DRAFT
Materials, Recovery and Waste Options for Reducing Greenhouse Gases
June 1, 2004

BACKGROUND

The goal of this effort is to identify and evaluate options that could reduce greenhouse gas (GHG) emissions associated with the use and discard of materials by households and businesses in Oregon. Oregon can achieve this goal by controlling methane emissions from solid waste landfills, reducing the burning of certain wastes, increasing recycling and composting, and using materials more efficiently.

The manner in which materials use and waste in Oregon contributes to greenhouse gases is multi-faceted and complex. Some emissions occur inside Oregon while others occur in other states or even other nations. For options that reduce emissions, some options lead to an immediate reduction in emissions while other options may reduce emissions by smaller amounts each year for many years into the future. For a more thorough explanation of the materials life cycle, its greenhouse gas emissions, background on waste recovery and disposal in Oregon, and the accounting framework used by the Technical Subcommittee on Materials, Recovery and Waste, please refer to the document "Briefing Paper: Materials and Greenhouse Gases". (This document was provided to Advisory Group members on May 2; electronic copies are also available at:
http://www.energy.state.or.us/climate/Warming/Documents/May12/SupportDocs.htm).

BASE CASE PROJECTION OF EMISSIONS

According to the Oregon Department of Environmental Quality (DEQ), per-capita waste generation in Oregon rose from 5.9 pounds per person per day in 1993 to 7.5 pounds per person per day in 2002. Of this, recovery (recycling, composting and certain types of waste combustion) grew from 1.8 to 3.2 pounds per person per day, while landfilling held fairly constant throughout 1993 – 2002 in the range of 4.1 to 4.5 pounds per person per day. (Waste generation is the sum of recovery plus disposal.)

This historic trend is used as the starting point for projecting future growth in waste generation. To project future per-capita waste generation, we first divided the waste stream into 30 different material categories. Using DEQ and EPA data, with adjustments to account for changes in reporting and assumptions regarding shifts of waste into the "counting" waste system (such as away from open burning), estimates were made of the rate of change in per-capita waste generation during the period 1993 – 2002 for these 30 different categories. (The accuracy of these estimates is better for some material categories than others.) The rates of adjusted growth in per-capita waste generation (by material) were then related to the rate of growth in inflation-adjusted Oregon personal income during the same period, 1993 – 2002.

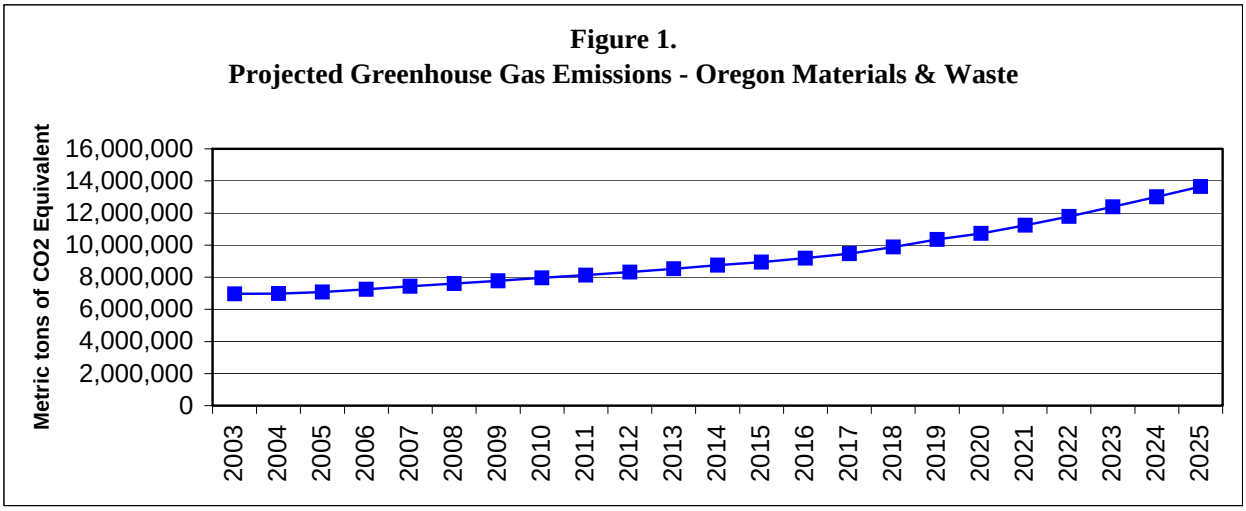
Assuming these relationships between personal income and materials use/waste holds constant, and using projections of inflation-adjusted personal income from the Oregon Department of Administrative Services, we project that per-capita waste generation aggregated across all 30 material categories will grow to 10.1 pounds per person per day in 2025 under the baseline or a

"business as usual" scenario. Coupled with projected population increases, total in-state waste generation (all discards, including recycling and composting) is projected to grow from 5.1 million tons in 2003 to 8.4 million tons in 2025.

Emissions factors over the entire materials life cycle (materials production, transportation, and end-of-life management) are applied to these projections of in-state waste generation. Oregon also imports significant quantities of municipal solid waste (garbage) from other states. Waste imports are modeled growing at a rate of approximately 4.6% per year, from approximately 1.5 million tons projected in 2003 to 4.0 million tons in 2025. Only emissions associated with the disposal portion of the life cycle are counted for these imported wastes.

Assuming that per-ton emissions factors for material production, transportation and end-of-life management of each material type (glass, corrugated paper, yard trimmings, etc.) remain constant between 2003 and 2025, open burning of wastes continues to fall, and the disposition of all remaining wastes (between recycling, composting, energy recovery, and different landfills) remains fairly constant, greenhouse gas emissions are projected to rise from 7.0 million metric tons of CO_2 (carbon dioxide) equivalent in 2003 to 13.6 million metric tons in 2025. This represents almost a doubling of emissions between 2003 and 2025, or an average annual growth rate of approximately 3.1% under the business as usual scenario.

Figure 1.
Projected Greenhouse Gas Emissions - Oregon Materials & Waste



RELATIVE IMPORTANCE OF DIFFERENT LIFE CYCLE STAGES

The different life cycle stages (production, recycling, landfilling, etc.) contribute different amounts to the estimate of total net emissions. The relative importance of different life cycle stages vary widely across different types of materials. For example, most of the greenhouse gas emissions associated with steel result from energy used during manufacturing, while most of the greenhouse gas emissions associated with yard debris occur during landfilling. For the mix of materials and waste as a whole, emissions associated with resource extraction and product manufacturing, on average, are significantly higher than any other category of emissions. Put differently, the majority of emissions occur "upstream" of the user (Oregon household or business). "Downstream" emissions associated with management of discards tend to be smaller, on average, than upstream emissions.

Figure 2 shows the contribution of different life cycle stages to the projected net emissions of 8.9 million metric tons of carbon dioxide equivalent ($MMTCO_2E$) in 2015 associated with the materials life cycle for materials used and discarded in Oregon.

Figure 2
Metric Tons of Carbon Dioxide Equivalent, Oregon Materials Life Cycle, 2015
(Baseline Scenario)

Waste generation		
	"Upstream" activities of resource extraction, product manufacturing, and transportation	10.92 $MMTCO_2E$
Recycling		
	Material production and transportation	-1.01 $MMTCO_2E$
	Indirect carbon storage in forests	-2.13 $MMTCO_2E$
Composting		
	Production and transportation	0.02 $MMTCO_2E$
	Carbon storage in soils treated with compost	-0.10 $MMTCO_2E$
Combustion		
	Open burning*	0.06 $MMTCO_2E$
	Mass incineration of garbage (Marion, Coos Counties)	0.10 $MMTCO_2E$
	Emissions from combustion of other wastes for energy	0.22 $MMTCO_2E$
	Energy recovery offset	-0.58 $MMTCO_2E$
Landfilling**		
	Pre-2003 waste	1.30 $MMTCO_2E$
	Waste 2003-2015	0.04 $MMTCO_2E$
Total		**8.94 $MMTCO_2E$**

Negative numbers represent offsets. Positive numbers represent net emissions.
*Agricultural and forestry open burning not included
**For pre-2003 waste, only methane emissions and energy recovery offsets are included. For waste disposed of in 2003 and subsequent years, the number shown includes methane emissions, energy recovery offsets, transportation/equipment emissions in 2015, and the sizeable carbon storage offsets for materials disposed of in landfills.

REGULATORY VS. NON-REGULATORY APPROACHES

Several of the measures described below are characterized as new regulatory requirements of waste generators (businesses, households), local governments, and/or landfill operators. All of the regulatory measures have costs associated with them. However, for some measures, the associated reduction in greenhouse gas emissions could be achieved through financial incentives in lieu of regulation. For example, while the State could require all large landfills to capture 65% of methane by 2010 through a statutory requirement, the State (or another party) could also provide financial incentives that would achieve the same goal. In some cases, financial incentives (such as grants or tax credits) might a better option than regulation, especially where the costs and benefits are not well established.

UNCERTAINTY IN EVALUATING MEASURES

The Technical Subcommittee on Materials, Recovery and Waste had difficulty evaluating certain measures (options), in part because of time constraints and insufficient data. Specific measures of interest to the Advisory Group can be evaluated further and with greater precision at a later date, if desired.

For the most part, the Technical Subcommittee has relied on U.S. EPA emissions factors for the many different types of materials/wastes (steel, aluminum, corrugated, newsprint, etc.) and their different management options (recycling, landfilling, etc.). Some estimates of GHG emissions and savings potential have significant uncertainty and should be considered in that context. Tools, data, and accounting standards for evaluating greenhouse gas impacts of the materials life cycle are still relatively new and substantial research is needed to improve their accuracy.

Several measures vary in their degree of stringency. For example, requirements that landfills collect 50% of generated methane will have a different effect on emissions than a requirement that landfills collect 80% of generated methane, and will have correspondingly different economic repercussions. Some measures are evaluated at varying levels of intensity or implementation, while others are evaluated at only one level.

The effectiveness of measures also varies over time. For example, the placement of a ton of waste in a solid waste landfill is expected to generate a certain quantity of methane over the period of its decomposition. However, decomposition in "wet" landfills (such as those in Western Oregon) occurs much faster than decomposition in "dry" landfills (including the Columbia Ridge landfill in Arlington, which is the largest in the state and repository for most of the Portland area's garbage). Thus, diverting putrescible wastes from landfills in any single year will lead to reductions in actual methane emissions over a period of several decades (in Western Oregon) or even several centuries (in Eastern Oregon). An important corollary to this fact is that programs that divert certain carbonaceous wastes from landfills, even if only for one year, will result in reductions in methane emissions spread over many subsequent years. Therefore, for some measures, the estimates of greenhouse gas reductions in the years 2015 and 2025 significantly understate the full quantity of emissions reductions associated with the measure.

The difference between wet and dry landfills also means that waste-related greenhouse gas emissions and reduction potentials – both in terms of absolute amounts and timing – vary in different areas of the state.

Projections of methane emissions from solid waste landfills also are uncertain and somewhat controversial because of limited data. A variety of computer models are used to project methane emissions but the models suffer from some uncertainty and results are dependent on the quality of data inputs. Measuring actual methane emissions from landfills is quite difficult.

The greenhouse gas reduction impacts of individual measures are also influenced by whether or not additional measures are implemented. For example, enhancing methane collection at landfills will reduce the greenhouse gas benefit of diverting highly putrescible wastes such as food away from those landfills and towards composting sites. (The greenhouse gas benefit of food waste composting is a function of many variables, including the presence or absence of gas collection and energy recovery at landfills, the timing of any changes in gas collection, and whether the food is being diverted from a wet or a dry landfill.) Conversely, achieving the state's waste generation and recovery goals will result in lower emissions from landfills over time, thus decreasing the benefit of enhanced energy recovery systems at those landfills.

Finally, it is important to note that all emissions reported below are *net* emissions. In the accounting approach used by the U.S. EPA and the Technical Subcommittee, certain types of

activities contribute to offsets which are counted as negative emissions. Using landfills again as an example, there are four categories of emissions, two of which are offsets (negative emissions):

- CO_2 emissions from equipment used to operate the landfill (positive number).
- Methane emissions from the landfill (positive number).
- An offset for landfills that recover energy from landfill gas, which decreases the need to burn fossil fuels elsewhere (negative number).
- An offset for that portion of biogenic carbon which is expected not to decompose in a landfill (negative number). An example of this would be that portion of dimensional lumber which does not decompose. The U.S. EPA has defined a carbon sequestration offset for "carbon storage in landfills".

Because of this storage offset, a landfill with a moderately effective gas collection system might appear to have zero or even negative *net emissions*. However, ongoing emissions of heat-trapping methane continue and could be further reduced through enhanced gas collection systems.

(Technical note: Due to technical challenges, our accounting calculates emissions differently if the waste was generated before or after the start of 2003. For pre-2003 wastes, the only emissions and offsets accounted for are gross methane emissions from landfills and offsets from energy recovery from landfills. All other emissions and offsets from activities occurring prior to 2003, including carbon storage offsets and offsets associated with pre-2003 recycling and composting are not counted in this baseline. In contrast, the baseline counts all categories of emissions and offsets for the years 2003 and later. From the perspective of modeling impacts of future activities, this is a reasonable approach as reducing methane emissions from landfills is the only change we now can make to reduce emissions resulting from pre-2003 activities.)

MEASURES

This document evaluates measures relative to a common baseline and independent of other measures. Evaluation of "packages" of measures can be conducted at a later date as needed.

Figure 3 lists the measures that were identified by the Technical Subcommittee and where DEQ's evaluation indicates potential for a reduction in greenhouse gas emissions. A few measures identified by the Technical Subcommittee are not shown, as analysis revealed that they would increase net emissions rather than reducing them. Each of the measures in Figure 3 is described in greater detail in the remainder of this report. Measures are grouped according to their place on the State's "solid waste management hierarchy" (ORS 459.015), which ranks the preferred order of waste management options in order as follows:

1. prevention/reuse
2. recycling,
3. composting,
4. energy recovery, and last
5. landfilling.

Information sources used to evaluate specific measures include waste composition studies, existing policy documents and feasibility studies, reports from evaluation of existing programs in Oregon and elsewhere, and in some cases, estimates informed by the professional judgement of individual subcommittee members.

Figure 3.
Summary of Measures

Measures		**Reductions in Greenhouse Gas Emissions in $MMTCO_2E$* (% of Baseline)**	
		2015	**2025**
Waste Prevention/Reuse			
1.	Achieve the waste generation goals in statute.	1.4 (15%)	5.0 (37%)
2.	Provide grants to increase edible food rescue.	less than 0.01† (0.1%)	less than 0.01† (0.1%)
3.	Provide grants to increase salvage of reusable building materials.	0.01 (0.1%)	0.02 (0.1%)
Recycling			
4.	Achieve the recovery goals in statute.	0.15 (1.7%)	0.25 (1.8%)
5.	Subsidize development of agricultural plastics recycling infrastructure.	0.02 (0.2%)	0.02 (0.2%)
6.	Require all loads of construction & demolition debris to be sorted prior to disposal (Metro, Lane & Marion Wastesheds only)	0.03 (0.3%)	0.04 (0.3%)
7.	Require all dry waste loads to be sorted prior to disposal (Metro Wasteshed only)	0.02 (0.2%)	0.02 (0.2%)
8.	Require recycling of specific materials by businesses in certain areas	0.12 (1.3%)	0.26 (1.9%)
9.	Ban disposal of recyclable paper	0.17 (1.9%)	0.33 (2.4%)
10.	Increase "Bottle Bill" redemption value from 5-cents to 10-cents.	0.02 (0.3%)	0.03 (0.2%)
11.	Increase "Bottle Bill" redemption value from 5-cents to 10-cents and expand "Bottle Bill" to all beverages except milk, including juice, water, liquor, wine, tea and sports drinks.	0.04 (0.5%)	0.05 (0.4%)
Composting			
12.	Change land use laws to allow commercial composting on land zoned High Value EFU (exclusive farm use)	less than 0.01† (0.1%)	less than 0.01† (0.1%)
13.	Mandatory recovery of food wastes from larger businesses (Metro, Lane, and Marion Wastesheds only)	0.04† (0.4%)	0.11† (0.8%)
14.	Implement combined residential food & yard debris collection and composting in cities >10,000 population (Metro, Lane, and Marion Wastesheds only)	less than 0.01† (0.1%)	less than 0.01† (0.1%)
Waste Combustion			
15.	Discourage on-site burning of garbage, particularly fossil-carbon derived materials	0.01 (0.1%)	0.02 (0.2%)
Disposal (Landfilling)			
16.	Continue landfill regulation with additional reporting and analysis	Unknown	Unknown
17.	DEQ develop guidance to clarify alternative final cover performance at larger landfills: Demonstrate control of gas emissions comparable to geomembrane cover	0.22 (2.5%)	0.53 (3.9%)
18.	Require (and/or provide incentives for) larger landfills to collect and burn minimum percentage (65% to 80%) of methane generated	@65%: 0.42 (4.7%) @80%: 0.70 (7.8%)	@65%: 0.47 (3.4%) @80%: 0.79 (5.8%)
19.	Evaluate methane emissions from closed landfills and options to reduce such emissions	Unknown	Unknown

*Million Metric Tons of Carbon Dioxide Equivalent

†Actual reductions over time could be several times higher than shown, depending on the measure and the details of implementation. Most of the greenhouse gas benefit of these measures is associated with reducing methane generation at landfills; for the dry landfill that accepts most of the Metro area's waste, methane generation occurs up to 150+ years following disposal, so the majority of emissions offsets occur after the 2015 and 2025 time horizons of this project.

1. Achieve the Waste Generation Goals in Statute.

ORS 459.015 establishes the following solid waste generation goals for Oregon:

- By 2005 and in all subsequent years, no increase in per-capita waste generation.
- By 2009 and in all subsequent years, no increase in total waste generation.

There is currently no plan in place to achieve these goals, which were added to statute by the 2001 Legislature. DEQ and several local governments have a number of pilot projects currently in various stages of implementation and evaluation and DEQ is scheduled to develop a waste generation plan during the current biennium. Lacking details on how these goals would be achieved, it is not realistic to evaluate the cost, feasibility, etc. of this measure. Therefore, this measure is evaluated for its greenhouse gas reduction potential only, assuming that reductions in waste generation occur across all material types.

Because of significant emissions in manufacturing stages of the life cycle, some materials, such as aluminum, carpet, and electronics, have relatively high per-ton reductions in greenhouse gas emissions associated with waste prevention and reuse. Other materials have relatively low per-ton emissions reductions but are present in such large quantity that significant emissions reductions can still be realized through waste prevention.

CRITERIA	**COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	1.4 $MMTCO_2E$* in 2015 5.0 $MMTCO_2E$ in 2025	
2. Cost Effects?	Unknown but potentially significant. Some waste prevention measures will reduce costs to Oregon households and businesses.	
3. Technically Feasible?	Unknown.	
4. If legislation or regulation needed, how difficult?	Unknown. Difficulty of legislation will vary, could be very difficult.	
5. Early or delayed reductions; permanent or temporary?	Most reductions occur early, but reductions in landfill emissions are delayed.	
6. Equitable distribution of costs/impacts?	Unknown.	

*Million metric tons of carbon dioxide equivalent.

2. Provide Grants to Increase Edible Food Rescue (Waste Prevention/Reuse)

Oregon is consistently ranked as having among the highest rates of hunger and food insecurity in the nation. At the same time, grocery stores, restaurants, hotels and other businesses dispose of millions of pounds of edible but perishable food annually. Many food banks are not equipped to collect and redistribute perishable food because they lack sufficient equipment. Grants to food banks for refrigerated trucks, walk-in coolers and freezers etc. can help establish the infrastructure necessary for edible food rescue.

Between 1999 and 2003, Metro made significant investments in these types of projects, although that funding has now ended. DEQ is currently providing limited funding support for edible food recovery through its solid waste grants program for local governments. In all areas of the state, potential exists for more effort in this area. The amount of potentially divertable edible food currently being disposed of has not been well documented.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.003 $MMTCO_2E$* in 2015 0.003 $MMTCO_2E$ in 2025	
2. Cost Effects?	Approximately $4 million in grants over 20 years. However, the value of the additional recovered food is much higher. An analysis of Metro's program suggests a benefit of $31 per $1 in grant funds spent.	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Not difficult except for funding.	
5. Early or delayed reductions; permanent or temporary?	Long term effects; equipment lasts approximately 10+ years following grant but reductions in landfill methane generation are delayed.	
6. Equitable distribution of costs/impacts?	Depends on funding mechanism.	

*Metro's $573,000 in food recovery infrastructure grants between 1999 and 2002 have led to an increase in food recovery of approximately 5,200 tons/year. We assume that statewide potential is at least an additional 20,000 tons/year and that diversion is maintained for ten years following the new grants. Most of the greenhouse gas benefit of this measure is associated with reducing methane generation at landfills (food is highly putrescible); for the dry landfills that accepts most of the State's waste, methane generation occurs up to 150+ years following disposal, so the majority of emissions offsets occur after the 2015 and 2025 time horizons of this project. Actual greenhouse gas reductions over time could be up to 4 times higher than shown.

3. Provide Grants to Increase Salvage of Reusable Building Materials (Waste Prevention/Reuse)

Salvage of reusable building materials, sometimes called "deconstruction" is growing in popularity in Oregon. Some buildings slated for demolition contain valuable furnishings and fixtures, high-value wood flooring, moulding and structural lumber, and other materials that can be reused such as doors and sinks. A growing number of not-for-profit organizations are trying to capture reuseable building materials and resell them for reuse.

In this measure, the state would provide grants, presumably for capital expenses, to help establish an infrastructure of reusable building materials sites. In addition to environmental and resource benefits, building material salvage provides more affordable materials to middle- and lower-income households.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.011 $MMTCO_2E$ in 2015 0.016 $MMTCO_2E$ in 2025	
2. Cost Effects?	$2.3 million in grants between 2010 and 2025.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	Not difficult except for funding.	
5. Early or delayed reductions; permanent or temporary?	Most reductions are immediate.	
6. Equitable distribution of costs/impacts?	Yes.	

4. Achieve the Waste Recovery Goals in Statute (Recycling/Composting)

ORS 459.015 establishes the following solid waste recovery goals for Oregon:

- 45% recovery in 2005.
- 50% recovery in 2009.

In 2002, the State's recovery rate was 46.6%. The 2003 recovery rate, which is currently being calculated, may be lower due to reduced demand for waste urban wood as fuel in industrial boilers. Achieving this measure may require several new initiatives, examples of which are described as subsequent measures below. Therefore, like the waste generation goal, this measure is evaluated for its greenhouse gas reduction potential only.

The greenhouse gas benefit of material recovery varies widely across material types (mixed waste paper, film plastics, tires, etc.) and management methods (recycling, composting, combustion with energy recovery). For example, recycling a ton of aluminum reduces net emissions more than recycling a ton of office paper, but there is more office paper disposed of in Oregon than aluminum cans. And while many recovery activities decrease net emissions, a few (such as energy recovery from tires and motor oil) actually *increase* net emissions.

The state of Oregon and all wastesheds in Oregon ("wastesheds" include Metro, all other counties, and one city) have waste recovery goals for 2005 and 2009. Because the waste recovery rates are calculated on a tonnage basis, strategies to achieve the goals have often involved targeting materials that are heavy and/or are disposed of in significant quantities. Some recovery proposals have emphasized the idea of "keeping material out of landfills" without consideration of broader environmental impacts. Improved analysis and evaluation tools, education of private industry and government staff, and even directives from the Governor's office and/or Legislature to include environmental considerations other than recovery rates (such as greenhouse gases) in program planning would likely lead to improvements in the environmental benefit of waste recovery programs as a whole.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.15 $MMTCO_2E$ in 2015* 0.25 $MMTCO_2E$ in 2025*	
2. Cost Effects?	Unknown but potentially significant.	
3. Technically Feasible?	Yes, but highly dependent on strong market demand for recyclables and compostables as well as energy recovery.	
4. If legislation or regulation needed, how difficult?	Unknown but potentially difficult (see measures below).	
5. Early or delayed reductions; permanent or temporary?	Some reductions occur immediately, while others are delayed.	
6. Equitable distribution of costs/impacts?	Unknown.	

*Assumes 50% recovery rate is achieved through increases in recycling, composting, and energy recovery across a variety of materials. Actual reductions over time could be lower or higher than shown. Some of the greenhouse gas reduction resulting from this measure is associated with reducing methane generation by diverting food waste from landfills (food is highly putrescible); for the dry landfills that accepts most of the State's waste, methane generation occurs up to 150+ years following disposal, so most of these emissions offsets occur after the 2015 and 2025 time horizons of this project.

5. Subsidize Development of Agricultural Plastics Recovery Infrastructure (Recycling)

Nurseries, dairies, and other farms use large quantities of plastics. A significant (and difficult to quantify) amount of waste plastics never enters the solid waste "system" but is stockpiled on-site. Several studies estimate that more than half of agricultural plastics are burned on-site, with significant air quality impacts. Recycling agricultural plastics reduces greenhouse gas emissions associated with open burning as well as from energy savings in the recycling process. Oregon is home to one company that specializes in agricultural plastics recycling.

The State could provide financial assistance to help build the agricultural plastics recycling infrastructure. This could take the form of grants and/or low-interest loans to help capitalize the system, as well as operating costs to help pay for the clean-up of existing stockpiles of agricultural plastics. Alternatively, the State could ask or require the agricultural plastics industry to provide assistance with recovery of their products. (Assistance could include financing and/or back-haul of wastes.)

While the logistics of agricultural plastics recycling is difficult, this measure involves a relatively small number of waste generators. Many farmers and growers are willing to keep their waste plastic dry and separated from other wastes if it can be collected at no charge. Some local trade associations have been very interested in identifying solutions to the problem of agricultural plastics waste.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.021 $MMTCO_2E$ in 2015* 0.021 $MMTCO_2E$ in 2025	
2. Cost Effects?	Unknown at this time, potentially in the range of $500,000/year.	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Difficult if producer responsibility is mandated. Securing stable State funding is also difficult.	
5. Early or delayed reductions; permanent or temporary?	Reductions are immediate but are only maintained as long as recycling activities continue.	
6. Equitable distribution of costs/impacts?	Depends on funding mechanism.	

*Assuming current level of agricultural plastics recycling can be doubled.

6. Require Construction & Demolition Debris Loads to Be Sorted Prior to Disposal: Metro, Lane & Marion Wastesheds Only (Recycling)

Construction and demolition (C&D) activities generate large quantities of recoverable steel and corrugated (for which markets are stable) as well as wood, film plastics, drywall, and roofing (for which markets are less secure).

While some construction/demolition contractors source separate recyclables at the job site, others do not. Some loads of mixed C&D waste are sent from the job site to materials recovery facilities (MRFs) where higher-value materials are sorted by manual and mechanical means and removed for recycling.

Under this measure, the State would require that loads of mixed C&D waste be sorted at MRFs prior to disposal, in the Metro area as well as Marion and Lane Counties. C&D MRFs already exist in these areas.

Metro's Council recently directed staff to convene a work group to develop details of how this measure might be implemented in the Metro area.

The only two C&D waste landfills in the Metro region are both in Washington County, which has expressed several concerns with this measure. In a worst case scenario, this measure might contribute to the closure of one of the two landfills, which would reduce competition and increase rates, and additional funding might be needed to pay for early closure of the site.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.032 $MMTCO_2E$ in 2015 0.036 $MMTCO_2E$ in 2025	
2. Cost Effects?	Unknown at this time.	
3. Technically Feasible?	Yes, but highly dependent on strong market demand for recyclables as well as energy recovery.	
4. If legislation or regulation needed, how difficult?	Legislation required and would be difficult.	
5. Early or delayed reductions; permanent or temporary?	Mixed; recycling and recovery reductions are immediate; disposal impacts are extended over time.	
6. Equitable distribution of costs/impacts?	Disposal sites and integrated collection companies with installed MRF capacity would benefit; two privately owned disposal sites without existing MRF capacity would face significant capital costs or lose market share.	

7. Require All Dry Waste Loads to Be Sorted Prior to Disposal: Metro Wasteshed Only (Recycling)

"Dry waste" is garbage that does not include food or other putrescible materials. It includes loads of waste from businesses that contain materials such as paper, plastic film, wood pallets, etc. Two landfills in the Portland Metro area accept dry waste for disposal. In addition, some of the other disposal sites (transfer stations) in the area take mixed commercial drop boxes that contain only dry waste.

In this measure the State would prohibit the disposal of unsorted dry waste at disposal sites in the Metro region, including dry waste landfills as well as solid waste transfer stations. Loads of dry waste would be required to be sorted at material recovery facilities (MRFs) prior to disposal. Several MRFs already exist in the Metro region.

Metro's Council recently directed staff to convene a work group to develop details of how this measure might be implemented in the Metro area.

The only two dry waste landfills in the Metro region are both in Washington County, which has expressed several concerns with this measure. In a worst case scenario, this measure might contribute to the closure of one of the two landfills, which would reduce competition and increase rates, and additional funding might be needed to pay for early closure of the site.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.017 $MMTCO_2E$ in 2015* 0.022 $MMTCO_2E$ in 2025*	
2. Cost Effects?	Unknown at this time.	
3. Technically Feasible?	Yes, but highly dependent on strong market demand for recyclables as well as energy recovery.	
4. If legislation or regulation needed, how difficult?	Legislation required and would be difficult.	
5. Early or delayed reductions; permanent or temporary?	Mixed; recycling and recovery reductions are immediate; disposal impacts are extended over time.	
6. Equitable distribution of costs/impacts?	Disposal sites and integrated collection companies with installed MRF capacity would benefit; two privately owned disposal sites without existing MRF capacity would face significant capital costs or lose market share.	

*This measure is evaluated with the assumption that it is implemented concurrent with or following mandatory C&D waste sorting (described above). The benefit of this measure is limited to those dry waste loads coming from sources other than C&D sites.

8. Require Businesses in Certain Areas to Recycle Specific Materials (Recycling)

The State could require that businesses in certain areas of the state assume greater responsibility for their wastes by recycling materials such as corrugated cardboard (unwaxed), newspapers, and office paper. In many areas of the State, particularly between Portland and Eugene, recycling services for these materials are readily available at no additional fee to businesses. While many business waste generators are already recycling, some are not.

This requirement could be implemented by the Legislature (statutory change) or by the Environmental Quality Commission, which is currently authorized to mandate participation in recycling under certain circumstances. Although uncommon in the West, mandatory recycling is more common in the East and in Canada. As with other government mandates, this would likely be unpopular with many businesses.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.12 $MMTCO_2E$ in 2015 0.26 $MMTCO_2E$ in 2025	
2. Cost Effects?	Unknown at this time; likely cost increases in some areas.	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Might be implemented by rule; statute change could be more effective. Both would be difficult.	
5. Early or delayed reductions; permanent or temporary?	Mixed; recycling and recovery reductions are immediate; some disposal impacts are extended over time.	
6. Equitable distribution of costs/impacts?	No; requires participation by businesses or classes of businesses in certain areas.	

9. Ban Disposal of Recyclable Paper (Recycling)

Opportunities to recycle certain types of paper exist throughout much of Oregon. Under this alternative, the State would ban the disposal of certain grades of paper in certain wastesheds (counties).

Oregon already bans the disposal of lead acid batteries, tires, large appliances and liquids. Disposal bans for recyclable paper have been implemented in several communities outside of Oregon and in one state (Wisconsin); many communities and more than fifteen states have banned the disposal of all or certain types of yard debris.

This measure is evaluated assuming that corrugated (unwaxed) and newspaper would be banned in all counties where these materials have been designated by the Environmental Quality Commission to be "principal recyclable materials", which is all of the State except for five smaller Eastern Oregon counties. Other recyclable paper (office paper, phone books, magazines, boxboard) would be banned from disposal in the Metro area as well as Marion and Lane

Counties. This measure would apply to all waste generators (households and businesses). Recycling opportunities for these materials exist in these areas.

Garbage collection companies and landfill operators often oppose disposal bans for several reasons, including difficulties involving enforcement (who enforces and how enforcement is conducted) and identifying which waste generators are not recycling. Disposal bans are also opposed by the American Forest & Paper Association due in part to concerns that the quality of collected materials might decline. In addition, some local governments, such as Marion County, have expressed reservations with this measure as they also don't want their garbage haulers to assume enforcement responsibilities with waste generators. Conversely, some local governments find bans attractive because they encourage participation in recycling.

Typically, disposal bans are not enforced rigorously but rather are used to increase participation in recycling. For example, the Greater Vancouver Regional District (British Columbia) enforces its ban on the disposal of recyclable corrugated, newsprint and office paper with occasional spot checks at the landfill. Violations are only noted if garbage trucks contain more than 10% prohibited material, in which case and the garbage company is charged extra.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.17 $MMTCO_2E$ in 2015 0.33 $MMTCO_2E$ in 2025	
2. Cost Effects?	Unknown at this time.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	Legislation required and difficult.	
5. Early or delayed reductions; permanent or temporary?	Mixed; recycling and recovery reductions are immediate; disposal impacts are extended over time.	
6. Equitable distribution of costs/impacts?	Effects both households and businesses.	

10. Increase Bottle Bill Redemption Value from 5-cents to 10-cents (Recycling)

The deposit and redemption value for beverage containers covered under Oregon's "bottle bill" was established at 5 cents in 1970. Adjusted for inflation, it is worth about 1.6 cents in today's dollars. In recent years, the percentage of containers returned for deposit under the bottle bill has fallen.

This measure would change the deposit/redemption value of the bottle bill from 5 cents to 10 cents. It would make no other changes to the bottle bill. As a result, the recycling of bottle bill containers would increase. Most of the associated reductions in greenhouse gas emissions result from energy savings when post-consumer aluminum, glass and plastic displace the production of virgin resources.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.024 $MMTCO_2E$ in 2015 0.026 $MMTCO_2E$ in 2025	
2. Cost Effects?	Approximately $1.8 million/year in additional handling costs.	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Legislation required and difficult.	
5. Early or delayed reductions; permanent or temporary?	Savings occur immediately upon implementation.	
6. Equitable distribution of costs/impacts?	Under current system, retailers pay for handling costs while distributors retain escheats (unclaimed deposits). This would remain unchanged. Higher retailer costs are passed on to all consumers.	

11. Increase Bottle Bill Redemption Value from 5-cents to 10-cents <u>and</u> Expand Bottle Bill to all Beverages Except Milk Including Juice, Water, Liquor, Wine, Tea and Sports Drinks (Recycling)

This measure builds on the previous measure by increasing the deposit/redemption value from 5 to 10 cents, then goes a step further and expands the bottle bill to a much wider variety of beverage containers, many of which were not commercially available (or at least were uncommon) when the bottle bill was established in 1970.

This measure represents a major expansion of the bottle bill. There are other changes to the structure of the bottle bill that might also be proposed although these have more impact on distribution of costs and responsibilities and less impact on environmental results. These other issues include:

- Allowing redemption to occur at locations other than grocery stores, and exempting grocery stores from providing redemption if nearby alternatives are available.
- The formation of an industry-operated container stewardship organization to oversee and operate the redemption system.
- The disbursement of escheats (unredeemed deposits), which are currently maintained by the distributors.
- The addition of a processing fee to compensate redemption centers for their costs in handling bottle bill materials

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.044 $MMTCO_2E$ in 2015 0.050 $MMTCO_2E$ in 2025	
2. Cost Effects?	Approximately $3.5 million/year in additional handling costs.	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Legislation required and difficult.	
5. Early or delayed reductions; permanent or temporary?	Savings occur immediately upon implementation.	
6. Equitable distribution of costs/impacts?	Under current system, retailers pay for handling costs while distributors retain escheats (unclaimed deposits). Higher retailer costs are passed on to all consumers. This might be changed under a major redesign of the bottle bill.	

12. Change Land Use Rules to Allow Commercial Composting on Land Zoned High Value EFU (Exclusive Farm Use)

Composting of food wastes can significantly reduce net greenhouse gas emissions, both by reducing methane emissions from landfills and by sequestering carbon in agricultural soils treated with finished compost. However, food waste composting operations, even when operated at high standards, can create odor problems. Because of this, commercial food waste composters are not ideally suited for land zoned as industrial and, as a practical matter, cannot locate near residential or commercial lands without major capital investments (such as mechanical aeration systems with biofilters or totally enclosed composting operations).

Commercial composting that is not in conjunction with farm use is not allowed on lands zoned for high value exclusive farm use (EFU) use. According to compost industry experts, this makes it very difficult to site a commercial composting operation in most areas of the Willamette Valley, which are zoned high value EFU.

The goal of this measure is to allow for the establishment of composting capacity that is relatively close to waste generators (cities) and is protective of the environment while being affordable. Amending Oregon Administrative Rules (OAR) 660-033-0120 to allow commercial composting as a conditional use on lands zoned High Value EFU would likely allow for the establishment of a few commercial composting operations in the Willamette Valley. Because of high disposal fees for garbage in Marion County and the Metro area, a nearby commercial composter could likely set tip fees high enough to be profitable, yet low enough that larger waste generators could realize financial savings from separating their food wastes from their garbage.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.002 $MMTCO_2E$ in 2015* 0.004 $MMTCO_2E$ in 2025*	
2. Cost Effects?	Program would be voluntary and would lead to disposal cost savings for larger food-intensive businesses. Local governments might choose to spend some money to support establishment of collection (containers, education, etc.).	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	Rule change required by LCDC (Land Conservation and Development Commission).†	
5. Early or delayed reductions; permanent or temporary?	Reductions are delayed and accumulate over time.	
6. Equitable distribution of costs/impacts?	Yes	

*Actual reductions over time could be several times higher than shown. Most of the greenhouse gas benefit of this measure is associated with reducing methane generation at landfills (food is highly putrescible); for the dry landfills that accepts most of the State's waste, methane generation occurs up to 150+ years following disposal, so the majority of emissions offsets occur after the 2015 and 2025 time horizons of this project.

†Alternatively, a commercial composter could attempt to site on high value EFU land via an "exception area", which requires demonstrating that there is no other land available. Exceptions may be very difficult to obtain.

13. Mandatory Recovery of Food Wastes from Larger Businesses in Metro, Lane, and Marion Wastesheds (Composting)

The State could require that certain types of businesses (such as grocery stores, hospitals, restaurants and food processors) over a certain size separate their food waste from disposal. This could be accomplished through direct regulation of businesses and/or by requiring that local governments extend the "opportunity to recycle" to include food waste for certain classes and sizes of businesses. In either case it is assumed that this measure would be implemented only in the Metro area and in larger cities in Marion and Lane Counties. Requiring that local government implement this measure would be an unfunded mandate unless passed by a 3/5 majority of both houses of the Legislature; as an unfunded mandate the State would be responsible for reimbursing the local governments their costs of the program.

The City of Portland is planning to require separation of compostable food and paper from larger food-generating businesses once a transportation and composting infrastructure is securely established. The City's experience under a pilot project and from rate modeling is that food waste separation can be cost effective (relative to disposal) for larger waste generators, but mandatory participation could increase costs for medium- and smaller-sized businesses. The situation elsewhere in the Metro region and Marion County is fairly comparable as disposal fees in both areas are about $70/ton; however, Portland is unique among larger Oregon cities in that it does not set commercial garbage rates. In Lane County, the garbage tipping fee is considerably lower (about $45/ton) and this lower potential for avoided disposal savings will result in higher net costs to businesses required to participate in this program (relative to Metro and Marion County).

While mandatory programs can be unpopular, they can improve program cost effectiveness by increasing the on-route density of participants, thus allowing for greater collection tonnages per hour of truck and driver time.

One added environmental benefit of this program would be a reduction in food waste sent into wastewater systems.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.04 $MMTCO_2E$ in 2015* 0.11 $MMTCO_2E$ in 2025*	
2. Cost Effects?	Could save money for larger waste generators but will cost money for others. Cost to local governments (and DEQ): unknown at this time.	
3. Technically Feasible?	Yes but contingent on establishment of commercial composting sites with affordable tipping fees.*	
4. If legislation or regulation needed, how difficult?	Legislation needed and difficult.	
5. Early or delayed reductions; permanent or temporary?	Varies by location; most benefits are delayed and ongoing.	
6. Equitable distribution of costs/impacts?	Depends on details of implementation.	

*Estimates assume that local composting infrastructure is established near Portland, Salem, and Eugene. Actual reductions over time could be up to 4 times higher than shown. Most of the greenhouse gas benefit of this measure is associated with reducing methane generation at landfills (food is highly putrescible); for the dry landfills that accepts most of the State's waste, methane generation occurs up to 150+ years following disposal, so the majority of emissions offsets occur after the 2015 and 2025 time horizons of this project.

14. Implement Combined Residential Food & Yard Debris Collection and Composting in Cities >10,000 Population in Metro, Lane, and Marion Wastesheds (Composting)

Metro and the City of Portland are currently studying the impact of adding food waste and non-recyclable (but compostable) paper to curbside yard debris collection programs. This measure would provide incentives or requirements to make this kind of weekly "mixed organics" collection a standard service for households in the Metro area and Marion and Lane Counties. (If mandated, the State could be required to pay extra costs as an unfunded mandate.) With food waste diverted into the mixed organics bin, mixed organics would be collected weekly and dry (non-putrescible) garbage might be collected less frequently.

The greenhouse gas benefit of this measure depends in part on whether or not facilities that can compost mixed residential organics can be established in the Willamette Valley. Currently, residential yard waste in Oregon is composted by a network of private companies in or near the cities where the waste is generated. If the mixed organics have to be shipped long distances because of problems siting food waste composters in the Willamette Valley, the resulting increase in fuel use significantly diminishes the greenhouse gas benefit of this measure. Diversion of recyclable paper into the organics mix would further reduce the greenhouse gas benefit of this measure.

Adding food wastes to residential yard debris could significantly impact some private compost operations which, due to location or other reasons, cannot compost food waste and would lose a significant source of feedstock (and revenue) if this measure is implemented.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.002 $MMTCO_2E$ in 2015* 0.009 $MMTCO_2E$ in 2025*	
2. Cost Effects?	Unknown at this time.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	Probably required outside of Metro area; would be difficult due to unfunded mandate.	
5. Early or delayed reductions; permanent or temporary?	Reductions are delayed and accumulate over time.	
6. Equitable distribution of costs/impacts?	Would most likely increase costs to households, but not business waste generators. Could negatively impact some yard debris composters.	

*Estimates assume that local composting infrastructure is established near Portland, Salem, and Eugene. Actual reductions over time could be up to 4 times higher than shown. Most of the greenhouse gas benefit of this measure is associated with reducing methane generation at landfills (food is highly putrescible); for the dry landfills that accepts most of the State's waste, methane generation occurs up to 150+ years following disposal, so the majority of emissions offsets occur after the 2015 and 2025 time horizons of this project.

15. Discourage On-Site Burning of Garbage, Particularly Fossil-Carbon Derived Materials (Combustion)

Burning of garbage in burn barrels, burn piles, and fireplaces is a source of greenhouse gases and a wide variety of air toxics. It also can create fire risks. Greenhouse gases of concern are carbon dioxide from the combustion of fossil-derived materials (plastics, synthetic fabrics, tires, rubber) and nitrous oxide from combustion of paper and wood.

Outdoor burning of plastics, rubber and tires is already illegal in Oregon. Additional restrictions on open burning at both the state (DEQ/EQC) and local (city, fire district) level further limit the outdoor burning of other wastes. Still, in some areas of the state, significant quantities of wastes are burned.

The State could work with local governments, including fire districts, to further discourage on-site burning of garbage. (The baseline scenario assumes that existing restrictions and enforcement programs remain in place.) This could include education of households and businesses and the development of model ordinance language to make it easier for local governments to adopt burning restrictions.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.01 $MMTCO_2E$ in 2015* 0.02 $MMTCO_2E$ in 2025*	
2. Cost Effects?	$100,000/year or less for outreach. Significant public health benefit in some areas from reducing outdoor burning of wastes.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	Funding only. Local governments may choose to add local restrictions.	
5. Early or delayed reductions; permanent or temporary?	Reductions are immediate.	
6. Equitable distribution of costs/impacts?	Yes.	

*Very difficult to estimate due to insufficient data on current quantities and types of waste burned.

16. Continue Landfill Regulation with Additional Reporting and Analysis

DEQ will continue to require the installation of methane controls at landfills to meet federal and state regulations. Under this measure, DEQ would require additional reporting of estimates of methane generation, collection, and collection system effectiveness at larger landfills.

Collection system effectiveness is defined as gas collection divided by gas generation. One challenge is that while gas collection is easily measured, gas generation is not. Normally landfill engineers rely on computer modeling to estimate gas generation. Under this alternative, DEQ would support landfill operators interested in conducting actual measurements and enhanced modeling of generation.

Ongoing administration of current environmental laws, and compliance with those laws, is assumed as part of the baseline forecast. This measure would result in additional reductions in gas emissions if landfill owners chose to improve further upon gas collection systems in order to maintain competitiveness in a marketplace where potential customers (particularly local governments) might include greenhouse gas considerations in their procurement of disposal services.

Specific Actions:

- Continue to implement Title V regulations for control of methane emissions at landfills and installation of wells in active areas where waste has accumulated for five or more years.
- Require annual reporting of methane generation, collection and collection effectiveness (much of this reporting is already occurring).
- Encourage landfill owners/operators to collect actual data on gas generation.
- Evaluate the accuracy of measurement efforts.

CRITERIA	**STAFF COMMENTS**	**ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS**
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Unknown.*	
2. Cost Effects?	Unknown.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	None required.	
5. Early or delayed reductions; permanent or temporary?	Improvements in gas collection systems result in immediate and long-lasting reductions in emissions.	
6. Equitable distribution of costs/impacts?	Yes.	

*****Could result in additional reductions in gas emissions particularly if local governments and/or waste collection companies include greenhouse gas considerations in their procurement of disposal services.

17. DEQ Develop Guidance to Clarify Alternative Final Cover Performance at Larger Landfills: Demonstrate Control of Gas Emissions Comparable to Geomembrane Cover

When landfills in wet climates are closed, they are normally covered with an impermeable geomembrane, primarily in order to reduce infiltration of rain water into the landfill. Because methane cannot easily pass through such a cover, geomembranes have the added advantage of improving the effectiveness of methane collection systems. EPA rules allow DEQ's Director to approve "alternative final cover" designs (such as thick layers of soil) as long as these covers are, at a minimum, comparable to the standard design (geomembrane) at reducing infiltration and stormwater runoff. As a practical matter, alternative final covers are only feasible in dry areas east of the Cascades.

Under this measure, DEQ would revise landfill guidance so that alternative final covers would also need to be as effective at reducing greenhouse gas emissions as a conventional (geomembrane) cover. Such a guidance change might only effect three to four landfills in Oregon.

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	0.22 $MMTCO_2E$ in 2015 0.53 $MMTCO_2E$ in 2025	
2. Cost Effects?	$18.4 million between 2010 and 2015* $10.6 million between 2015 and 2025*	
3. Technically Feasible?	Yes	
4. If legislation or regulation needed, how difficult?	No new legislation needed.	
5. Early or delayed reductions; permanent or temporary?	Effective upon implementation; measure is permanent and long-lasting.	
6. Equitable distribution of costs/impacts?	Assuming that costs are passed back to customers through rates, this would increase garbage costs for users of the larger eastside landfills. Users of landfills where a geomembrane cover is already planned/required would not see a rate impact.	

*Landfills in dry areas are currently allowed to install alternative final covers that cost less than the standard, prescribed design (geomembrane). This measure would continue to allow for alternative designs but the potential cost savings would be less. The costs estimated here are costs compared to the existing minimum allowed as an alternative final cover. Even with these increased costs, landfills would still save money relative to the prescribed (default) design, which DEQ is currently authorized to require at all landfills.

18. Require (and/or Provide Incentives for) Larger Landfills to Collect and Burn a Minimum Percentage (65% to 80%) of Methane Generated (Disposal)

Under this measure, the Legislature would establish mandatory methane collection goals for large landfills subject to existing EPA New Source Performance Standards (NSPS) for landfill gas, or direct the DEQ to establish such goals through rule.

For the purpose of this analysis, we have modeled this measure at two different levels: 65% and 80% by the year 2010, applied to the eight landfills expected to be open in 2010 that are or are eventually expected to be subject to NSPS. Of these, six are privately owned while the other two are owned by Lane and Deschutes Counties. Three of the eight landfills are already at or above 80% gas collection rates; two more are estimated at being between 65% and 80%; two are in the 20% to 40% range; and the last has minimal gas collection.

Gas collection rates are defined as gas collection divided by gas generation. One significant challenge is that while gas collection is easily measured, gas generation is not. Normally landfill engineers rely on computer modeling to estimate gas generation. Under this alternative, landfills required to increase their gas collection rate would have the opportunity to demonstrate an alternative gas generation estimate in order to achieve partial or full compliance with the goals.

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	<u>65% collection goal:</u> 0.42 $MMTCO_2E$ in 2015 0.47 $MMTCO_2E$ in 2025 <u>80% collection goal:</u> 0.70 $MMTCO_2E$ in 2015 0.79 $MMTCO_2E$ in 2025	
2. Cost Effects?	<u>65% collection goal:</u> $3.4 million between 2010 and 2025* <u>80% collection goal:</u> $4.9 million between 2010 and 2025*	
3. Technically Feasible?	Yes, although significant uncertainty can exist in estimates of gas generation (and thus collection efficiency).	
4. If legislation or regulation needed, how difficult?	Legislation and regulation would be required and would be difficult.	
5. Early or delayed reductions; permanent or temporary?	Permanent.	
6. Equitable distribution of costs/impacts?	Landfills already at or above 65% or 80% would not incur expenses; garbage rate impacts would vary across the state.	

*In some cases, this measure will cause landfill operators to accelerate installation of gas collection equipment that would be installed at a later date anyways, without this measure.

19. Evaluate Methane Emissions from Closed Landfills and Options to Reduce Such Emissions

Oregon is home to many smaller landfills which are now closed and have no or very limited engineered methane controls. The quantity of methane emitted from these landfills is unknown but is estimated (in 2003) to be about half as much as the emissions from the larger open landfills. Emissions from these closed landfills are (on the whole) are assumed to be falling while emissions from larger open landfills continue to climb as waste disposal continues to increase.

Under this measure, the State would evaluate methane emissions from closed landfills and conduct a feasibility and cost-benefit study of methods to reduce emissions. Few if any of these closed landfills have closure funds available to spend on methane controls, so implementation of any such controls would require additional funding.

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Potentially.	
2. Cost Effects?	$50,000 - $100,000 for the study; additional for implementation.	
3. Technically Feasible?	Yes.	
4. If legislation or regulation needed, how difficult?	None.	
5. Early or delayed reductions; permanent or temporary?	Reductions would occur as soon as controls are installed but would decline over time as gas generation declines.	
6. Equitable distribution of costs/impacts?	Depends on mechanism for funding implementation.	

Other Measures (Not Evaluated)

The Technical Subcommittee identified several measures which were not evaluated due to lack of time and/or insufficient information. These measures include:

- Educate the solid waste community about greenhouse gas emissions and opportunities to reduce them. (In addition to four Technical Subcommittee meetings and two meetings with the State Solid Waste Advisory Committee that have already been held in association with this project, a two-hour workshop on climate change and waste is scheduled for the Association of Oregon Recyclers annual conference in June.)
- Better incorporate greenhouse gas information into solid waste program decision making.
- Provide greater financial incentives to landfill operators to reduce gas emissions and recovery energy.
- Provide greater financial incentives to recovery energy from urban waste wood.
- Incorporate materials prevention, reuse, recycled content, and recycling activities into the growing “green building” movement.

- Incorporate waste prevention, recycling, and "buy recycled" efforts into other outreach to businesses (such as business outreach programs funded by the Energy Trust of Oregon).
- Reduce the frequency of garbage collection and/or recycling collection.
- Explore the use of crumb rubber as an asphalt additive, particularly to see if it reduces rolling resistance from tires.
- Explore the use of finished compost as an "oxidation layer" to reduce methane emissions at landfills. Compost could be used as a final cover over closed landfills, and as part of an interim cover at open landfills.
- Reducing burning of wastes through mandatory garbage collection.
- Ban food waste from landfills.
- Re-evaluate whether food waste composting presents environmental and health risks comparable to other compost feedstocks and modify permitting standards if appropriate (this would reduce costs to compost facility operators).