VAN HORN CONSULTING
Energy & Environmental Markets, Planning and Regulation

12 Lind Court
Orinda, California 94563-3615
925 254-3358 Phone
consulting@vhcenergy.com
www.vhcenergy.com

Memorandum

To: GHG File

From: Andy Van Horn

Date: April 23, 2009

Re: **Best-in-Class Allocation of GHG Allowances**

Free allocation of GHG emissions allowances is needed to ease the transition to an auction-based method for distributing GHG allowances under cap-and-trade. This memo describes a simple, best-practice method for allocating allowances during a transition period. The output-based method described here is based on historical, measured, best-practice emission rates. It:

- is straightforward, simple and easily understood,
- would utilize available data,
- could be based on only two, fuel-differentiated classes (coal and natural gas) or on more diverse classes based on fuel, combustion and control technologies similar to those used for familiar New Source Performance Standards,
- requires only one parameter, the percentage of total class output to include in calculating the best-in-class CO_2 emission rates for sources within each industrial sector. This percentage would be applied to base-year data in an industrial sector to determine the best-in-class emissions rate for each class,
- provides annual allocations to each source that are known in advance,
- is broadly equitable for both coal and natural gas fuels,
- rewards low emitters in each class, and
- indicates best current practice emission rate targets for future market entrants.

During the transition period, annual allowance allocations would decline and allowance auctioning would increase, subject to satisfying the overall industry sector cap. The method outlined here would allocate allowances in advance to existing sources for each year of the transition period, greatly reducing the market uncertainty that would be created by output-based allocation proposals that update the next year's allocations based on the prior year's output. It could be applied across different industrial sectors, where the product output for each source is likely to be better known than each individual source's GHG emissions.

The method is based on identifying basic fuel and technology classes for GHG sources, similar to the classes now used for EPA's New Source Performance Standards. For each class, a best-in-class GHG output emissions rate would be established, based on the observed, historical emissions rates of the Lowest Emission rate Greenhouse Gas Sources (LEGGS). For the electric utility industry, the simplest division would be to divide sources into only two broad

classes: coal-fired and natural gas-fired. A fuel-differentiated, output emissions rate would be determined based on best-in-class or best-practice historical emission rates for each fuel. Because the rate is output-based (e.g., lbs. CO_2 per MWh), the initial allocations would reward more efficient sources. However, because the classes are fuel-differentiated, coal-fired sources would not be unduly penalized.

For the base year, emission sources are ranked from lowest to highest GHG emission rates in each class. Then, cumulative tons emitted are calculated until the cumulative generation from the lowest emission rate sources exceeds ***P*** percent of the total generation from all sources in that class. The average rate for the lowest emission rate sources (cumulative tons/cumulative generation, when cumulative generation first exceeds ***P*** percent of that class's total base-year generation output) is taken as the calculated LEGGS rate for the base-year in (lbs.CO_2/MWh). The same percentage, ***P***, of cumulative total output would be applied across all different source classes in the sector to calculate each class's LEGGS best-in-class rate. Once ***P*** and the base year(s) are specified, the LEGGS rates for all classes can be determined.

For example, if ***P*** = *100*, the LEGGS 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 might be a more appropriate percentage to define a best-in-class rate, the LEGGS rate would be the cumulative average rate for those lowest emission rate sources that cumulatively produced 20 percent of the total coal generation output or 20 percent of the total gas generation output in the base-year.

Each source's first-year GHG allowance allocation is calculated by multiplying its class LEGGS rate by the source's base year output or by its average output during several base years. In subsequent years, the first-year LEGGS class rates would all decline by a designated percentage, as the overall GHG cap is ramped down and as the percent of allowances auctioned increases. Each source's base-year or base-years' average output would be kept fixed for allocations and would be multiplied by each year's LEGGS class allocation rate. Hence, the free allocations for existing sources would be specified in advance.[1] Allowances that are not allocated would be available for auction, set-aside for new entrants or reserved for other uses.[2] At the end of the transition period, free allocations would cease or remain at agreed levels.

[1] Using a fixed base-year output and a known, declining LEGGS rate would enable advance allocations to be made during the entire transition period. Updating allocations based on each year's output would be quite cumbersome and would introduce considerable uncertainty into the market. Debates about initial allocations would focus on a source's base year output, e.g., MWh, not on each source's base year GHG emissions.

[2] 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 LEGGS rate(s) for that year. This potential free allocation would provide an incentive for new entrants to meet or beat the LEGGS rate and would place them on a level playing field with existing facilities during the transition period.

Three simple steps illustrate how the first-year allocations for the electric generation sector would be determined.

1. **A best-in-class, output-based CO_2 emission rate in (lbs.CO_2/MWh) is first calculated from historical data for two (or more) classes of fossil-fired electric generators.** Two fuel-differentiated classes could consist of all coal-fired and all natural gas-fired emission sources operating in the specified historical base-year(s) across the U.S. or within a region, e.g., the Western Electricity Coordinating Council (WECC).[3]
2. **The LEGGS rate for coal sources, LEGGSc, or the rate for natural gas, LEGGSg, is then multiplied by each source's base-year generation to obtain each source's first-year allowance allocation.** In subsequent years, each source's allocation would be determined by its base-year(s) generation or product output multiplied by the applicable LEGGS rate in each year. The LEGGS rate for all classes would decline each year at the same rate to reflect the desired increase in auctioning and the mandated decline in the overall GHG emissions cap. The LEGGS rate for each class would reach zero in the year in which full auctioning is implemented.
3. **The sum of LEGGS allocated GHG emissions in each year would be subtracted from each year's cap to set the quantity of allowances to be auctioned or set-aside for other purposes. The parameter, *P*, can be set to give an approximate first-year auction percentage, which can be increased in subsequent years by pro-rata decline in the first-year LEGGS emissions rates.**

Note that the application of the best-in-class, LEGGS method requires agreement upon only **one** parameter, the percentage, ***P***. ***P*** is the percentage of cumulative total output contributed by sources ranked according to the lowest emission rates in each class, and it would be applied across all source classes within an industrial sector.[4] The sole other requirement needed to determine a source's first-year allocation would be to select the base-year(s) for historical data regarding each source's CO_2 emissions and output. Values for the parameter, ***P***, the resulting first-year allocations, and the resulting approximate percentage of allowances that would be auctioned in each year can be readily analyzed and discussed, even without knowing the precise value for the total emissions cap. However, once the caps are determined and the initial year for full-auctioning is specified, allocations for intervening years can be readily calculated. The effects of different choices for ***P*** can be straightforwardly calculated and then modeled quantitatively for each year under a variety of cap-and-trade and auction/allocation proposals.

[3] If desired, additional categories can be created based on particular fuel, generation technology and control technology classes, similar to those applied for New Source Performance Standards.
[4] ***P*** might be different for different industries, in order to equalize differences in marginal GHG reduction costs or to reflect other differences between industrial sectors.

Calculated first-year LEGGS emissions rates for fossil-fired electric generators in the WECC and for the contiguous U.S., using 2004 as the base-year, are:

P, Percent of Cumulative Class Generation Included in Best-in-Class, Lowest Emission rate Greenhouse Gas Sources	**WECC Coal-fired Electric Generators LEGGSc (lbs. CO_2 Per MWh)**	**WECC Natural Gas Electric Generators LEGGSg (lbs. CO_2 Per MWh)**
P = 5 = ~40 % auctioned	1,452	590
P = 10 = ~ 22 % auctioned	1,948	678
P = 20 = ~ 18 % auctioned	2,022	760
P = 50 = ~ 13 % auctioned	2,121	847
P = 100 = ~ 0 % auctioned	2,247	1,205

P, Percent of Cumulative Class Generation Included in Best-in-Class, Lowest Emission rate Greenhouse Gas Sources	**U.S. Coal-fired Electric Generators LEGGSc (lbs. CO_2 Per MWh)**	**U.S. Natural Gas Electric Generators LEGGSg (lbs. CO_2 Per MWh)**
P = 5 = ~ 46 % auctioned	1,235	530
P = 10 = ~ 33 % auctioned	1,547	650
P = 20 = ~ 25 % auctioned	1,727	742
P = 30 = ~ 21 % auctioned	1,803	783
P = 50 = ~ 16 % auctioned	1,923	846
P = 100 = ~ 0 % auctioned	2,138	1,173

Overall, the best-in-class allocation of allowances would ease the transition to full auctioning of allowances. The output-based method described here

- is straightforward, simple and easily understood,
- would utilize available data,
- could be based on only two, fuel-differentiated classes (coal and natural gas) or on more diverse classes based on fuel, combustion and control technologies similar to those used for the familiar New Source Performance Standards,
- requires only one parameter, the percentage of total class output to include in calculating the best-in-class rates CO_2 emission rates for sources within each industrial sector,
- provides annual allocations to each source that are known in advance
- is broadly equitable,
- rewards low emitters in each class, and
- indicates best current practice emission rate targets for future market entrants.

At the least, this best-in-class allocation method should be compared quantitatively with other, more complex methods now being proposed for allocating GHG emissions.

I would be interested in your comments regarding this potential method for GHG allowance allocation. If you have any questions or comments, please let me know.