

Modeling Energy and Greenhouse Gas Savings from Implementing Bottle Bill Task Force Recommendations - Revised.

On October 10, 2008, DEQ provided the Oregon Bottle Bill Task Force with estimates of the energy and greenhouse gas savings that would result from implementing task force recommendations. Shortly after producing these estimates, DEQ examined new information on the beverage containers recycled under the Bottle Bill in 2006 and 2007, and found that the tonnage being redeemed for deposit had shown substantial declines over previous estimates. In particular, the tons of aluminum cans being recycled had declined by more than 10 percent, glass had declined by more than 4 percent, and plastic had declined around 14 percent. DEQ has now redone the energy and greenhouse gas estimates provided earlier using the new tonnage estimates for 2006 and 2007. The net effect is to increase the estimate of energy and greenhouse gas savings that would be accomplished by implementing the task force recommendations. This is because under the model, the tonnage of material being recycled shows a greater decline over the years if the task force recommendations are not implemented. However, the rates will become elevated and then not decline as much over the years if the task force recommendations are implemented, in particular due to the activities that would be required to be implemented to keep the redemption rate from falling below 80% in the future. Other than changing the 2006 and 2007 redemption and recycling estimates and making corresponding changes in redemption rates for new containers when added in the year 2013, the assumptions made in this revised estimate are the same as those used before.

Base Case: Exist bottle bill is implemented, including adding water bottles as of January 1, 2009, but no task force recommendations or other new programs are implemented.

Task Force Recommendations Case: Begin with the same situation as the Base Case above, but then include the following:

- Deposit doubles as of January 1, 2011
- All beverages except milk, milk substitutes are added as of January 1, 2013
- The aggregate redemption rate for all covered beverages is not allowed to drop below 80% after 2015

This model looked at the redemption, recycling, and disposal rate for each type of container through the year 2030. Subtracting the amount of material redeemed or recycled under the base case from the amount redeemed or recycled under the Task Force Recommendations case for each year gives an estimate of the additional material that would be recycled if the Bottle Bill Task Force recommendations were implemented.

Base case assumptions:

1. The starting point for the model is the estimates on beverage containers redeemed, recycled, and disposed as of 2005 for each beverage and material type, as presented to the Bottle Bill Task Force by DEQ on April 1, 2008, with one correction (bottle bill aluminum in 2005 was 13,062 tons, not 13,960 tons). In this revised version, lower redemption rates were also used for 2006 and 2007 based on actual data results.
2. With the exception of water and soft drinks, there is no change in relative market share of beverages through 2030, and the volume of beverages consumed increases in direct proportion to projections of population increase in Oregon.
3. For any specific beverage container covered under the Oregon Bottle Bill, the number of containers that are not redeemed for deposit (equal to the number disposed plus the number recycled without being redeemed) increases each year by 5% of its own value, due to the

effects of inflation and to new people moving into the state who might not be as familiar with the system. For example, in a year in which 80% of the containers are redeemed and 20% are not redeemed, then the following year the number not redeemed will increase to 21%, meaning that only 79% of the containers will be redeemed. If the redemption rate falls below 50%, then from that point on the percentage of redeemed containers decreases by 5% of its value each year.

4. The market share of water was assumed to keep growing at a large but declining rate through 2009. This increase was assumed to be partially offset by declines in soft drink consumption, such that for every extra water bottle sold in excess of normal per-capita growth, the sales of soft drinks declined by 0.8 containers, with 70% of the decline being in aluminum and 30% in plastic bottles.
5. For containers not covered under the bottle bill prior to 2009, the new containers that are not redeemed each year end up being allocated to disposal and to recycling (without redemption) in proportion to the existing ratio of disposal to recycling (without redemption). For example, if 18% of containers of one type are being disposed and 6% are being recycled, then as container redemption goes down over time, the new containers not being redeemed would be either disposed or recycled in proportion to this 18 to 6 ratio. For beer and soft drink, it was assumed that 60% of the newly non-redeemed containers would be disposed and 40% would be recycled without redemption. Some manual adjustments were made to this ratio for beer and soft drinks where needed to keep the numbers in a realistic range.
6. Water bottles are added to the model starting at the beginning of 2009, based on existing law. It was assumed that initially 56% of plastic water bottles would be redeemed, 6% would be recycled without redemption, and 38% would be disposed. The redemption rate is modeled to decrease each year based on assumption 3 above.
7. Paper cartons were not included in the model, since they were not included in the Bottle Bill Task Force recommendations.

Assumptions for modeling the effects of Bottle Bill Task Force recommendations

1. The model starts with the same assumptions as were made for the base case.
2. The refund value doubles to 10 cents at the beginning of 2011. The immediate effect is modeled to reduce the containers not being redeemed by about 50%. Thus, for example, if aluminum soft drink cans had fallen to 67% redemption by 2010, they would climb back to 83.5% redemption in 2011 due to the doubling of the refund value.
3. Juice, tea, wine, and liquor containers are added to the Bottle Bill as of 2013. Estimates are provided for the redemption, recycling, and disposal rate of each type of container in that year.
4. The redemption rates of all beverage containers decline each year due to the effects of inflation. However, starting in 2015, the decline of redemption rates diminishes and the redemption rates stabilize as the overall redemption rate for all covered beverage containers approaches 80%, based on expected efforts to be made to meet the 80% recovery goal proposed by the Bottle Bill Task Force beginning in 2015.

Model Results

Based on the above assumptions, the number and tonnage of each container type that was redeemed, recycled, and disposed was estimated for each year through 2030. Results for the 20-year period from 2011 through 2030 were then summed for both the base case and for the bottle bill task force recommendation case. The difference between these two sets of numbers can then be attributed to the effect of the bottle bill task force recommendations. The below table gives the results of this model, summed over the full 20-year period and also the average per year.

	20 year total	per year
Aluminum tons	103,000	5,000
Steel tons	6,000	300
Plastic tons	170,000	8,000
Glass tons	540,000	27,000
Million BTUs saved by recycling	32,000,000	1,600,000
Gallons of gas equivalent	250,000,000	13,000,000
Equivalent of cars driving 1 year	490,000	25,000
Metric tons CO2 saved	2,000,000	100,000

Conversion factors:

Million BTUs saved per ton of material recycled:

Aluminum: 206.95
Steel: 20.50
Plastic: 52.95
Glass: 2.66

Source: [http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/TMAL6GDR3K/\\$File/Energy%20Savings.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/TMAL6GDR3K/$File/Energy%20Savings.pdf)

1 gallon of gas = 125,000 BTU

gallons of gas used per car per year: 513

Metric tons CO2 saved per ton of material recycled:

Aluminum: 15.107
Steel: 1.833
Plastic: 1.54
Glass: 0.33

Source: <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteToolsSWMGHGreport.html>
(factors converted from metric tons carbon to metric tons CO2 by multiplying by 44/12)

Prepared by Peter Spendelow, Oregon Department of Environmental Quality, October 21, 2008
