ Allowances that are not allocated would be made available for auction, set-aside for new entrants or reserved for other uses.¹¹ At the end of the transition period, free allocations would cease or remain at agreed-upon levels.

The application of this best-in-class method requires agreement upon only one parameter, the percentage, \( P \), which would be applied across the different fossil-fired classes of electric generators.¹² The only other requirement needed to determine a source’s first-year allocation is to select the base-year(s) for historical data regarding each source’s CO₂ emissions and output. Once the overall GHG caps are specified and the year to reach full-auctioning is known, allocations for intervening years can be calculated. Different choices for \( P \) can be straightforwardly modeled and analyzed to evaluate the effects of alternative values.

**First-year Best-in-Class (BIC) CO₂ Emission Rates for Electric Generators in the WECC Region and in the Contiguous U.S.**

Calculated first-year BIC emissions rates for fossil-fired electric generators in the Western Electric Coordinating Council (WECC) region and for the contiguous U.S. are shown in the following two tables, using 2004 as the base-year. Five potential BIC rates are shown, along with the resulting percentages of allowances that would be available for auctioning or set-aside for other purposes. The average emission rate for each fuel class is determined from the case where \( P = 100 \). In this case only, all the allowances would be allocated; none would be retained for auctioning. However, if \( P = 20 \) for fossil generators across the U.S., 75 percent of the allowances would be allocated, leaving 25 percent to be auctioned in the first year with increasing amounts auctioned in subsequent years, depending on the period selected for phasing out allocations.

Results based on 2004 data are as follows:

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¹⁰ Using a fixed base-year output and a specified, declining BIC rate would enable advance allocations to be made for the entire transition period. Debates about the BIC allocations would focus on the time period for determining the base year output, e.g., MWh or other product output, and on the percentage of total class output, \( P \), to be included in calculating the BIC rates.

¹¹ New entrants could either purchase allowances in auctions or in the secondary market, or new entrants could be retroactively awarded a free allocation from a pool of reserved, set-aside allowances. This award would be made during the true-up period at the end of the year in which the new entrant first operated. Free allocation to new entrants would be based on the entrant’s actual output during its first 12 months of in-service operation multiplied by the applicable, declining BIC rate for its class in that year. The potential free allocation would provide an incentive for new entrants to meet or beat the BIC rate and would place them on a level playing field with existing facilities during the transition period.

¹² \( P \) could be different in other industries and for differing products within an industry sector.

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Table 1. Best-in-Class (BIC) CO₂ Emission Rates for Allocating Allowances to Fossil-fired Electric Generators in the Western Electricity Coordinating Council Region and Percentages of the Allowances Available for Auction in the First Year

<table>
<thead>
<tr>
<th>P, Percent of Cumulative Class Generation Included in Best-in-Class emission rate for Greenhouse Gas Sources</th>
<th>U.S. Coal-fired Electric Generators BICc Rate (lbs. CO₂ Per MWh)</th>
<th>U.S. Natural Gas Electric Generators BICg Rate (lbs. CO₂ Per MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = 5 ⇒ ~ 40 % auctioned</td>
<td>1,452</td>
<td>590</td>
</tr>
<tr>
<td>P = 10 ⇒ ~ 22 % auctioned</td>
<td>1,948</td>
<td>678</td>
</tr>
<tr>
<td>P = 20 ⇒ ~ 18 % auctioned</td>
<td>2,022</td>
<td>760</td>
</tr>
<tr>
<td>P = 50 ⇒ ~ 13 % auctioned</td>
<td>2,121</td>
<td>847</td>
</tr>
<tr>
<td>P = 100 ⇒ ~ 0 % auctioned</td>
<td>2,247</td>
<td>1,205</td>
</tr>
</tbody>
</table>

Table 2. Best-in-Class (BIC) CO₂ Emission Rates for Allocating Allowances to U.S. Fossil-fired Electric Generators and Percentages of the Allowances Available for Auction in the First Year

<table>
<thead>
<tr>
<th>P, Percent of Cumulative Class Generation Included in Best-in-Class emission rate for Greenhouse Gas Sources</th>
<th>U.S. Coal-fired Electric Generators BICc Rate (lbs. CO₂ Per MWh)</th>
<th>U.S. Natural Gas Electric Generators BICg Rate (lbs. CO₂ Per MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = 5 ⇒ ~ 46 % auctioned</td>
<td>1,235</td>
<td>530</td>
</tr>
<tr>
<td>P = 10 ⇒ ~ 33 % auctioned</td>
<td>1,547</td>
<td>650</td>
</tr>
<tr>
<td>P = 20 ⇒ ~ 25 % auctioned</td>
<td>1,727</td>
<td>742</td>
</tr>
<tr>
<td>P = 30 ⇒ ~ 21 % auctioned</td>
<td>1,803</td>
<td>783</td>
</tr>
<tr>
<td>P = 50 ⇒ ~ 16 % auctioned</td>
<td>1,923</td>
<td>846</td>
</tr>
<tr>
<td>P = 100 ⇒ ~ 0 % auctioned</td>
<td>2,138</td>
<td>1,173</td>
</tr>
</tbody>
</table>

The straightforward Best-In-Class method could be applied on regional or national scales. Its potential outcomes should be compared with less transparent allocation methods now being debated.

In summary, the BIC distribution of allowances in advance of the start-up of a domestic cap-and-trade program would

- lower transaction and compliance costs,
- reduce market uncertainty,
- provide incentives to lower emitting sources in each class,
- enhance the trading of all vintages of allowances,
- ease the transition to auctioning, and
- send appropriate signals to encourage the development of U.S. and international programs to reduce GHG.

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