ARB Calculation Methodology for Allocating to Refineries

In the first compliance period, a total amount of allowances is assigned annually to the refining sector. This sector allocation is then divided among individual refiners using methods specified in section 95891(d) of cap-and-trade.

In the second and third compliance period, there will no longer be a sector allocation determined for the refining sector. The amount allocated to each individual refinery will be based on the product output-based allocation approach and the "CO2 weighted tonne" benchmark.

First Compliance Period

1. Sector Allocation

The sector allocation is based on the simple barrel metric as the benchmark.
The total amount of allowances to the sector increases or decreases automatically in response to future production levels of refinery products consistent with the product-based allocation approach and is directly comparable to the requirements for other industrial sectors. The following is the equation for use to calculate the refinery sector allocation.

$$SA_t = O_{t-2} * B_R * AF_{R,t} * c_t$$

Where:

"SA_t" is the allocation to the refining sector from budget year "t";

"O_{t-2}" is the output of primary refinery products, in barrels, from the refining sector in year "t-2";

"B_R" is the benchmark for primary products produced by the refining sector, equal to 0.0462 metric tons of allowances per barrel of primary refinery product;

"$AF_{R,t}$" is the assistance factor for budget year "t" assigned to petroleum refining as specified in Table 8-1; and

"c_t" is the cap adjustment factor for budget year "t" assigned to petroleum refining to account for cap decline as specified in Table 9-2.

2. Dividing the Sector Allocation to Individual Refiners

The sector allocation is divided between individual facilities using a two-pronged method.

a. Facilities with a representative Solomon Energy Intensity Index (EII)Value

Refineries with an EII value, complex refiners, will be allocated using a methodology based on the following factors: (1) historical emissions from each refinery (BE_Y), (2) the Solomon Energy Intensity Index (EII) for each refinery, (3) an adjustment factor (Adj) to reduce competitiveness impacts of allowance allocation between in-state refineries, (4) ratio of total allocations over the total emissions for all complex refineries (F_t), and (5) a complex refinery distribution factor ($DF_{Y,t}$).
ARB uses the following formula to calculate the refineries initial (2013, 2014 vintage allowances) allocations:

$$A_{Y,t} = BE_Y * DF_{Y,t} * F_t$$

Where:

"$A_{Y,t}$" is the initial allocation to refinery "Y" that has an EII value for year "t";

"BE_Y" is the baseline average annual greenhouse gas emissions for refinery "Y" adjusted for steam purchases and sales and electricity sales using the following equation:

$$BE_Y = GHG + (S_{Purchased} - S_{Sold}) * 0.06244 - e_{Sold} * 0.431$$

"GHG", for the purposes of this calculation, is the annual arithmetic mean amount of greenhouse gas emissions from the refinery;

"$S_{Purchased}$" is the annual arithmetic mean amount of steam purchased by the refinery in MMBtu;

"S_{Sold}" is the annual arithmetic mean amount of steam sold from the refinery in MMBtu; and

"e_{Sold}" is the annual arithmetic mean amount of electricity sold from the refinery in MWh.

To calculate these values, ARB may employ data reported to ARB for data years 2008-2010. If the facility reported facility level, third-party verified, greenhouse gas emissions data to the California Climate Action Registry for data years 2006-2007, ARB may

consider these years in determining representative baseline values. If necessary, ARB will solicit data to establish a representative baseline allocation;

"$DF_{Y,t}$" is a distribution factor calculated as:

$$DF_{Y,t} = ((Avg / EII_Y) + Adj_t) / (1 + Adj_t)$$

"Avg" is the weighted average EII for all facilities with EII values calculated as:

$$Avg = \frac{\sum BE_Y}{\sum (BE_Y / EII_Y)}$$

"EII_Y" is the Solomon Energy Intensity Index (EII) for facility Y for 2008, 2009 or 2010 as determined to be representative by the Executive Officer. For the purposes of this calculation, EII values shall be rounded to one digit after the decimal;

"Adj" is an adjustment factor designed to provide the facility with the best EII the most allowances relative to its baseline level:

$$Adj_t = ((Avg/EII_{Best}) * F_t - 1) / (1 - F_t)$$

"EII_{Best}" is the EII of most efficient facility (lowest EII in sector); and

"F_t" is a fraction calculated as:

$$F_t = \frac{SA_t - \sum A_{X,t}}{\sum BE_Y}$$

If actual 2013 and 2014 emissions are less than the amount of allowances allocated, the entity will need to surrender additional allowances according to the following true-up debit equation:

$$\text{If:} \quad (AE_{Y,2013} + AE_{Y,2014}) < (A_{Y,2013} + A_{Y,2014})$$

$$\text{Then:} \quad A_{Y,Debit} = 0.8 * \left[(AE_{Y,2013} + AE_{Y,2014}) - (A_{Y,2013} + A_{Y,2014})\right]$$

Where:

"$AE_{Y,t}$" = Actual GHG emissions from a facility in year "t" adjusted for heat sales and purchases and electricity sold; and

"$A_{Y,Debit}$" = A debit (shown as a negative value in the equation above) to be surrendered in addition to the triennial compliance obligation for refinery "Y."

If actual 2013 and 2014 emissions are greater than the assumed baseline emissions, a true-up allocation will be conducted using 2015 vintage allowances and the following true-up credit equation:

$$\text{If:} \quad (2 * BE_Y) < (AE_{Y,2013} + AE_{Y,2014})$$

$$\text{Then: } A_{Y,Credit} = (AE_{Y,2013} * DF_{Y,2013} * F_{2013} * AF_{2013} + AE_{Y,2014} * DF_{Y,2014} * F_{2014} * AF_{2014}) - (A_{Y,2013} + A_{Y,2014})$$

Where:

"$A_{Y,Credit}$" = An additional true-up allocation distributed by the Executive Officer to refinery "Y" using 2015 vintage allowances.

Under this approach, the facility with the best (most efficient) EII receives allowances equal to its historical emissions baseline. Allocations to refineries as a percentage of baseline emissions decrease approximately linearly as a function of the refiner's EII value. A true-up using actual emissions will occur at the end of the compliance period to ensure there is no excessive under or over allocation.

b. Facilities without EII or non-representative EII Values

Refineries that do not have an EII or a non-representative EII value receive allowances based on facility production or the facility historical emissions baseline. The allocation formula used is determined by applying the following inequality:

$$\text{If:} \quad O_{X,-2} * B_R * c_t * AF_{R,t} \leq BE_X * c_t * AF_{R,t}$$

$$\text{Then:} \quad A_{X,} = O_{Xt-2} * B_R * c_t * AF_{R,}$$

$$\text{If:} \quad O_{X,-2} * B_R * c_t * AF_{R,t} > BE_X * c_t * AF_{R,t}$$

$$\text{Then:} \quad A_{X,} = BE_X * c_t * AF_{R,}$$

Where:

"$A_{X,t}$" is the allocation to refinery "X" without an EII value for year "t";

"$O_{X,t-2}$" is the output of primary refinery products, in barrels, from refinery "X" in year "t-2";

"B_R" is the benchmark for primary products produced by the refining sector, equal to 0.0462 metric tons of allowances per barrel of primary product;

"$AF_{R,t}$" is the assistance factor for budget year "t" assigned to petroleum refining as specified in Table 8-1; and

"c_t" is the adjustment factor for budget year "t" assigned to petroleum refining to account for cap decline as specified in Table 9-2.

"BE_X" is the baseline average annual greenhouse gas emissions for refinery "X" adjusted for steam purchases and sales and electricity sales using the following equation:

$$BE_X = GHG + (S_{Purchased} - S_{Sold}) * 0.06244 - e_{Sold} * 0.431$$

"GHG" is the annual arithmetic mean amount of greenhouse gas emissions from the refinery using data from 2008-2010;

"$S_{Purchased}$" is the annual arithmetic mean amount of steam purchased by the refinery in MMBtu using data from 2008-2010;

"S_{Sold}" is the annual arithmetic mean amount of steam sold from the refinery in MMBtu using data from 2008-2010; and

"e_{Sold}" is the annual arithmetic mean amount of electricity sold from the refinery in MWh using data from 2008-2010.

3. 2013 Summary Calculations

ARB derived factors for calculating a refinery's 2013 vintage allocation are as follows:

1) SA for 2013 allocation to the refining sector is 29,163,759.
It is derived using:

$$SA_{2013} = O_{2011} * B_R * AF_{R,t} * c_t$$

Where:

B_R is 0.0462;

$AF_{R,t}$ is 1; and

c_t is 0.981.

2) Adj for 2013 allocation is 0.423455.[i]
It is derived using:

$$Adj_t = ((Avg/EII_{Best}) * F_t - 1) / (1 - F_t)$$

Where:

EII_{Best} is 79.0;

F_t is (see below); and

Avg is (see below).

3) F_t for 2013 allocation is 0.886867.[i]
It is calculated as:

$$F_t = \frac{SA_t - \sum A_{X,t}}{\sum BE_Y}$$

Where:

SA_t is 29,163,759.0;

$\Sigma A_{X,t}$ is withheld to protect confidential business information; and

ΣBE_Y is withheld to protect confidential business information.

4) Avg for 2013 is 93.344987. [i]
It is calculated as:

$$Avg = \frac{\sum BE_Y}{\sum (BE_Y / EII_Y)}$$

Where:

ΣBE_Y is withheld to protect confidential business information; and

$\Sigma(BE_Y / EII_Y)$ is withheld to protect confidential business information.

[i] Rounded to six decimal places for this paper, but were not rounded in actual allocation calculations.