Subject: Comments - March 17, 2008 Economic Analysis workshop (AB 32)
From: Ken Johnson <kjinnovation@earthlink.net>
Date: Tue, 18 Mar 2008 11:56:23 -0700
To: ccplan@arb.ca.gov

This is a copy of an email that I sent Kevin Kennedy on Feb 12, which I am submitting as a written commentary for the March 17 Economic Analysis workshop [http://www.arb.ca.gov/cc/scopingplan/pgmdesign-sp/meetings/meetings.htm]. (I will also be submitting separate comments for the March 17 Program Design workshop.)

[Note: The spreadsheet referenced under "CA Electricity Market" is not included with this commentary, but can be obtained from Kevin Kennedy. Refer to "CA_Electricity.xls", attached to my Feb 12 email.]

Ken Johnson

-------- Original Message --------
Subject: Allocation
Date: Tue, 12 Feb 2008 11:01:42 -0800
From: Ken Johnson <kjinnovation@earthlink.net>
To:kmkenned@arb.ca.gov

Kevin,

Following up on our phone conversation yesterday, here are some brief notes relating to allocation.

Swedish REP (Refunded Emission Payments) program for stationary-source NOx emissions:

- Refunded emission tax; tax rate = 40 SEK/kg-NOx (about $5600/ton), refunded in proportion to "useful energy output".

- Covers a wide variety of industries (electricity, heating, and various industrial processes) and fuels (e.g., coal, oil, biofuel).

- Enacted in 1990 with the intent of achieving 35% emissions reduction within five years; by 1995 emissions had reduced by about 50% (including demand growth).

- NOx emission performance of Swedish plants is much better than other industrial countries (e.g., coal plants in 2000 were about 4X better than U.S. plants on a per-MWh basis, and 9X better if cogeneration heat is counted).

- Net economic costs have been estimated at only 0.04 cents per KWh, about one-fifth of what it would have been without the refund.

- Without the refund, additional emission reduction from decreased consumption would have only amounted to about 2-3%, a small fraction of the technology-enabled reduction.

- A refunded tax instrument was chosen to address concerns of fairness, industry competitiveness, leakage, and political viability. (Initially, combustion units with less than 50 GWh annual generation were exempt

from NOx regulation because of the high cost of NOx monitoring equipment, although cost reductions allowed smaller facilities to later be incorporated in the program. The refund mitigated the disparity between large and small plants.)

References:

[1] Ågren, C., 2000. Nitrogen oxides: emissions charge works well. Acid News 2, 1–4
http://www.acidrain.org/pages/publications/acidnews/2000/AN2-00.pdf

[2] Barg, S., Duraiappah, A., Exan, V. E., 2000. Economic Instruments for Environmental Policy Making in Ontario. International Institute for Sustainable Development (pp. 48–50)
http://www.ene.gov.on.ca/envision/ergreport/downloads/report_paper2.pdf

[3] Isaksson, L., Sterner, S., 2006. Refunded emission payments theory, distribution of costs, and Swedish experience of NOx abatement, in: Ecological Economics 57 (1), 93-106.
http://www.sciencedirect.com/science/journal/09218009
http://dx.doi.org/10.1016/j.ecolecon.2005.03.008

[4] Millock, K., Sterner, T., 2004. NOx emissions in France and Sweden. In: Harrington, W., Morgenstern, R.D., Sterner, T. (Eds.), Choosing Environmental Policy: Comparing Instruments and Outcomes in the United States and Europe. Resources for the Future, Washington, DC, pp. 117–132.
http://www.rff.org/rff/RFF_Press/CustomBookPages/Choosing-Environmental-Policy.cfm
[Note: This reference erroneously states the NOx emissions of Swedish coal power plants as 0.246 lbs/MWh thermal, or 0.56 lbs/MWh electric (p. 126). These values should be 0.246 kg/MWh, and 0.56 kg/ MWh, respectively, or equivalently 0.542 lbs/MWh and 1.230 lbs/MWh. By comparison, typical US coal plant emissions are 5 lbs/MWh. Sterner also has more recent data on NOx performance of Swedish plants.]

[5] Sterner, T., Hoglund, L., 2000. Output-Based Refunding of Emission Payments: Theory, Distribution of Costs, and International Experience. Discussion Paper 00-29. Published by Resources for the Future.
http://www.rff.org/Documents/RFF-DP-00-29.pdf

[6] (USEPA), 1997. Performance of Selective Catalytic Reduction on Coal-Fired Steam Generating Units. U.S. Environmental Protection Agency, Office of Air and Radiation. (See esp. p. 37.)
http://www.epa.gov/airmarkets/progsregs/arp/docs/scrfinal.pdf

[7] Wolff, G. H., 2000. When Will Business Want Environmental Taxes? Redefining Progress.
http://www.redefiningprogress.org/newpubs/2000/etr_business.pdf

U. S. SO2 trading program

- SO2 emissions from U.S. coal plants in the U.S. averaged about 9 lbs/MWh in 2006, but ranged as high as 40 lbs/MWh.

- State-of-the-art scrubbers can reduce coal plant SO2 emissions to about 1 lb/MWh. The mitigation cost of scrubbers can be less than $300/ton-SO2.

- Quantifiable benefits of SO2 mitigation (counting only public health benefits, not environmental impacts) are estimated to be $7300/ton.

- The market efficiencies that lead to substantial and unexpected cost reductions in the SO2 program could have been harnessed to achieve similar reductions in emissions by employing an REP-type instrument, or by applying a price floor in the context of cap-and-trade with a refunded auction. Program goals could have been achieved much sooner, and without the need for supplemental CAIR legislation. In the context of GHG regulation, this type of policy approach would be more compatible with the AB 32 maximum reduction mandate.

References:

Ilan Levin. 50 Dirtiest U.S. Power Plants: CO2 Pollution Linked to Global Warming on Track to Rise by a Third, Mixed Picture on Other Key Pollutants (2007), published by the Environmental Integrity Project, http://environmentalintegrity.org/pub457.cfm

EPA data
http://camddataandmaps.epa.gov/gdm/

CA Electricity Market

The following comments to WCI and CPUC analyze several allocation methods in the context of a cap-and-trade system applied to the CA electricity sector, using 2004 data provided by ARB (from Larry Hunsaker in late Nov). The WCI document includes the CPUC submission. Jump to the bottom of page 7 in the WCI comments and page 3 in the CPUC comments for an overview of the analysis results.

http://docs.cpuc.ca.gov/efile/CM/75992.pdf
http://www.westernclimateinitiative.org/ewebeditpro/items/O104F15024.pdf

The spreadsheet calculations underlying the CPUC comments are attached.

Four basic policy options were analyzed:

(1) Unrefunded auction at an emission price of $10/MTCO2e (which could be either a market price, a floor price, or a tax): The emission charge for Import_Coal would be $9.76/MWh, and for renewables (e.g. CA_WindSolar) would be zero.

(2) Refunded auction with pure output-based refunding (still at $10/MTCO2e): A uniform refund rate of $4.05/MWh is applied (based on revenue neutrality), reducing the net charge for Import_Coal to $5.71/MWh, and resulting in a subsidy of $4.05/MWh for CA_WindSolar.

(3) Output-based refunding with selective elimination of cross-subsidies to or from Nuclear/Hydro, and from Coal to NG: The Import_Coal net charge is reduced to $0.61/MWh and the CA_WindSolar subsidy is unaffected.

(4) Same as (3) but with emission price increased from $10/MTCO2e to $50/MTCO2e: The Import_Coal net charge is increased to $3.06/MWh (still much less than Option 2) and the CA_WindSolar subsidy is increased 5X to $20.27/MWh.

Vehicle Feebates

The following Scoping Plan proposal and supplementary SSRN document discuss allocation methodologies in the context of vehicle feebates. (The SSRN document is referenced in the proposal.)

http://www.arb.ca.gov/cc/scopingplan/submittals/transportation/transportation.htm (See "Ken Johnson".)
http://ssrn.com/abstract=1014866

The Scoping Plan proposal is based on the data (CA MY2002) and policy reasoning underlying the AB 1493 regulations, while the SSRN document analyzes a broader range of feebate policy options using national-scope data for 2005 (from Polk). Four allocation methods are considered in the SSRN paper: attribute-neutral, volume-based, footprint-based, and weight-based. Following is a brief comparison of several scenarios based on this analysis. (Note: The "feebate price" is effectively an emission price, based on the emission intensity of fuel, and represents the regulatory incentive for improving fuel economy.)

```
    US MY 2005 feebate simulation: weight-based; footprint-based; volume-based;
attr-neutral; unrefunded
    Feebate price                       $1.00/gal       $1.00/gal      $1.00/gal
$1.00/gal     $1.00/gal
    aggregate fees and rebates:         $4.522B;        $7.238B;       $8.926B
$12.624B      $129.383B
    Truck-to-Car feebate revenue flow:  $1.057B;        $3.432B;       $3.417B
$10.873B
    Avg Fee                             $738            $1239          $1441
$2031         $9594
    Avg Rebate                          $615            $947           $1224
$1734
```

The refunding method can be used to either reduce industry costs, as illustrated above, or to increase emission reduction incentives without increasing costs. For example, if the feebate price is set to make the average fee $1000 for all options, then the following results are obtained:

```
    US MY 2005 feebate simulation:  weight-based; footprint-based; volume-based;
attr-neutral; unrefunded
    Feebate price                       $1.36/gal       $0.81/gal      $0.69/gal
$0.49/gal     $0.104/gal
    Aggregate fees and rebates:         $6.13B          $5.84B         $6.19B
$6.22B        $13.486B
    Truck-to-Car feebate revenue flow:  $1.43B          $2.77B         $2.37B
$5.35B
    Avg Fee                             $1000.00        $1000.00       $1000.00
$1000.00      $1000.00
    Avg Rebate                          $833.33         $764.33        $849.41
$853.77
```

Note that all of the feebate prices in the above tables are well below the cost-effectiveness threshold, based on fuel savings alone. At a fuel price of about $3.00, the fuel cost associated with each ton of vehicle emissions is about $300. Assuming a 5% discount rate (which ignores fuel price inflation) the cost-effectiveness limit (according to the AB 1493 criterion) would be about $2.00/gal. By comparison, the AB 1493 regulations were premised on "feasible" vehicle technologies with maximum regulatory costs of about $0.80/gal, and average compliance costs (according to the Climate Action Team report) are projected to be only about $0.40/gal. Technologies such as gas-electric hybrids were considered to be "infeasible" for the purpose of establishing the AB 1493 standard, in order to ensure cost-effectiveness under conservative predictive scenarios. Such extreme cost conservatism would not be required with a feebate-type instrument, which provides direct regulatory control over emission prices. The AB 1493 regulations are also limited by the simplistic LEV-based allocation method (which awards light trucks emission allowances about 62% higher than cars, independently of vehicle attribute characteristics). The LEV-based allocation would probably be impractical

at emission prices closer to the marginal benefit limit.

It should be noted that revenue-neutral allocation can eliminate problems of double counting between complementary policies. For example, an emission price applied to new vehicles would be premised on some industry-average emission intensity of transportation fuel. A feebate-type monetary incentive applied directly to transportation fuels would be zero for fuels that match the industry-average emissions intensity, so there would be no double counting. The fuel incentive would effectively act as a "correction factor" applied to the vehicle incentive to account for actual fuel emission intensity. (PHEV's should be equipped with some type of odometer-type electricity meter so that electricity can be properly credited as a transportation fuel, and ARB might consider establishing standards for PHEV electricity metering.)

Ken Johnson
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