Part Two

SECTION 1

Introduction to Recommended Actions

The Advisory Group's list of recommended actions fall under seven major areas:

- **Integrating Actions (IA)**
- **Energy Efficiency (EE)**
- **Electric Generation and Supply (GEN)**
- **Transportation (TRAN)**
- **Biological Sequestration (BIOSEQ)**
- **Materials Use, Recovery and Waste Disposal (MW)**
- **State Government Operations (GOV)**

Actions are also grouped as Category I or Category II as follows:

> **Category I: Significant Actions for Immediate State Action.** These actions promise significant greenhouse gas savings (usually greater than or equal to 0.25 million metric tons/year of CO_2 or equivalent savings); are technically feasible today; and are often the most cost-effective first actions to be taken.
>
> **Category II: Other Immediate Actions.** These actions make sense for Oregon to undertake immediately. In most cases the greenhouse gas savings are less significant, but costs are also proportionately lower and many actions are cost-effective now.

Each specific action is identified with an abbreviation denoting the action area and a number for reference (e.g., IA-1). Category I and State Government Operations actions are listed below. A full discussion of Category I and II recommended actions under the seven major areas follows.

Table 1
Category I and State Government Operations

Integrating Actions

IA-1	Recommend the Governor adopt near-term, intermediate and long-term greenhouse gas emissions goals for Oregon.
IA-2	Urge the Governor to renew the charter of the Advisory Group on Global Warming (or a successor body) to continue the Advisory Group's unfinished agenda.
IA-3	The Oregon University System should develop strategic and targeted research, development and demonstration (RD&D) programs for greenhouse gas reduction technologies.
IA-4	The Advisory Group should work with state agencies, colleges and universities, schools, non-profit organizations and businesses to develop a global warming education program that will provide information and outreach to the public.

Energy Efficiency

EE-1	Meet the Northwest Power and Conservation Council goal of implementing cost-effective electricity efficiency measures for electric users and an equivalent goal for natural gas users.

Electric Generation and Supply

GEN-1	Increase the renewable content of electricity.
GEN-2	Recommend the Governor create a special interim task force to examine the feasibility of, and develop a design for, a load-based greenhouse gas allowance standard.
GEN-3	Support Oregon PUC's review of rules and tariffs for renewable and combined heat and power facilities.

Transportation

TRAN-1	Convene an interim task force to recommend a proposal for the Environmental Quality Commission or the Governor and the Legislature to adopt emission standards for vehicles.
TRAN-2	Integrate land use and transportation decisions with greenhouse gas consequences.
TRAN-3	Promote biofuel use and production.

Biological Sequestration

BIOSEQ-1	Reduce wildfire risk by creating a market for woody biomass from forests.
BIOSEQ-2	Consider GHG effects in farm and forest land use decisions.
BIOSEQ-3	Increase forestation of under-producing lands.

Materials Use, Recovery and Waste Disposal

MW-1	Achieve the waste generation and recycling goals in statute.
MW-2	DEQ should develop guidance to clarify alternative final cover performance at larger landfills: Demonstrate control of gas emissions comparable to geomembrane cover.
MW-3	Provide incentives for larger landfills to collect and burn a minimum percentage (65 percent to 80 percent) of methane generated.

State Government Operations

GOV-1	State agencies should use their agency Sustainability Plans as the tool for agencies dynamic involvement in greenhouse gas reductions with respect to both their internal operations, and their external program or regulatory activities.
GOV-2	Through a collaborative effort, the Departments of Energy, Environmental Quality and Administrative Services should develop a process to educate agency personnel about opportunities for GHG reductions including how to set goals and calculate GHG reductions.

Criteria for Reviewing and Assigning Actions to Categories

The Advisory Group is a diverse group of Oregon citizens who brought equally diverse life experiences and perspectives to their task. Applying their perspectives was a valuable first step in evaluating the choices Oregon faces, but the Group used a more systematic evaluation tool. The Group agreed on the following criteria, although each Group member may weigh and prioritize these independently.

1. Are significant quantities of CO_2 or other greenhouse gases reduced, avoided or sequestered?
2. Are the reductions captured early or delayed?
3. Is the measure technically feasible? How do its costs compare to the costs of alternative actions (or inaction)?

4. Does the measure require new legislation or regulatory action? By whom? Are there political barriers to be addressed?
5. What collateral benefits or costs may accompany the measure? These might include uneven distribution of impacts, economic development gains, education values, demonstration values, and overlap with the West Coast Governors' Global Warming Initiative.

Estimated Reductions from Implementing Actions

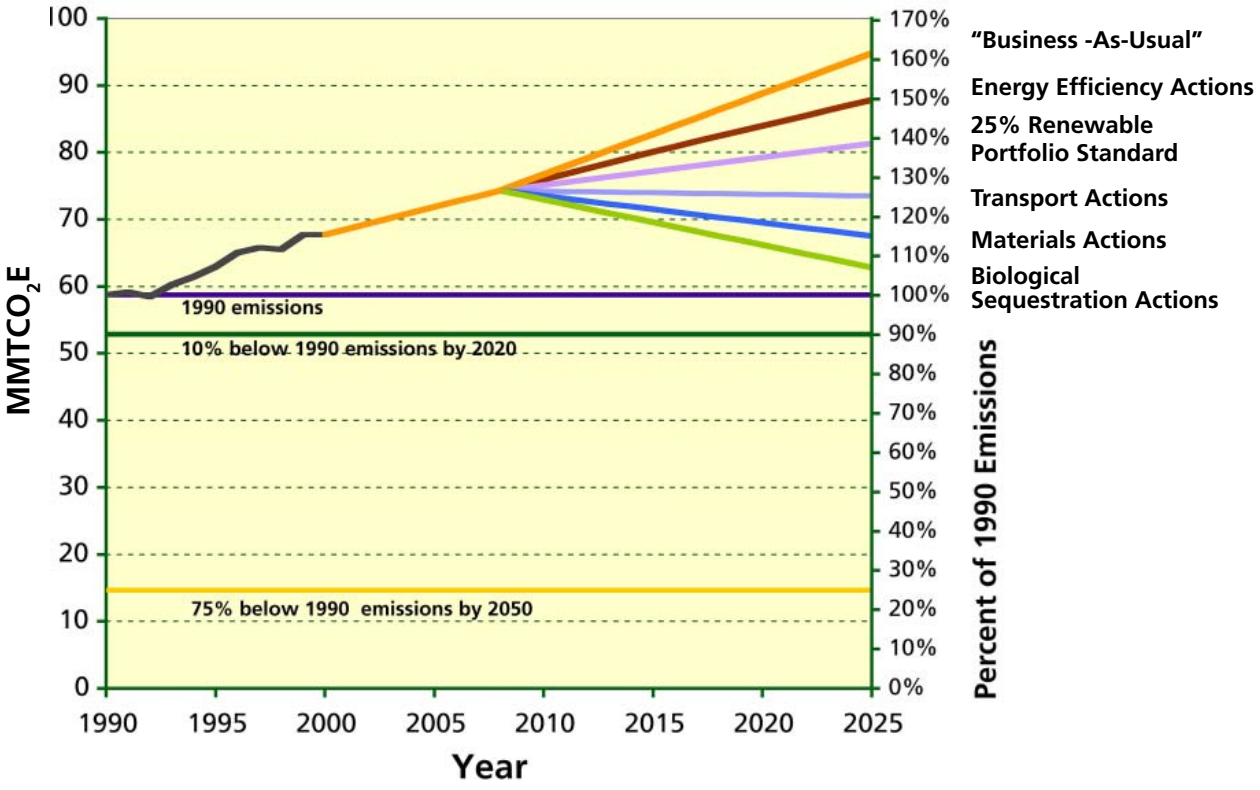
Figure 8 below integrates several aspects of historical and forecast emissions of greenhouse gases for Oregon, the mitigation actions and their relationship to the recommended goals. Emissions are expressed as million metric tons of carbon dioxide-equivalent (MMT CO_2E) in the left vertical axis from 1990 through 2025. It shows how far we can expect to reduce greenhouse gas emissions by implementing all the recommended actions in Part Two.

1. As in Figure 3 in Part One above, the horizontal lines show the level of greenhouse gas emissions (a) in 1990, (b) at 10 percent less than 1990 levels, and (c) at 75 percent below 1990 levels. These levels represent proposed goals for the State's strategy and provide a context for the expected reductions from the proposed actions. The 75 percent reduction of greenhouse gas emissions is what is required globally to stabilize atmospheric concentration of greenhouse gases at 550 parts per million of carbon dioxide equivalent, or double the pre-industrial concentration. Although double the pre-industrial concentration, this level is assumed to avoid serious climate impacts.
2. As in Figure 1 in Part One above, the black line that rises from 1990 to 2000 represents historical greenhouse gas emissions from Oregon. The orange line that continues beyond that represents a forecast of future emissions under a "business as usual" approach, which assumes we continue present activities (including many that now restrain greenhouse gas emissions), but take no additional special actions to reduce these emissions. The vertical axis on the right shows differences from 1990 levels, with 1990 representing 100 percent of emissions.
3. The graph then shows the cumulative, sequential reductions that would result from the proposed actions as subtractions from the "business as usual" approach. The reductions begin in 2008, based on the assumption that it would take that long for most of the new proposals to begin to be effective. The "actions" are the sum of the emissions reductions from each of the major types of recommended actions. Each "action" creates a new, lower forecast of emissions. For example, all of the reductions from energy efficiency actions are subtracted from "business as usual," then all of the reductions from adopting a 25 percent renewable portfolio standard are subtracted from the level achieved by the energy efficiency actions, and so forth. The reductions also account for the interactive nature of specific actions, as described in the discussion of the actions. Therefore, the total of all actions for a sector and between sectors is not necessarily the sum of all the individual actions within every sector.

   Also, the reduction labeled "25% Renewable Portfolio Standard" (RPS) should be seen as a placeholder for the carbon allowance standard proposal. In fact, the State could set a carbon allowance standard at any amount of reduction. If the recommendation for a

carbon allowance standard is adopted, it would be up to the task force designing the carbon allowance standard to recommend a specific level of reduction and the means – possibly including an RPS – to achieve that level.

FIGURE 8
Historic and Forecast Greenhouse Gas Emissions in Oregon and Estimated Cumulative Reductions from All Measures in Sequence



In sum, Figure 8 shows that if we continue "business as usual," by 2025 Oregon's greenhouse gas emissions would be 61 percent higher than 1990 levels. On the other hand, if we accomplish reductions from all the actions recommended in the report, our emissions would only be 7 percent higher than they were in 1990 and trending downward, consistent with the Advisory Group's recommended 2020 goal.

SECTION 2

Recommended Actions

Integrating Actions to Reduce Greenhouse Gases

Issue:
The four recommended Integrating Actions described in this section are crosscutting and affect the six other action areas. In order to slow and then reverse greenhouse gas (GHG) emissions, it is essential to have a long-term focus.

Solutions:
Action IA-1 recommends goals that provide a long-term context for all other actions. The goals extend out 45 years.

IA-2 recommends that the Governor continue the work this group has begun. This includes appointing a successor group that could oversee implementation of global warming actions, develop adaptation actions and develop additional actions to reduce GHGs.

IA-3 recommends the Oregon University System develop a research strategy for technologies and techniques to reduce GHGs and adapt to climate change. This would allow Oregon to foster new industries and would help Oregon's economy.

IA-4 recommends that the subsequent Advisory Group develop an education and information plan and implement it with stakeholders throughout the state.

Table 1 (IA)
Category I – Significant Actions for Immediate State Action

IA-1	Recommend the Governor adopt near-term, intermediate and long-term greenhouse gas emissions goals for Oregon.
IA-2	Urge the Governor to renew the charter of the Advisory Group on Global Warming (or a successor body) to continue the Advisory Group's unfinished agenda.
IA-3	The Oregon University System should develop strategic and targeted research, development and demonstration (RD&D) programs for greenhouse gas reduction technologies.
IA-4	The subsequent Advisory Group should work with state agencies, colleges and universities, schools, non-profit organizations and businesses to develop a global warming education program that will provide information and outreach to the public.

IA-1: Recommend the Governor adopt near-term, intermediate and long-term greenhouse gas emissions goals for Oregon.

Near-term Goal: The Advisory Group recommends the State meet its existing Benchmark #76, which specifies that carbon dioxide (CO_2) emissions should not exceed 1990 levels. Recognizing that Oregon is unlikely to meet that benchmark by 2010, the Advisory Group still recommends that Oregon retain this benchmark. As a near-term strategy, we recommend that by 2010 Oregon will arrest the growth of and begin to reduce Oregon's total greenhouse gas emissions, meeting or making measurable progress toward meeting Oregon's current CO_2 benchmark.

Based on current scientific guidance and goals adopted by other states and countries, we consider the following additional goals to be appropriate for Oregon:

Intermediate Goal: By 2020, Oregon's total greenhouse gas emissions will not exceed a level 10 percent below 1990 levels.

Long-term Goal: By 2050, Oregon's total greenhouse gas emissions will achieve a "climate stabilization" level at least 75percent below 1990 levels.

Background: Setting a Goal

Setting a goal and adopting actions that constitute a path to meet this goal send an important signal about the seriousness of Oregon's commitment to reduce greenhouse gas emissions. It encourages the expanded use of renewable energy and increased energy efficiency. It positions Oregon to take significant steps to protect the economic and environmental health of the region.

The appropriate objective of a greenhouse gas (GHG) emissions reduction goal or program is ultimately to prevent dangerous climate change, as stated in the goal of the United Nations Framework Convention on Climate Change. In order to meet such a goal, the first step must be to stabilize emissions and then begin to reduce them.

Most greenhouse gas goals are based on either returning to 1990 emission levels or achieving a reduction in emissions to a level below 1990. Often, there will be an initial goal of reaching 1990 levels, then later achieving the lower emissions target. For example, the Kyoto Protocol to the United Nations Framework Convention on Climate Change uses 1990 as the baseline year for its targets. The Protocol is scheduled to go into effect in February 2005.

Although the Bush Administration has stated it will not submit the Kyoto Protocol for ratification to the U.S. Congress, it is useful to use the same baseline year for goals that the Protocol and other entities have adopted. The first targets of the Protocol differ from what the Advisory Group has recommended for Oregon. If the Congress were to ratify the Protocol, it would have to meet a binding target for the U.S. of achieving a level that is 7 percent below its 1990 greenhouse gas emissions level, on average, over the period from 2008-2012. The Advisory Group is recommending that Oregon work on a longer time frame and aim for greater reductions over a longer time.

Numerous states and cities have adopted goals, either in plans or legislatively. Some address only CO_2; others address all GHGs. Most set 1990 as the base year and then set targets for 2010 and sometimes later for achieving levels below 1990. For example, the City of Portland and Multnomah County have a goal of reducing GHG emissions 10 percent below 1990 levels by 2010. In most cases, the states and cities have developed or are in the process of developing strategies to achieve their goals. Those that set long-term goals often include provisions to revisit the goal on a regular basis and provide for revisions.

Most state goals are expressed in terms of achieving a certain quantity of emissions at a specific year in the future. Current federal policy takes a second approach and sets a target expressed as "*emissions intensity,*" which it measures as the ratio calculated by dividing the greenhouse emissions in a given year by the economic output for that year. A third approach is to set technology-based standards. This approach is tied to specific technologies or sub-sectors, such as Oregon's CO_2 standard for new energy facilities.

Setting absolute quantity limits provides simplicity and certainty. One knows in advance how many tons of GHGs will be emitted into the atmosphere if the goal is achieved. More importantly, *absolute* quantities of atmospheric GHG levels are scientifically meaningful, while *relative* amounts (e.g., relative to transient human factors such as economic activity or growth) are not scientifically meaningful if the object is to control and mitigate global warming. Historically, moderate concentrations of such gases are benign, while the higher concentrations that we are generating pose an extremely serious threat to the ability of the planet to sustain human and other life. The physical processes that take place in the earth's atmosphere, and the threat they pose, are facts that must be faced, whether or not they are convenient to one set of economic strategies or another. Most states and cities have used absolute quantities as goals.

Certainly our mitigation strategies must be sensitive to economic effects if we are to choose the most cost-effective and least disruptive mitigation path; but we must not lose sight of the fact that the ultimate objective is a physical one – benign levels of the gases – not a short-term economic one. Thus, fixed physical emissions goals must be set and achieved independent of changes in population or economic activity.

The current U.S. Administration's goal is to reduce carbon emissions intensity by 18 percent between 2000 and 2012. The Government Accounting Office[17] estimates that this target would represent only a 2 percent absolute reduction from the likely GHG emissions that would otherwise accumulate over the period 2002-2012. Under this scenario, GHG levels in 2012 would remain significantly above 1990 levels. IPCC scientists generally agree that a climate stabilization level of emissions would need to be some 75 percent to 85 percent below 1990 emissions levels.

Technology-based targets (e.g., emissions caps for new power plants) can contribute to reducing physical concentrations of GHGs in the atmosphere, but they are likely to be more effective in the context of established goals to which other actions can also contribute. Oregon, Washington,

[17] United States General Accounting Office, Letter from John B. Stephenson to Senator Ernest F. Hollings and Senator John F. Kerry, regarding "Climate Change Trends in Greenhouse Gas Emissions and Emissions Intensity Factors in the Unites States and Other High-Emitting Nations," October 28, 2003.

New Hampshire and Massachusetts have all set technology-based standards for power plants, either new or existing. California has set technology-based standards for new vehicles. The Northeastern states and some Mid-Atlantic states are considering setting a cap on emissions from power plants.

Consistency with Goals Established by Other States

In 2001, the New England Governors and Eastern Canadian Premiers (NEG/ECP) adopted goals to reduce GHG emissions: (a) to 1990 levels by 2010; (b) to 10 percent below 1990 levels by 2020; and (c) to a long-term goal of 75 to 80 percent below current levels eventually. These goals are consistent with the objectives of the United Nations Framework Conventions on Climate Change. They are ambitious, but they represent the path the region must be on to begin responding to global warming. The Governors and Premiers acknowledged that the science – and the consequences of a failure to respond – compel us to set these goals, even if we don't yet have all the tools and technologies we'll need to meet them. Setting expectations is itself a stimulus to developing needed responses.

The Advisory Group is recommending goals generally consistent with those of the NEG/ECP. In addition to the scientific defensibility of setting such goals, Oregon's action will reinforce the emergence of a common, more predictable level of commitment within the state-led action on global warming.

IA-2: Recommend that the Governor renew the charter of the Advisory Group on Global Warming or appoint a new successor body to continue the Advisory Group's unfinished agenda.

The Advisory Group strongly recommends that the Governor appoint one successor advisory group to deal with the following topics:

- Develop a "Global Warming Adaptation Strategy for Oregon."
- Evaluate and report on implementation progress.
- Reconsider deferred actions.
- Develop an education plan.
- Advise the Governor on influencing and integrating Oregon actions with international, federal and other state-level greenhouse gas reduction policies and activities.
- Appoint two related task forces, one addressing how to limit utility and other stationary GHG emissions, and the second advising the Environmental Quality Commission (or potentially the Governor and the Legislature) on adopting the California tailpipe emission standards for passenger and light-duty vehicles.

To ensure coordination and systematic progress in implementing this Strategy, the Advisory Group recommends that the Governor ask each state agency with implementing responsibilities

to designate lead staff. In addition, the Group asks the Governor to appoint a senior member of his staff to oversee implementation and the ongoing work of a future Advisory Group.

The Advisory Group recommends that the Governor continue the work this Advisory Group has begun. The State of Oregon has devoted policy and technical attention to global warming issues directly and indirectly, through energy, waste management, transportation and other policies since 1988. Even if Oregon chose not to be proactive on global warming, we would have to respond to the changing climate and the growing attention paid to this issue globally, nationally and regionally. However, Oregon can continue to do more than react. It can continue to lead by argument and example. In doing so, Oregon will be able to achieve the GHG reductions ultimately required of it at the lowest possible cost. It can capture the co-benefits that its past commitments to carbon constraints, energy efficiency and renewable technologies have already demonstrated are available. It also can position itself to be a market leader in selling goods and services to its slower-to-respond trading partners.

GW Adaptation Strategy: This Advisory Group has left a very large task – adaptation – barely visible on the State's radar screen. And yet we know that if we could arrest the growth in GHGs tomorrow, we face more than a century of climate change and its oceanic and terrestrial consequences. We need to think through strategies for dealing with lower snowpack and altered regional hydrology; forests more susceptible to variable weather, pest infections, stress, and catastrophic fires; and other consequences that are already locked in. The Advisory Group asks that the Governor direct a successor Advisory Group and staff to work with Oregon's academic expertise and with governments and businesses to develop our adaptation strategy for the next 100 years. By then we hope to see a downturn in the atmospheric concentrations of GHGs, the result of beginning today to reduce the emissions that are the subject of this report.

Evaluate and Report on Implementation Progress: The successor Advisory Group should also oversee and report on progress the State, its citizens and businesses have made in implementing the strategy adopted in the current process. Recommending actions is the first and easiest step. Action is more difficult and problematic, the more so in the absence of accountability. The Advisory Group recommends that it or a successor body provide that accountability.

Reconsider Deferred Actions: The Advisory Group began by considering a wide range of options. While it dropped some ideas because they do not seem appropriate at this time, it deferred consideration of many others because they require additional evaluation. This would further quantification of costs and benefits before they are ripe for recommendation to the Governor and Legislature. The successor Advisory Group can work with state staff and interested parties to develop these ideas, as well as other ideas we expect to receive as Oregonians increasingly commit to addressing global warming issues.

Develop an Education and Outreach Plan: The Advisory Group recommends that the subsequent advisory group work with state agencies, colleges, universities, schools, businesses, and non-profit organizations to develop an education and outreach plan:

- to inform Oregonians about the potential impacts to the state, the region, and the globe;
- to inform Oregonians about what they can do to reduce greenhouse gas emissions; and

- to inform Oregonians about what actions may be required to adapt to the changes from global warming that are already unavoidable, and the costs these adaptation actions may impose.

Advise the Governor on international, federal and other state-level greenhouse gas reduction policies and activities: While Oregon acts to reduce its greenhouse gas emissions, it is also participating in regional, national, and international forums. The Advisory Group needs to stay informed and keep the Governor informed of actions that other states are taking, especially on the East and West coasts. It also needs to follow the national dialogue on global warming if there is potential to influence Congressional action. Finally, it needs to be informed of international activities that may affect Oregon's opportunities for finding ways to trade in an international market.

Appoint two related task forces: In addition to a continuation and expansion of the role of the current Advisory Group, the Group separately recommends two additional task forces. One task force would advise the Governor and Legislature on how to limit utility and other stationary GHG emissions. This activity is discussed in GEN-2 and GEN-2a in the Electric Generation and Supply section below. The second task force would advise the Environmental Quality Commission (or potentially the Governor and Legislature) on adopting the California tailpipe emission standards for passenger and light-duty vehicles. This is discussed in the Transportation section under TRAN-1 below.

IA-3: The Oregon University System should develop strategic and targeted research, development and demonstration (RD&D) programs for greenhouse gas reduction technologies.

Oregon universities have expertise related to mitigation and biological sequestration (carbon capture and storage) of GHG emissions. Enhanced efforts to develop and deploy specific technologies, services or applications can enable Oregon to foster new industries. Possible areas of effort include renewable generation technologies; biofuels production; energy efficiency for electricity, natural gas and oil uses; bio-sequestration; materials disposal; and renewable energy production using landfill gas or agricultural or forestry biomass. Large emission reductions are possible.

Oregon's higher education system is capable of designing and identifying applications for beyond off-the-shelf technologies. It is likely Oregon and other states will need such applications in responses to global warming. Oregon has significant competitive advantages. We have a broad array of educational expertise in energy efficiency research, forestry and renewable energy. Oregon has been an early adopter of these technologies and services.

State RD&D funds, combined with funds from competitive grants, could enable Oregon's economy to benefit from local deployment. In addition U.S. and worldwide efforts to reduce GHG emissions will create additional demand for these services. Increased state revenues from increased economic activity could more than offset any state expenditures. Local investment and

demonstrations can help develop export markets. Collaboration with other West Coast states could better leverage institutional strengths and develop complementary regional capacity.

Legislative appropriations are required to conduct an inventory of current programs, capability and interests and to plan future development and support for these programs. Not all technologies for GHG reduction merit funding. The Oregon University System, in coordination with GHG work groups in Oregon, Washington and California, should develop strategic and targeted RD&D programs for GHG reduction technologies.

IA-4: The subsequent Advisory Group should work with state agencies, colleges and universities, schools, non-profit organizations and businesses to develop a global warming education program that will provide information and outreach to the public.

Public education is needed to assist Oregonians in making informed decisions and to participate in developing State and individual actions to reduce greenhouse gas emissions that will be practical, effective, and supported by the citizens of Oregon. The Advisory Group would work with stakeholders to develop a plan for public education and outreach on global warming. Topics would include the potential impacts of global warming, what Oregonians can do to reduce greenhouse gas emissions, and how to adapt to changes caused by global warming.

Energy Efficiency Actions to Reduce Greenhouse Gases

Issue: For the past twenty years and more, Oregon has had successful energy savings programs for electricity, natural gas and petroleum users. These have included incentive programs and building codes. Even so, significant savings remain to be captured, and new technologies create opportunities for still more savings. Petroleum and natural gas use emits CO_2 and other greenhouse gases directly. Almost half of the electricity used in Oregon is met by coal and gas-fired generation that emit GHGs.

Solutions: To reduce emissions, Oregonians will need to use all energy more efficiently. Oregon's incentive and building code programs need to be reviewed and upgraded, based on concerns over global warming.

Note that, while the recommended Energy Efficiency actions will require significant effort and investment, the level of effort remains roughly comparable to how Oregon has performed over the last 20 years. In other words, this Oregon Strategy to Reduce Greenhouse Gas Emissions assumes the State will continue its current aggressive level of investment and accomplishment in this area.

Table 1 (EE)

Category I: Significant Actions for Immediate State Action		MMT CO2E 2025	C/E?
EE–1	Meet the Northwest Power and Conservation Council (NWPCC) goal of implementing cost-effective electricity efficiency measures for electric users and an equivalent goal for natural gas users.		
	EE-1a: Expand and coordinate electric incentive programsfor Investor-Owned Utilities (IOUs).	3.20	Y
	EE-1b: Upgrade Oregon building codes to reduce energy use by at least 15 percent by 2015 (building shell measures).	0.52	Y
	EE-1c: Amend building codes to set minimum space and water heating/cooling standards.	0.09	Y
	EE-1d: Adopt state appliance efficiency standards.	0.41	Y
	EE-1e: Advocate with Bonneville Power Administration (BPA) and Oregon electric consumer-owned utilities (COUs) to meet the NWPCC goal.	1.24	Y
	EE-1f: Support Oregon Public Utility Commission (OPUC) actions to evaluate NW Natural/ETO and ODOE natural gas incentive programs.	0.24-0.48	Y
	EE-1g: Advocate with OPUC for Avista and Cascade natural gas utilities to meet energy savings goals comparable to NW Natural.	0.05	Y
	EE-1h: Advocate for federal equipment and appliance efficiency standards.	0.40	Y
	EE 1i: Strengthen state marketing of energy efficiency and incentive programs; initiate Governor's Awards.		Y
	SUB-TOTAL FOR EE-1	6.15-6.39	
Category II: Other Immediate Actions			
EE-2	Support OPUC and COU efforts for modified rate designs to reflect daily and seasonal peak demand.	0.16	Y
EE-3	Support OPUC initiatives for natural gas and fuel switching.	0.10	Y
	TOTAL ALL EE ACTIONS	6.41 -6.65	

Generation mix affects efficiency saving. In the table above, column three shows estimated CO_2 equivalent savings in million metric tons (MMT) through 2025. Column four asks if the action is cost-effective (C/E) - yes (Y) or no (N) - to the consumer over the action's lifetime. (This does not address whether it is cost-effective to Oregon and Oregonians broadly, considering the projected effects of global warming and the costs of adapting to those effects.) The estimates assume displaced generation at a 50-50 mix of gas-fired and coal-fired generation. Refer to Figure 8 in Part Two, Section 1 (Introduction to Recommended Actions) for the cumulative impact of actions.

EE-1: Meet the Northwest Power and Conservation Council (NWPCC) goal of implementing cost-effective electricity efficiency measures for electric users and an equivalent goal for natural gas users.

The Advisory Group recommends achieving Oregon's 960 average Megawatts (aMW) share of the Northwest Power and Conservation Council's regional cost effective energy efficiency for 2005 to 2025 (18 percent of 2002 sales). Meeting this target over 20 years would be the equivalent of saving more than three times the current energy use of a city the size of Eugene. Also recommended are savings of 7.5 trillion Btus (TBtu) of Oregon commercial and residential natural gas between 2005 and 2025 (11 percent of 2003 commercial and residential gas sales).

In March 2004 the NWPCC published its draft conservation resource assessment. The assessment indicates that the NWPCC region (Oregon, Washington, Idaho and the western third of Montana) could reduce electric sales by 2,880 aMW by 2025 if fully effective conservation programs and regulations were implemented. Oregon's share of this savings is 960 aMW. The Council also notes that about 3,000 aMW were saved in the period 1980 through 2002. While many measures have been implemented, technological change has created new opportunities.

Savings of 960 aMW electricity and 7.5 trillion Btus of natural gas are assumed in the energy efficiency case forecast of CO_2 emissions. The efforts needed to accomplish this goal are shown in Table 2 (EE) and Table 3 (EE) below. All of these actions are cost-effective and would improve Oregon's economy. With all these measures, Oregon electric loads would grow 1.0 percent per year from 2002 to 2025. If none of this energy efficiency is captured, loads would grow at 1.6 percent per year and CO_2 emissions would be 5.6 million metric tons (MMT) higher than assumed. The generation displaced by the energy efficiency is assumed to be a 50-50 mix of gas and coal-fired power plants. Acronyms used in the tables below include IOUs (investor-owned utilities) and COUs (consumer-owned utilities), which include people's utility districts, cooperatives and municipal utilities.

TABLE 2 (EE)

Oregon Electric Efficiency Case Energy Savings

MMT CO_2	aMW	Measure	
3.20	545	EE 1a	State and Utility Incentives (IOUs)
1.24	212	EE 1e	State and Utility Incentives (COUs)
0.37	63	EE 1b (electric only)	Improved Building Codes (building shell)
0.32	55	EE 1h (electric only)	Federal Standards
0.09	15	EE 1c	Calif. Equipment Standards*
0.41	69	EE 1d	Calif. Appliances Standards**
5.63	960		Total Electricity

** Oregon can adopt California equipment standards through rule changes.*
*** Adopting appliance standards in Oregon would require legislation.*

Efficiency case natural gas utility incentive savings are for Energy Trust of Oregon (ETO) programs for Northwest Natural and savings from state energy efficiency programs. Estimates of savings from incentive programs and improved building codes are from the Oregon Department of Energy (ODOE).

TABLE 3 (EE)
Oregon Natural Gas Efficiency Case Savings

MMT CO_2	Trillion Btu	Measure	
0.29-0.53	4.6	EE 1f and 1g	Utility and State Gas Incentives
0.15	2.9	EE 1b (gas only)	Improved Building Codes (building shell)
0.08		EE 1h (gas only)	Federal Standards
TBA			Calif. Equipment Standards
TBA			Calif. Appliances Standards
0.52-0.71	7.5		Total Natural Gas

The actions to achieve EE-1a through EE-1i are discussed as individual actions following the discussion of the NWPCC goal below.

Discussion of NWPCC Goal
The most difficult or controversial element of achieving these CO_2 savings is possible legislation to adopt appliance efficiency standards for devices not covered by Oregon building codes (EE-1d). This element is discussed in the West Coast Regional Appliance Efficiency Codes and Standards Working Group Paper (WG4 – from three-state West Coast Governors' Global Warming Initiative).

Allowing builders to take an ODOE Residential Energy Tax Credit would require legislation, but may not be controversial (part of EE-1a). The savings are small, but grow as penetrations grow over time. Integrating efficient water-heating equipment at the time of construction is less expensive and requires fewer incentives than adding equipment later.

Actions by ODOE, ETO, the Oregon Public Utility Commission (OPUC) and the Building Code Division might accomplish the remainder of the savings. These might require budget adjustments for the 2005 session. If a joint OPUC-ODOE assessment indicates the natural gas and electricity efficiency goals cannot be met with existing funding levels, legislation for the electric portion may be needed in the 2007 session because of restrictions enacted in SB 1149[18] in 1999.

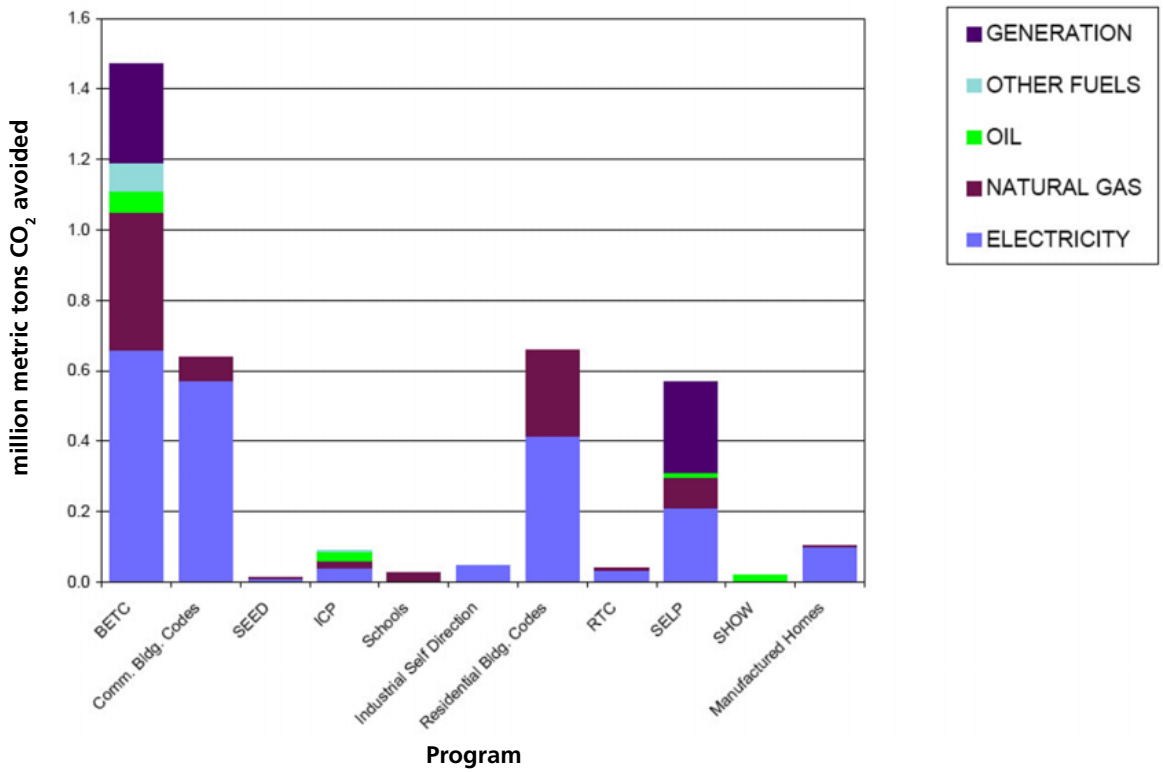
The savings goal is achievable. The NWPCC estimates that almost 3,000 aMW were saved in the region between 1980 and 2002. Of this, roughly 40 percent was saved through codes and standards. This is consistent with experience with Oregon programs where 35 percent of savings were from the energy standards in Oregon's building codes. Figure 1 (EE) below shows the distribution of

[18] SB 1149 is an electric industry restructuring law of the state's largest investor-owned utilities. Restructuring is designed to give Portland General Electric and PacifiCorp consumers more energy options, while at the same time encouraging the development of a competitive energy market. Current utilities continue to deliver power and maintain the safety and reliability of the poles and wires that deliver power, regardless of who supplies it.

CO_2 savings from state programs. Savings are annual savings from program activity from 1978 through 2002. Savings from program measures reduce CO_2 emission by 3.7 million metric tons per year. Had these savings not occurred, 2002 emissions from Oregon stationary sources would have been 11 percent higher than they were. This indicates that further large CO_2 savings from energy efficiency programs are achievable.

Historical savings in Figure 1 (EE) estimates do not include the additional savings from utility energy efficiency programs during the period. Utility programs added substantial saving, especially in the residential sector. In addition to reducing CO_2 emissions, these and utility program savings reduced costs to businesses, governments and households compared with purchasing fuel or power, and they improved Oregon's economic performance.

Figure 1 (EE)
Avoided CO_2 Emissions in 2002 by Program
(includes all projects from start of program through 2002)
Total avoided emissions = 3,681,000 metric tons CO_2



Key to Figure 1 (EE)
BETC: *ODOE Business Energy Tax Credit*
SEED: *State Energy Efficient Design requirements for new state government buildings*
ICP: *discontinued federal energy efficiency program for schools and hospitals (Institutional [building] Conservation Program)*
Schools: *current K-12 school programs*
Industrial Self-Direction: *measures paid for by large electric users who self-direct their SB 1149 public purpose charges*
RTC: *ODOE Residential Energy Tax Credit*
SELP: *ODOE Small-scale Energy Loan Program*
SHOW: *ODOE State Home Oil Weatherization program*

EE-1a: Expand and coordinate incentives for electric investor-owned utilities (IOUs).

Electricity sales of IOUs accounted for 72 percent of Oregon sales in 2002. The Energy Trust of Oregon (ETO) began running the energy efficiency programs of PacifiCorp and Portland General Electric (PGE) in 2002 and of Northwest Natural gas utility in 2003. Idaho Power runs utility incentive programs in the Ontario area. These IOU programs and those of ODOE and the Department of Housing and Community Development might be better coordinated to be more effective with existing funds. Efforts to this effect are underway.

The most important need is to track total savings to compare to the global warming goals. If increased coordination is not sufficient to meet the goal, increased funding will be needed. Application of the NWPCC's estimates to Oregon indicates that IOU incentive programs could save 545 aMW by 2025. If this conservation goal were not achieved, Oregon's emissions would be 3.20 MMT CO_2 higher (this assumes the extra generation would be a 50-50 mix of new gas- and coal-fired generation). Below are other actions needed to achieve this goal.

Assess Oregon program performance relative to the NWPCC goal in 2006. As part of the study due on January 1, 2007, as required under SB 1149 (1999 session), OPUC, ODOE and ETO should assess the effectiveness of existing electric programs and regulations in 2005 and 2006 to see if Oregon is capturing its share of the NWPCC goal. These assessments should consider state tax credits; loan financing programs and other state incentives; regulatory tools such as building and equipment codes; technology assessments; utility planning assessments; ETO programs; and other SB 1149 mechanisms. The agencies should conduct a similar program for natural gas programs. If an assessment indicates substantial increases in electric funding and authorities are needed, this would indicate legislation may be needed in the 2007 session.

Similarly the State should review the effectiveness of BPA and COU energy efficiency programs and whether the State's programs are consistent with and supportive of comparable efficiency efforts among non-regulated utilities (see EE-1e below).

Through legislation, allow homebuilders to take state Residential Energy Tax Credits (RETC) for heat pump water heaters (HPWH), solar photovoltaic (PV) and solar domestic hot water (DHW). Currently, only the homeowner is allowed to take the credit. With this change, either the builder or the homeowner could get the RETC. The NWPCC estimates that the region could acquire 195 aMW of cost-effective savings from HPWH by 2025. Oregon's share of this would be 64 aMW, which would reduce annual CO_2 emissions in 2025 by 0.35 MMT CO_2. This measure will make an important contribution to achieving the NWPCC target for heat-pump and solar water heating.

Solar PV and solar DHW savings are not included in the NWPCC plan, as the plan estimates these measures are not currently cost-effective. Savings or production from solar PV would be in addition to the NWPCC goal. Savings from solar DHW are included in the 195 aMW of savings, because homes will have either a solar DHW or HPWH system, but not both.

For new homes built on speculation, the builder is the decision-maker on whether to integrate HPWH, solar PV or solar DHW systems. Integration is less expensive than adding these systems later. This would require a statutory change, but it may not be controversial.

EE-1b: Upgrade Oregon building codes to reduce energy use by at least 15 percent by 2015 (building shell measures).

Amend the energy portions of the residential and commercial building codes for shell measures that address exterior structure walls, ceilings and floors to save energy. Because technologies continue to change, Oregon needs additional revisions to its building codes. Significant additional cost-effective savings are possible. As an example, many new or refurbished commercial buildings do not operate properly. Today's building energy systems are complex and should be commissioned (certified) to ensure they perform properly as designed.

ODOE estimates that structural codes improvement (shell measures) from 2005 through 2025 could save 63 aMW of electricity for a savings of 0.37 MMT CO_2 in 2025 at the assumed displaced generating mix of 50-50 natural gas and coal plants. ODOE also estimates that CO_2 savings in natural gas heated homes and commercial buildings could be 0.15 MMT CO_2. These savings include building commissioning and increased enforcement measures described below and are included in the energy efficiency forecast. Achieving these savings requires a stronger change in state policy than achieving the energy efficiency savings in EE-1a above. Oregon currently has substantial energy efficiency incentives such public purpose charges for investor-owned utilities, consumer-owned utility programs and state tax credits and loans. Residential and commercial building codes should be upgraded to reduce energy use and costs on a schedule to meet or exceed the target of at least 15 percent savings by 2015 recently set by the staff report of the West Coast Governors' Global Warming Initiative. Otherwise, building users will miss cost saving opportunities from new technologies.

Require commissioning certification of new buildings and major renovations. The major barrier to requiring commissioning by code is that code officials don't have the time or expertise to verify that building systems are operating as designed. A viable alternative is a seal of approval from an accredited (certified) commissioning agent. Oregon, Washington, and California should work together to develop commissioning and certification standards that would be incorporated into building codes. These standards could be developed in cooperation with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the Building Commissioning Association. This would also facilitate re-commissioning of existing commercial buildings. This could be relatively easy, if done cooperatively with California and Washington. This program is likely cost-effective. This would also help achieve cost-effective conservation in new gas- and oil-heated commercial buildings.

Support the infrastructure for enforcement of building energy codes. Codes only save energy if compliance is met. Among competing priorities, energy efficiency is often overlooked. There should be a renewed effort to provide information and training for code officials, designers, contractors, equipment vendors and others on energy code requirements and the benefits of energy efficiency. These measures would be cost-effective.

EE-1c: Amend building codes to set minimum space and water heating/ cooling standards.

Amend the residential and commercial building codes to require minimum efficiencies for space heating/cooling and water heating/chilling based on cost-effectiveness and modeled after California equipment standards.

Oregon, Washington and California have long been leaders in building energy codes. Federal standards preempt state standards for some equipment, but not all. Failure of the federal government to set standards for several types of equipment allows Oregon, along with other West Coast states, to set equipment standards in codes. To date, Oregon building codes generally have not addressed equipment standards.

It would be cost-effective to raise the minimum efficiency of the equipment through changes in the building code. The Building Codes Division has no plans to do this. Also, Oregon currently has no efficiency certification or compliance-monitoring infrastructure for implementing standards, but may be able to adopt California protocols. This is an element of WCGGWI recommendations (see EE-1d below). ODOE estimates this measure will reduce CO_2 emissions in 2025 by 0.09 MMT CO_2 at the assumed displacement of a 50-50 gas and coal plant mix.

EE-1d: Adopt state appliance and equipment efficiency standards for Oregon.

Propose legislation for state appliance efficiency standards (California standards) that cannot be covered under the building code. Federal appliance efficiency standards could be achieving higher levels of cost-effective conservation. Federal standards preempt state standards for some appliances, but not all. California, Washington and Oregon are jointly exploring efficiency standards for appliances and equipment that cannot be covered by building codes. Appliance standards for products outside the scope of building energy codes would require legislation. This legislation will likely be controversial. The legislation would have to provide a mechanism for product efficiency certification (possibly by relying on California's certification program and database) and for compliance monitoring. These actions would be cost-effective. In the WCGGWI, the staff report recommends that all three states adopt energy efficiency standards for 8 to 14 products not regulated by the federal government, establishing a cost-effective efficiency threshold for all products sold on the West Coast. ODOE estimates this measure will reduce CO_2 emissions in 2025 by 0.41 MMT CO_2 at the assumed displacement of a 50-50 gas and coal plant mix.

EE-1e: Advocate with BPA and Oregon electric consumer-owned utilities to meet the NWPCC goal.

Continue Oregon and NWPCC efforts to work with the BPA and COUs to assure programs or incentives for effective energy efficiency programs. COUs account for 28 percent of the electricity sold in Oregon. Achieving the NWPCC goal in these areas will save 212 aMW and 1.24 MMT CO_2 at the

assumed mix of new generation. Recent funding levels by BPA and Oregon COUs are comparable to the public purpose charge for PacifiCorp and PGE. BPA is evaluating its funding levels for 2006-2011.

This will require effective programs for Oregon COUs, either run by BPA or by the utilities themselves. It is recommended that the governor's office follow the regional dialogue on this issue and make recommendations to BPA if necessary. Continued coordination among the existing and new programs of ODOE, ETO, BPA and Oregon COUs is also needed.

EE-1f: Support OPUC actions to evaluate Northwest Natural energy efficiency programs.

Support Oregon PUC's reexamination of Northwest Natural's gas utility efficiency programs and ODOE's energy efficiency programs and modify where cost-effective. This measure would evaluate the success of ETO's programs for NW Natural and ODOE's gas energy efficiency programs. The ETO has a goal of 1.9 trillion annual Btus (TBtu/year) by 2012. Extrapolated, this would imply savings of 4.6 TBtu per year in 2025 or 0.24 MMT CO_2 per year. More cost-effective savings may be possible through higher levels of ratepayer funding of utility marketing and information programs, better coordination with ODOE programs, increasing the level of NW Natural's public purpose charge, or by expanding or modifying ODOE programs. The PUC could examine how to improve the marketing of ETO programs to NW Natural's customers. This might involve increasing the overall level of funds for marketing and information or adjusting the balance of funds between the ETO and NW Natural's efforts. Whether these changes are possible or needed would be determined by a joint study of the OPUC, ODOE and ETO. Because the public purpose funding for NW Natural is not in statute, legislation would not be required to change it.

This evaluation could also involve filling gaps between ETO's gas program for NW Natural and ODOE school gas programs. ODOE's K-12 schools program (under SB 1149) for all fuels does not cover schools in COU territories. ETO programs for NW Natural cover some of these COU areas, but don't have targeted COU schools programs.

Substantial changes in ODOE programs would likely require legislation in 2007. Currently, the OPUC has a program that automatically compensates NW Natural for most of the revenue lost due to reduced sales from energy efficiency programs. If not for this program, conservation would reduce NW Natural profits. Before this program, lost revenue had discouraged NW Natural from aggressively pursuing conservation. Continuing this program is likely necessary for conservation to succeed. Doubling the implied ETO goal would reduce NW Natural's 2025 emissions by 0.24 MMT CO_2 per year.

EE-1g: Advocate with OPUC for Avista and Cascade natural gas utilities to meet energy savings goals comparable to NW Natural.

Recommend the OPUC institute programs for Avista and Cascade that resemble those of NW Natural (See EE 1f). Together these utilities sell 19 percent of the natural gas sold by utilities in Oregon. NW Natural sells the remainder. The OPUC and these utilities could

adopt a public purpose charge to fund ETO programs and could also remove rate-making disincentives that inhibit pursuit of cost-effective efficiency measures. Extrapolating the savings of NW Natural to these utilities yields a reduction in 2025 emissions of 0.05 MMT CO_2 per year.

EE-1h: Advocate for federal equipment and appliance standards.

Advocate for federal appliance and equipment standards that fully capture cost-effective energy efficiency. In recent years the federal government has decided not to apply its standards to several types of equipment and appliances and has not included all cost-effective savings in recent changes to appliances and equipment it does regulate. For example, the U.S. Department of Energy's attempt to weaken federal air conditioner standards in 2001 was overturned by federal courts. States have successfully lobbied for tougher standards in the past. Also, having state standards for non-regulated products has goaded federal action to avoid multiple state standards.

Federal standards and programs have been effective in reducing the economic impacts of electric price spikes and the high cost of imported natural gas and oil, as well as reducing CO_2 emissions. Oregon should vigorously support continued improvements in federal appliance and equipment efficiency standards. ODOE estimates that full implementation of cost-effective standards for federally covered appliances would save Oregon 55 aMW and 0.32 MMT of CO_2, assuming a 50-50 mix of new coal and gas-fired generation. Gas savings are estimated to be 0.08 MMT of CO_2.

EE-1i: Strengthen state marketing and public information of energy efficiency and incentive programs.

Improve marketing and public information for incentive programs. In cooperation with state agencies, local governments, utilities and conservation organizations, Oregon could enhance the effectiveness of public information, marketing and branding of energy efficiency efforts. This could involve a Governor's awards program.

EE-2: Support OPUC and COU efforts for modified electric rate designs to reflect daily and seasonal peak demand.

Support efforts by the OPUC and COUs to re-examine rate design measures that reflect daily and seasonal peak demand and reduce CO_2, and implement where cost-effective. Savings for these potential programs would be in addition to Oregon's share of the NWPCC goal of a 2,880 aMW reduction in electrical sales.

Electricity – Voluntary Peak Shaving: Examine voluntary demand-response (peak-shaving) rates and programs for PGE and PacifiCorp in Oregon and implement where cost-effective. These reduce CO_2 emissions because the gas-fired power plants that meet peak loads are the least efficient. This could be ranked as easy to accomplish, because the OPUC has adopted this goal. This measure might save an annual 0.05 MMT CO_2 in 2025.

Electricity – Residential: Redesign residential rates to reflect better the higher costs of electricity during peak seasons or times. Revise PGE's residential rate design from flat rates to rates that increase with use (inclining block rates). Revenues from the higher prices for higher use levels would be refunded to ratepayers through a lower price for the initial rate block. This could be ranked as easy. PacifiCorp's Oregon residential rates already have this feature. This measure might save 0.11 MMT CO_2 in 2025.

EE-3: Support OPUC actions for natural gas and fuel switching.

Support efforts by the OPUC and others to re-examine fuel switching to natural gas to reduce CO_2 and implement where cost-effective. Savings for the electric water heater program would be in addition to Oregon's share of the NWPCC efficiency goal, roughly estimated as 960 aMW.

Electric Water Heaters to Gas: Examine gas utility programs that would convert residential electric water heaters to gas and implement where cost-effective. The OPUC approved the concept in October 1991, but the program was not implemented due to concerns that most of the incentives would go to households who would have switched anyway (the so called free-rider effect).

A new issue would be the relative cost-effectiveness and CO_2 savings of switching existing electric-resistance water heaters to gas water heaters or heat-pump electric water heaters. The OPUC has adopted an objective to: "Investigate whether to promote the direct use of natural gas to meet customer needs over its use to generate electricity for that purpose." Savings in 2025 from this program would be 0.09MMT CO_2 per year at the assumed mix of new generation of 50-50 coal and gas plants.

Commercial Oil Boilers to Gas: Examine gas utility programs to convert existing commercial oil-fired boilers to efficient gas-fired boilers and implement if cost-effective and if the increased gas utility sales revenue would cover program costs. This could be controversial, especially among oil dealers. Savings from this program in 2025 would be 0.01 MMT CO_2 per year.

Electric Generation and Supply Actions to Reduce Greenhouse Gases

Issue: Oregon electricity supplies, once nearly all renewable (hydro), are now over 40 percent from coal and another 8 percent from natural gas. The latter two emit CO_2 and other greenhouse gases (GHGs) in combustion (although gas has lower emissions).

Solutions: To reduce GHG emissions, we must use all energy more efficiently, while meeting new load growth and replacing existing fossil fuel generation with energy efficiency and generation that does not produce GHGs.

Table 1 (GEN)

CATEGORY I: SIGNIFICANT ACTIONS FOR IMMEDIATE STATE ACTION		MMT CO_2E 2025	C/E?
GEN-1	Increase the renewable content of electricity.	0.80	Y
	GEN-1a: Increase retail energy sales from renewable resources by one percent or more annually in Oregon through 2015.		
GEN-2	Recommend the Governor create a special interim task force to examine the feasibility of, and develop a design for, a load-based greenhouse gas allowance standard.	At least 7.0*	?
	GEN-2a: The GEN-2 interim task force should also consider an Oregon Renewable Portfolio Standard (RPS) and potential changes to public purpose charges as tools to meet a greenhouse gas allowance standard and overall state CO_2 goals.		?
GEN-3	Support the Oregon Public Utility Commission's review of rules and tariffs for renewable and combined heat and power facilities.	0.54	Y
CATEGORY II: OTHER IMMEDIATE ACTIONS			
GEN-4	Encourage state government to purchase renewables.	0.08	N?
GEN-5	Advocate for specific federal policies or legislation.	varies	varies
GEN-6	Advocate with BPA to support Oregon's renewables measure.	varies	varies

Generation mix affects efficiency saving. In the table above, column three shows estimated CO_2 equivalent savings in million metric tons (MMT) through 2025. Column four asks if the action is cost-effective (C/E) - yes (Y) or no (N) - to the consumer over the action's lifetime. (This does not address whether it is cost-effective to Oregon and Oregonians broadly, considering the projected effects of global warming and the costs of adapting to those effects.) A question mark means that the estimates of cost-effectiveness are uncertain and more analysis is needed. The estimates assume displaced generation at a 50-50 mix of gas-fired and coal-fired generation. Refer to Figure 8 in Part Two, Section 1 (Introduction to Recommended Actions) for the cumulative impact of actions.

** Assumes a carbon constraint at least equal to an RPS of 25 percent.*

GEN-1: Increase the renewable content of electricity.

The forecast mix assumes Oregon will implement the final versions of the Oregon Renewable Energy Action Plan (currently in draft form) and the West Coast Governor's Global Warming Initiative (WCGGWI). This could have small fiscal impacts. The draft Oregon renewable plan calls for completing the following new renewable energy actions in calendar year 2005 and 2006:

- 300 megawatts (MW) of new wind energy capacity, of which 10 percent will be from community or locally-owned projects
- Effective solutions to the transmission capacity bottleneck(s) between Eastern and Western Oregon to provide access to renewable and other resources in Eastern Oregon to load centers
- Have all electric utilities offer a "stable price" renewable energy product to customers.
- 500 additional solar photo-voltaic electric installations (about 1 new MW)
- 25 MW of new biomass-fueled electric generation built or under construction (of which 5 MW will be from new biogas generation facilities from wastewater treatment, dairies and landfills)
- 25 MW of efficient new combined heat and power generation systems built or under construction
- 1 MW of new fuel cells
- 20 MW or more of geothermal generation projects built or under construction
- 1 to 4 MW of additional environmentally sustainable hydroelectric capacity in the process of being developed (primarily irrigation piping channels)
- An assessment of the feasibility of a renewable portfolio standard (RPS) for Oregon

These projects will produce about 150 average megawatts of electric energy. This is about 50 percent more than the load for the city of McMinnville. This would raise the fraction of loads met by non-hydro renewables to 5 percent. These measures, other than wind, will likely require additional staff of about 3 full-time employees (FTE). The staff could be spread out over several natural resource agencies or a single natural resource agency. These staff would primarily draft and oversee federal grants. Initially, this would require general funds, but after successful grant awards, only the grant writing portion would require general funds for about one FTE.

The generation mix is based roughly on the Northwest Power and Conservation Council draft mix that includes reduced load growth from energy efficiency actions applied in Oregon. The mix also assumes the equivalent of the Oregon Energy Facility Siting Council's (EFSC) CO_2 standard being applied gradually throughout the West. The resource additions listed above save 0.80 million metric tons (MMT) of CO_2 per year starting in 2006, assuming the displaced mix is half new coal-fired plants and half new natural gas-fired plants. Short-term impacts on power plant operations are similar because existing plants with higher fuel costs and CO_2 per kWh are displaced first when renewable resources are added.

GEN-1a: Increase retail energy sales from renewable resources by one percent or more annually in Oregon through 2015.

The WCGGWI (See Appendix E) calls for Oregon, Washington and California to set goals and implement strategies and incentives to increase retail electricity sales from renewable resources, adding one percent of load or more annually in each state through 2015. This is consistent with a path to meeting 20 percent of load with renewables by 2020 (not including large hydro-electric generation). Savings for this element of GEN-1 are included in GEN-2 below.

GEN-2: Recommend the Governor create a special interim task force to examine the feasibility of, and develop a design for, a load-based allowance standard.

This standard would reduce total amounts of CO_2 and other GHG emissions due to consumption of electricity, petroleum and natural gas by Oregonians in a deliberate, predictable, effective, equitable and verifiable manner. The task force should be directed to provide the Governor with its recommendation in time for legislative action, if necessary, in the 2007 session.

The task force should include a fair representation of parties with economic and environmental interests at stake, along with appropriate state agency staff and legislators. The long-term (2050) goal should be to reduce GHG emissions from all sources to levels that are consistent with a state goal of climate stabilization emissions levels. A secondary goal should be to capture and reinvest or equitably distribute economic benefits from energy efficiency, renewables and bio-sequestration strategies. Tools may include: utility and government resource programs (including those of the ETO and BPA's transmission and integration capabilities); government tax, long-term financing and incentive programs; and offsets and trading. Barriers to meeting allowance goals should be identified and addressed including current state regulatory signals if appropriate.

At a minimum the task force should address the following questions:

1. **Long-Term and Interim Sector Allowances:** What long-term (2050) sector GHG emissions allowances should be set for electricity, gas and oil (consistent with an overall State of Oregon GHG emissions goal)? What *interim* emissions levels should be set (e.g., what are the shape and slope of the compliance curves) that are feasible and allow deliberate, but not delayed, action? What intervals should be set for interim compliance? Should there be a brief "beta" period at the beginning of enforcement of the cap to test accounting principles and other mechanisms, during which greater compliance flexibility would be permitted?

2. **Different Fuels and Suppliers:** How can equitable standards and/or program options be applied to diverse energy sources (electricity, natural gas, petroleum) and suppliers (including public- and investor-owned utilities, non-utility suppliers and self-generators)? Should compliance curves be identical for all suppliers or different to reflect different supplier circumstances? Should other significant non-energy emitters of GHG's (e.g., industrial emissions) be incorporated into this mechanism, or will they require a different one?

3. **Emissions Credits Trading:** Should – and could – such a system be designed to incorporate features compatible with a regional emissions trading mechanism between Oregon and its West Coast partners (Washington and California) on the premise that the wider the market, the more efficiently it should function? Between the West Coast and the Eastern states? Could we design a system that includes and harnesses the initiative of non-utility contributors (e.g., renewable resource developers and others who do not emit GHGs and would not therefore receive an allocation to use or trade)?

4. **Compliance Flexibility:** How can such a system be designed to allow sufficient compliance flexibility – including trading, acquiring offsets from energy efficiency, renewable energy and/or GHG sequestration, and financial off-ramps – while still achieving real reductions of GHG emissions and a transition to a low-carbon energy supply system? Can we quantify these different kinds of contributions in comparable and tradable units? Can we, while avoiding being prescriptive, ensure a diverse portfolio of responses? How can we credit the appropriate utilities and ratepayers for the contributions of non-utility participants such as the Energy Trust of Oregon?

5. "**Leakage**"**:** How can such a system be designed to withstand "leakage" or gaming resulting from reallocation of generating resources across state boundaries? In particular, is there a way to account for new and existing resources among the states PacifiCorp serves, so that Oregon emissions reductions do not translate into emission increases elsewhere in the PacifiCorp system?[19]

6. **Economic Development:** How can such a system be designed to capture economic development benefits for Oregon including developing technologies, products and services for marketing outside the state? How can it be designed to reinvest energy efficiency savings into new job-creation and carbon-saving investments? Can we devise strategies for reconciling such investment objectives with the goal of keeping compliance costs manageably low?

7. **Protecting Oregon's Competitiveness:** How can a system be designed to capture the economic gains of Oregon's investments in GHG mitigation, while avoiding loss of competitiveness in energy pricing between Oregon and its neighbor states or other competitors? If there are near-term rate effects – costs or benefits – how can they be allocated in an equitable manner? How can a "safety valve" be designed into the system to create temporary breathing room to respond to critical competitiveness issues, energy market price spikes or other unanticipated and transient pressures?

8. **Federal Preemption:** Could such a mechanism be fitted with an automatic response – that is, an "off-ramp" – in the event of meaningful federal action that could constitute preemption. What should be considered "meaningful" federal action?

[19] Both this leakage issue and PacifiCorp's concerns about inconsistent state-by-state treatment could be addressed, in part, if Washington and California were to adopt compatible emissions credit trading mechanisms.

The discussion below focuses on CO_2, the principal GHG emission from fossil fuel and electricity use. To stabilize CO_2 concentrations in the atmosphere at roughly double pre-industrial levels, world-wide CO_2 emissions will have to be reduced by 60 to 80 percent of the 1990 rate this century. Cumulative CO_2 emissions over the 21st century are the key variable. This is the only proposed option other than a CO_2 tax that could reduce Oregon's electric emissions below the 1990 level. Other energy efficiency and generation actions primarily impact the amount and mix of new generating plants. If adopted, this measure could provide substantial incentives for renewable resource development, which would make Gen-2a (a Renewable Portfolio Standard or RPS) unnecessary. Alternately, an RPS could be enacted as one tool to assist the State and energy suppliers in complying with the allowance curve. The measure could also address the risks to Oregon's utilities and ratepayers of likely future carbon regulation affecting new coal plants.

To stabilize climate in this century requires reducing emissions from existing power plants. Some older coal-fired plants will be almost 100 years old in 2050. Without new regulations, these plants might continue to operate past 2050.

Clear long-term guidance on CO_2 is needed for utility planning. Utilities are considering retrofits at coal plants to reduce emissions of criteria pollutants (e.g., subject to Clean Air Act constraints) and mercury. If utilities face clear CO_2 emission limits in the near future, they can avoid wasting money upgrading the oldest coal-fired power plants and later having to shut them down because of CO_2 regulations.

To begin to address the difficult long-term issues, Northeast and Mid-Atlantic states are considering a regional cap-and-trade system for electric CO_2 emissions. Depending on how an Oregon or West Coast allowance mechanism is designed, Oregon and other West Coast states might be able to participate with an East Coast trading system and lower costs to achieve the needed emissions reductions.

Eastern states are designing a system based on allocations to generating plants located in their states. Designing allowances on GHG emissions for only those power plants located in Oregon would be inequitable for the state's two largest utilities. PGE has most of its fossil-fueled generation facilities in Oregon, while most of PacifiCorp's plants are in other states. Even though the disparities are less severe in the Northeast, this problem is serious enough to consider a different kind of cap.

Another problem with an allowance solely for in-state plants is that it might only encourage new power plants to be built outside of Oregon as it becomes more stringent. If so, this would only harm Oregon's economy with no reduction in CO_2 emissions.

Rather than a system based on generating plants located in Oregon, this action would develop a system to allocate emissions from utility power plants and purchases to their Oregon load and set limits on those emissions. This system is sometimes referred to as a load-based cap-and-trade system. It would be consistent with Oregon's CO_2 accounting system and the Oregon Public Utility Commission's (OPUC) labeling requirements for PacifiCorp and PGE.

Such a limit would be on total tons of utility CO_2 or GHG emissions, calculated by the pounds per kWh of utility generation sources multiplied by kWh of load during an accounting period, such as

annually. The limits could be designed to provide the appropriate trajectory of utility emissions for the 21st century. The limits for early years could be near existing emission levels. The limit would be reduced on an established, predictable curve through 2050 to achieve the desired mid-century emissions levels.

An alternative is to set limits only on the emission rates (pounds of CO_2 per kWh for each load-serving entity) rather than total CO_2 tons emitted. This is referred to as an emissions portfolio standard (EPS). While more comprehensive than a Renewable Portfolio Standard (see Gen-2a below), an EPS does not ultimately limit total emissions and would not incorporate emissions reductions from energy efficiency actions.

A greenhouse gas allowance system (unlike an EPS, an RPS or a ban on new coal plants) should be designed to allow utilities to minimize the cost of meeting an emissions target. An allowance system may allow explicit consideration of imported power and recognition that new gas-fired generation may serve to reduce overall average emissions from electricity generation and may also complement new, intermittent renewable generation such as solar and wind. If one utility has lower-cost energy efficiency or generation options, it can reduce its emissions below its allowance and sell allowances to another utility or load-serving entity. This trading could occur between East Coast and West Coast utilities if states adopted a coordinated system. It could also include appropriately designed project offsets. Allowing the use of project offsets can help limit the costs of meeting the limits on CO_2 emissions.

There are many details to be worked out. For example, utility limits would need to deal with loss of load through changes in utility service territories or customers choosing retail access suppliers. The design of the Oregon system should be coordinated with other states wherever possible.

GEN-2a: The GEN-2 interim task force should also consider an Oregon Renewable Portfolio Standard (RPS) and potential changes to public purpose charges as tools to meet a greenhouse gas allowance standard and overall state CO_2 goals.

Through legislation, substantially expand the amount of new renewable power projects. This could serve as a strategy to implement Gen-2 (above) and to be considered by the special interim task force that examines the feasibility of, and develops a design for, a load-based GHG allowance mechanism. This option could be accomplished with a renewable portfolio standard (RPS) complementing the existing public purpose charge for renewables. If applied in support of GEN-2, an RPS could help provide a better balance in the types of renewables. The mix should include small amounts of promising, but relatively expensive, renewable sources. This could help achieve aggressive long-term GHG emission goals. An RPS, together with Oregon's existing public purpose funding mechanism, can help achieve an appropriate mix and pace of renewable development.

The fraction of load-growth met by renewable resources could be increased by adopting an RPS for Oregon electric utilities and other retail electric suppliers. Another approach would be to expand the 0.5 percent renewable portion of the public purpose charge applied to PGE and PacifiCorp retail electric bills from SB 1149 (1999 session). In either case, the 0.5 percent

renewable public purpose charge should not be repealed entirely, because part of the funds go to renewables such as solar photovoltaics. These are expensive now, but have good long-term potential.

There are several states with an RPS that could serve as a model. A poorly devised RPS could imply action but be ineffective. Any RPS legislation would have to address several issues. These issues include:

- Resource eligibility (perhaps including separate targets for resources or sub-resource technologies within each category; inclusion of hydro and definitions of biomass tend to be controversial)
- Vintage (only projects built after a specific year)
- Size of targets (absolute capacity or energy, percent of load, or percent of load growth)
- Timing of targets (deferred until a time when loads have grown or fixed targets for specific years)
- Compliance paths (whether to require bundled power purchases or whether to allow renewable energy certificates or "green tags")
- Price or cost caps (absolute or pegged to shifting market values)
- Covered entities (all utilities or investor-owned only, inclusion of retail access suppliers)
- Geographic eligibility (in- and out-of-state plants or in-state only)
- Banking (carryover from over-compliance years to future years and true-up provisions)

This legislation would be highly complex and controversial. It may be perceived as violating the legislative intent of SB 1149. If so, this could lead to repeal of the renewable portion of the existing system benefit charges.

Having a 15 percent RPS by 2025 (as percent of 2025 load) would reduce annual carbon dioxide emissions between 3.6 MMT CO_2 (if it had the effect of banning new coal-fired power plants), and 2.8 MMT CO_2 (if it did not). A 25 percent RPS would fulfill all new baseload requirements and displace some existing gas- and coal-fired generation under the energy efficiency case forecast of one percent annual load growth. Estimated savings are 7.0 MMT CO_2 in 2025.

An RPS could be designed with earlier implementation for earlier savings, but an RPS is generally designed to address only new power plants that serve load growth. An RPS that acquires more electricity than is needed for load growth would necessarily back down existing generating plants, either utility-owned or purchased. However, without further direction, the plants where reductions occur may not be the least-cost source of CO_2 reductions. Emissions from existing plants would be better addressed by a load-based cap and trade system.

GEN-3: Support the Oregon Public Utility Commission's (OPUC) review of rules and tariffs for renewable and combined heat and power (CHP) facilities.

Support Oregon PUC's review of rules and tariffs to ensure they accurately reflect the costs and benefits to the utility system from CHP systems, also called cogeneration, especially within the distribution system. Also recommend that consumer-owned utilities conduct similar reviews. This should increase the number of CHP systems, especially efficient gas-fired technologies, which have lower CO_2 emissions than stand-alone gas generation and much lower emissions than coal plants. This requires action by an independent board or commission, but could be ranked as easy because the OPUC, which covers 72 percent of Oregon load, has begun this process. The emissions reduction in 2025 could be 0.54 MMT CO_2 per year assuming displacement of 200 average megawatts of the assumed mix of half coal and half gas-fired power plants.

GEN-4: Encourage state government to purchase renewables.

Suggest that the Governor establish a 2005-2007 budget for renewable purchases by state agencies. This could be through a "one percent for renewables" requirement for new state and university buildings (similar to the "one percent for art" program) or through state purchase of renewable power or renewable energy certificates (green tags) without the power. Spending the funds on visible technologies in new buildings, such as solar photovoltaic (PV), daylighting or ground-source heat systems, might increase public awareness and advance distributed renewable technologies more than purchases of renewable power. A combination of new building measures and purchases is possible. These options would require legislative approval of funding, but might not be controversial, depending on the level of funding.

Buying renewable power, along with renewable energy certificates, would insulate state energy bills from future fossil fuel cost increases or CO_2 regulations. If the State buys only the certificates, it would reduce the added costs to state government for the same number of megawatt hours of renewable claims by the State, but would not provide the price stability benefit.

Eugene Water & Electric Board (EWEB) is the only utility or retail electricity service supplier (ESS) that offers a fixed-price renewable product. The City of Portland is exploring this idea with Portland General Electric, either as a utility product or with PGE helping shape a renewable product from an ESS. If state government pursues this idea, it should be in collaboration with the City of Portland.

This measure refers only to costs of renewable energy in excess of the expected market price of electricity or fuel. Even if renewable resources are more expensive than expected market purchases, they would help insulate future state budgets from electric and natural gas price spikes. If actual fuel or electricity prices are higher than expected, these actions would reduce the cost of state operations over the lifetime of the buildings. It is unlikely fuel or electricity prices will be substantially below current levels. The 2000-2001 West Coast energy crisis showed that upside price risk is nearly unbounded.

During the last 15 years, the State spent about a billion dollars on new state buildings. One percent of this would be about $670,000 per year. For comparison, spending this same amount on the above-market cost of electric renewables purchases would make about one-third of the

state government's power renewable (assuming renewable power costs $5/MWh more than wholesale market power). This would add 2 to 3 percent to the State's electric bill. This would save 0.08 MMT CO_2 per year if the displaced mix of new generation were half coal and half natural gas-powered plants.

GEN-5: Advocate for specific federal policies or legislation.

State agencies could advocate for federal policies (U.S. DOE and EPA) on:

- energy tax breaks (including the renewable production tax credit);
- a Renewable Portfolio Standard;
- CO_2 caps (such as the McCain-Lieberman Climate Stewardship Act);
- CO_2 or other energy taxes;
- budgets for research, development and demonstration;
- appliance and equipment efficiency standards;
- biological and non-biological sequestration research and programs; and
- material use/recycle/disposal research or programs.

For critical legislative issues the Governor could work with the Oregon Congressional Delegation.

GEN-6: Advocate with Bonneville Power Administration (BPA) to support Oregon's renewables measure.

BPA's role in the Northwest since the passage of the NW Power Act of 1980 has been to support development of resources designated by the Act as higher priority (conservation and renewables) through direct acquisition, customer utility programs, products and transmission services. BPA's role is particularly pivotal with COUs, many of whom are small and reliant on the services the larger federal agency can provide.

BPA owns and operates the largest part of the Northwest transmission system and manages and dispatches output from the Federal Columbia River Power System. BPA also has the greatest capability to integrate and firm up intermittent generating technologies such as wind.

Oregon's renewable generation actions will be more effective if BPA continues to actively provide such support. Oregon should work with BPA in the following areas: a more effective Conservation and Renewable Discount, transmission sufficiency, affordable integration services, power rate designs that provide incentives for COUs to develop renewable resources; new non-firm and "near-firm" transmission products; and strategic renewable resources acquisitions. For critical issues, the Governor could support BPA through intervention with the Oregon Congressional Delegation.

Transportation Actions to Reduce Greenhouse Gases

Issue: One-third of Oregon's total greenhouse gas (GHG) emissions are from vehicle exhaust. Cost-effective opportunities to reduce these emissions are available, particularly in urban areas.

Solutions: Two categorical solutions are: 1) to reduce GHG emissions from consumption of fossil fuels by displacing conventional combustion engines with hybrid, electric and other technological/fuel options, and 2) to guide land use choices, especially in Oregon's urban areas, toward more efficient choices including higher densities, transit options, mixed-use neighborhoods, and common wall dwelling designs.

TABLE 1 (TRAN)

Transportation Actions

CATEGORY I: SIGNIFICANT ACTIONS FOR IMMEDIATE STATE ACTION		Reductions in Greenhouse Gas Emissions in $MMTCO_2E$ 2025	C/E?**
TRAN-1	Convene an interim task force to recommend a proposal for the Environmental Quality Commission or the Governor and the Legislature to adopt emission standards for vehicles.		
	TRAN-1a: Adopt Low Emission Vehicle (LEV II) Emission Vehicle Standards.	0.24	Y
	TRAN-1b: Adopt greenhouse gas Tailpipe Emission Standards (per California AB 1493 "Pavley" standards).	> 6.0	Y
TRAN-2	Integrate land use and transportation decisions with greenhouse gas consequences.	0.40	Y
TRAN-3	Promote biofuel use and production.	1.0	Y
CATEGORY II – OTHER IMMEDIATE ACTIONS			
TRAN-4	Review and enhance state tax credits and local incentives for citizens purchasing high efficiency vehicles.	-*	?
TRAN-5	Incorporate greenhouse gas emission impacts into transportation planning decisions.	-	Y
TRAN-6	Expand "Transportation Choices Programs" and "Travel Smart Pilots."	-	Y
TRAN-7	Adopt state standards for high efficiency/low rolling resistance tires.	0.12	Y
TRAN-8	Reduce GHG emissions from government fleet purchase and vehicle use.	-	Y

TRAN-9	State and local governments should switch to "clean diesel" fuel, vehicle purchases and retrofits.	0.10	Y
TRAN-10	Adopt state and local incentives for high efficiency vehicles.	-	Y
TRAN-11	Set and meet goals for reduced truck idling at truck and safety stops.	-	?
TRAN-12	Set up traffic flow engineering "Best Practices."	0.08	
TRAN-13	Set and meet goals for freight (truck/rail) transportation efficiency; achieve this through equipment, coordination and land use.	-	?
TRAN-14	Establish consumer awareness education link to transportation choices.	-	Y
TRAN-15	Improve mass transit and inter-city transit links.		
	TOTAL	7.84	

** Symbol "-" denotes savings of less than .0001, or unable to be estimated.*
*** Column four asks if the action is cost-effective (C/E) - yes (Y) or no (N) - to the consumer over the action's lifetime. (This does not include whether it is cost-effective considering the projected effects of global warming.) A question mark means that the estimates of cost-effectiveness are uncertain and more analysis is needed. Refer to Figure 8 in Part Two, Section 1 (Introduction to Recommended Actions) for the cumulative impact of actions.*

Background

The goal of this effort is to reduce GHG emissions from transportation-related activities in Oregon. Oregon can achieve this goal by optimizing freight and people movement through the use of new technologies and diverse modes, land use planning and the use of low carbon-content fuel. As a result, Oregonians will live in a healthier environment and show leadership in meeting the challenge of global warming.

How we plan for our future and build our communities can reduce GHG emissions and bring other benefits. Communities can create a range of housing choices, mixed uses and a variety of transportation choices. Mixed uses can provide for more efficient use of buildings. Communities can plan for streets and land use in a way that creates livable, transportation-efficient communities. Providing safe streets for bikes and walking can lead to healthier lifestyles. Adults can walk or ride bikes to work and children can walk or ride bikes to schools. Such walkable neighborhoods create a strong sense of place. Strengthening development in existing communities through coordinated land use and transportation planning can help preserve open space, farm and forest lands, natural beauty, and critical environmental areas. Strengthening existing communities can also make transit a feasible alternative. Building upon existing infrastructure is also a more fiscally sound public policy.

Transportation and electricity use are Oregon's two largest contributors to GHG emissions – more than each of these other direct energy use sectors: industrial, commercial or residential. One-third of Oregon's GHG emissions is from transportation. Modes contributing to these emission levels include cars, light trucks, sport utility vehicles (SUVs), buses, large trucks, airplanes, trains and marine vessels. In Oregon there are over 3.1 million motor vehicles registered for roadway use. Oregonians spend more than $3 billion for transportation fuels each year.

A balanced approach is needed to improve Oregon's climate, air quality and transportation efficiency objectives. Alternative transportation fuels and better designed vehicles can provide lower emissions and insulation from petroleum price spikes. A reduction in emissions from all transport sectors can result in a more stable climate, cleaner air and more livable communities.

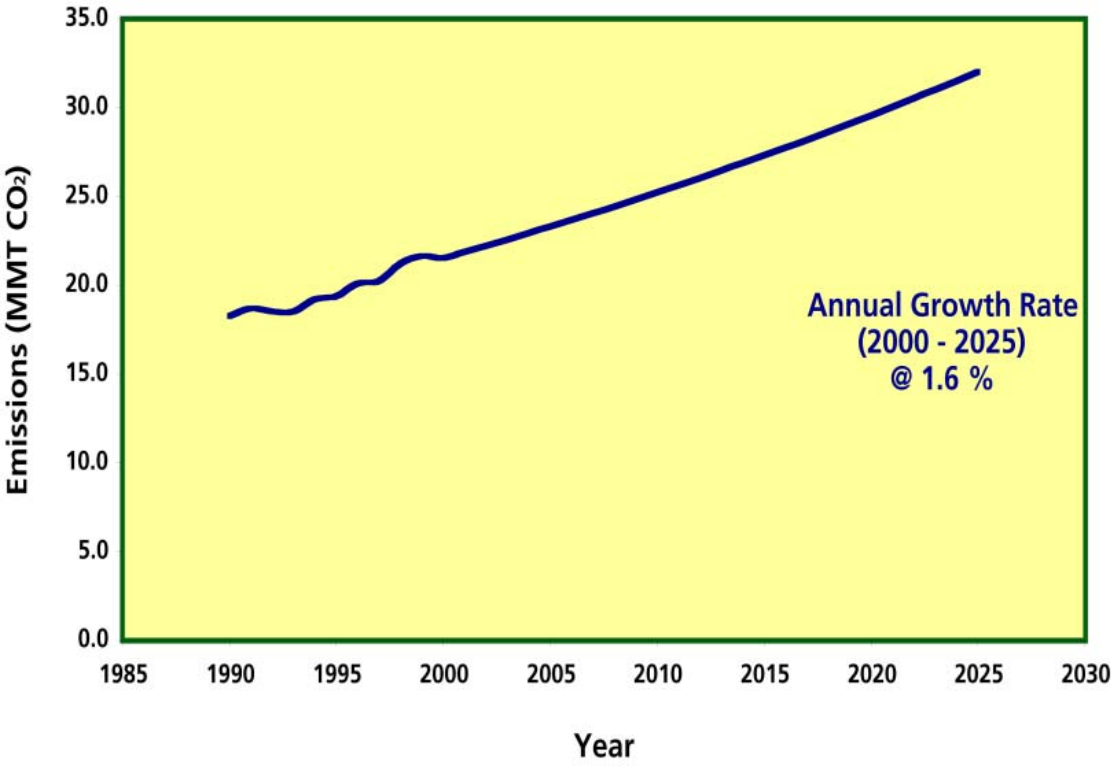
It is difficult to rank actions separately based on their GHG emission-savings potential. The rankings can be misleading for a number of reasons. For example, emission standards could be set at various levels, thus affecting the level of GHG savings from actions that reduce vehicle miles traveled. In addition, most of the following actions are listed exclusive of each other. However, it will be a combination of these ideas that will produce the greatest benefit.

Estimates of effectiveness rely upon key economic and behavioral assumptions, which are somewhat uncertain. Strategy effectiveness depends on vehicle emissions and upon the response of travelers to changes in fuel prices (price elasticity), non-monetary travel costs (i.e., time) and land use patterns. Alternative assumptions about economic parameters and determinants of travel demand can also lead to different policy impacts.

Current Emission Levels and Trends in the Transportation Sector

According to U.S. Department of Energy (USDOE) Energy Information Administration data, 1990 Oregon emissions were 18.3 million metric tons (MMT) of CO_2. By the year 2000, emissions reached 21.5 MMT CO_2, for an annual growth rate of 1.6 percent. Based on the Oregon Department of Transportation's forecast for taxed fuels and USDOE forecasts for jet fuel and freight diesel, the Oregon Department of Energy (ODOE) forecasts an annual growth rate of 1.6 percent, leading to emissions of 32.0 MMT CO_2 by the year 2025. The current transportation CO_2 emissions are forecast to grow 33 percent between 2000 and 2025.

Figure 1 (TRAN)
Historic and Projected CO_2 Emissions
from Transportation Use in Oregon



TRAN-1: Convene an interim task force to recommend a proposal for the Environmental Quality Commission or the Governor and the Legislature to adopt emission standards for vehicles.

Specific Recommended Actions:

- TRAN-1a: Adopt Low Emission Vehicle (LEV II) Standards.
- TRAN-1b: Adopt greenhouse gas Tailpipe Emission Standards (per California AB 1493, "Pavley" standards).

Currently, Oregon adheres to emission standards (Tier 2 Program) for passenger vehicles set by the federal government. Under federal law, Oregon could adopt California's stricter tailpipe standards. Doing so would ensure that auto-makers selling passenger vehicles in Oregon could only sell vehicles that produce less air pollution and fewer global warming gases than the national average.

LEV II Standards: Current California emission standards fall under its Low Emission Vehicle II program requirements. The LEV II program establishes emission standards for all new cars sold in California or any state that adopts the program. These standards are designed to address criteria pollutants (non-methane organic gas [NMOG], nitrogen oxides [NO_x], and carbon monoxide [CO]). California first adopted its first Low Emission Vehicle (LEV) standards in 1990. They were aimed at lowering the emissions of passenger and light duty vehicles. The LEV standards ran from 1994-2003. LEV II regulations, running from 2004 to 2010, represent continuing progress in emission standards. New "Pavley" standards, discussed below, will apply to motor vehicles manufactured in 2009 and thereafter. Adopting LEV II before Pavley comes into effect means that the standards automatically progress from LEV II to Pavley.

New York, Massachusetts, Connecticut, Vermont and Maine have adopted the California LEV II emission standards under Section 177 of the Clean Air Act. In addition, the State of Washington is pursuing the adoption of LEV II standards. Canada, a Kyoto Protocol signatory and itself a significant part of the North American vehicle market, is also likely to adopt tailpipe standards identical or comparable to the California "Pavley" standards. Vehicles that meet those current standards (which do not include new "Pavley" standards) result in about a $200 added sticker price compared to federal standards.

The LEV II program consists of two components: the LEV requirement and the advanced technology vehicle program. Under the California standards, 90 percent of a manufacturer's vehicle fleet is required to meet strict baseline emissions standards. Some studies have found that the emission standard for LEV vehicles, which is stricter than the federal standard, and can be achieved through the application of conventional pollution-control technology to the internal combustion engine. The remaining 10 percent of the vehicle fleet must be lower emitting than LEV standards, which qualify for credits under the advanced technology component of the program. The advanced technology components of the LEV II standards are summarized in the following table.

TABLE 2 (TRAN)
Advanced Technology Requirements of the LEV II Emission Program, 2005-2008

Category	Vehicle Type	Examples	Percent of Total Fleet	Percent of Total Alternative Compliance
Gold	Pure-Zero Emission Vehicle (PZEV)	Electric vehicles and fuel cells	2	250 total fuel cell vehicles by 2008
Silver	Advanced technology (AT) ZEVs	High Efficiency Vehicle (HEV), CNG* vehicles	2	3
Bronze	SULEVs	Super Ultra Low Emissions Vehicle (SULEV)	6	6

*Compressed natural gas

AB 1493 (Pavley bill) Standards: In 2002, recognizing that global warming would impose compelling and extraordinary impacts on California, the legislature adopted and the Governor signed AB 1493. That bill directs the California Air Resources Board (CARB) to adopt regulations to achieve the maximum feasible and cost effective reduction of GHG from motor vehicles. The Pavley standards would take effect for the 2009 model year when the LEV II program expires.

The Pavley bill requires that the new regulations be economical to the consumer over the life cycle of the vehicle. Consistent with this direction, the technology packages that provide the basis for the standard result in operating cost savings that exceed the initial capital cost. This results in a net savings to the consumer over the life cycle of the vehicle.

On September 23, 2004, CARB adopted regulations that achieve "the maximum feasible and cost-effective reduction of GHG emissions" from passenger vehicles and light-duty trucks. The California legislation requiring CARB to develop these GHG regulations explicitly states that CARB cannot impose taxes or restrict speed limits, vehicle size, or other consumer driving choices. It also gives auto-makers flexibility in meeting GHG emissions targets.

The regulations will go into effect in January 2006 and will apply to motor vehicles manufactured in model year 2009 and thereafter. Criteria to be used in determining "maximum feasible and cost-effective" include: 1) the ability to be accomplished within the time provided, considering environmental, economic, social, and technological factors, and 2) the economy to vehicle owners and operators, considering full life-cycle costs of a vehicle. CARB is required to consider the technical feasibility of the regulations and to consider their impact on the state's economy including jobs, new and existing businesses, competitiveness significantly affected by air contaminants, automobile workers and related businesses in the state. CARB is also flexible, to the maximum extent feasible, in terms of complying with the regulations. CARB must ensure that any alternative methods for compliance achieve equivalent or greater reduction in GHGs.

Under the new Pavley standards, the average first cost increase will be about $367 per passenger vehicle in 2012 and about $1,064 per passenger vehicle in 2016. The retail vehicle price increase is slightly less for SUVs and large trucks. This range results from the phasing in of higher standards starting in year 2009 and continuing through 2016. By 2020 the estimated savings from maximum feasible technology will result in a reduction of about 18 percent in total GHG emissions from passenger cars and light duty trucks and a 28 percent reduction by 2030. Despite higher initial costs, vehicles that meet these standards are less expensive over the life of the vehicle.

The Oregon Environmental Quality Commission has the authority to adopt emission standards for passenger and light duty vehicles, however legislative support would likely be prudent. Therefore, the Governor might choose to ask the Legislature to adopt the standards, given the significance of the action. By adopting California's vehicle emission standards, Oregon will have in place a progressive standard to curb emissions from vehicles, which will have a significant impact on meeting the Oregon Progress Board benchmark on climate change and the new goals recommended by the Advisory Group.

TRAN-2: Integrate land use and transportation decisions with greenhouse gas consequences.

Specific Recommended Actions:

- Revise the Oregon Transportation Plan to consider and implement non-road alternatives before road capacity is expanded. Alternatives that could be implemented now include transportation demand management and expanded transit service. Intelligent transportation systems and value pricing can be considered for later implementation.
- When transportation plans are updated and air quality conformity determinations are required, calculate estimates of GHG emissions from transportation sources using EPA approved methods. Comparisons with earlier GHG emission forecasts should be made available to document change over time.
- Through local planning and state policy, target infrastructure investments in GHG efficient locations (locations where people's homes are located near the places they regularly go).
- Foster a Location Efficient Mortgage pilot program, such as Fannie Mae's Smart Commute™ Initiative to encourage home ownership near public transportation.

The primary purpose of integrating land use and transportation decisions is to reduce the need to travel (or reduce trip length) by providing nearby access to goods and services. The State should consider policies to further limit sprawl and encourage efficient development of residential, commercial and industrial lands.

This action supports continued integration of land use and transportation planning by incorporating "Smart Growth" principles in decision-making processes, particularly in application of Goal 12 and 13[20] for Transportation and Energy, respectively. Smart growth concepts related to transportation include:

- Promoting transit oriented development
- Mixed-use development
- Minimum street connectivity standards
- Minimum densities and/or minimum floor-area ratios and parking standards (e.g., reducing the minimum number of parking spaces required, employee cash payout programs and pricing parking)

Specific standards for the strategies listed above will vary by community.

The State could accelerate "smart growth" objectives by continuing to support the on-going implementation of the Transportation Planning Rule (TPR) and Transportation Growth Management program that provides funds to local governments to help carry out TPR planning.

[20] Oregon Land Conservation and Development Commission's 19 Statewide Planning Goals and Guidelines.

Studies of the vehicle miles traveled (VMT) impacts of integrated packages of land use and transportation measures have found regional and statewide VMT reductions ranging from 2-10 percent below business-as-usual projections, resulting in roughly equivalent CO_2 reductions (1 VMT equals about 1 lb. of CO_2 emitted).

TRAN-3: Promote biofuel use and production.

Specific Recommended Actions:

- Establish fuel standards that meet engine makers' requirements.
- Require nearly all diesel fuel sold in the state to contain at least 2 percent biodiesel (B-2) by the time Ultra Low Sulfur Diesel (ULSD) fuel is mandated by the federal government (mid 2006). ULSD requires the use of a lubricity additive; biodiesel is a non-toxic lubricity agent.
- All diesel fuel sold in Oregon will contain 5 percent biodiesel (B-5) by 2010, growing to 20 percent (B-20) by 2025. All biodiesel will meet applicable American Society for Testing and Materials standards.
- Adopt a statewide ethanol fuel requirement for all gasoline sold in Oregon, such as all standard gasoline sold in Oregon will contain 10 percent ethanol by 2010.
- Mandate a minimum biofuel content for all state-owned fueling stations; for example, 10 percent of the gasoline used by state government vehicles will be E-85 by 2010 and 20 percent of the diesel used by state fleet vehicles will be B-20 by 2010. This percentage will grow to 25 percent by 2025.
- Review the effectiveness of federal and state incentives for producers, blenders or retailers.

Recommended biofuels include biodiesel and ethanol that reduce GHG emissions. Biodiesel can displace conventional diesel with blends ranging from 2-100 percent. Blends up to 20 percent require no engine modifications. Ethanol can be blended with conventional gasoline up to 10 percent without any engine modifications. Blends using 85 percent ethanol (E-85) require slight engine modifications.

Biodiesel is a cleaner burning alternative fuel, produced from domestic, renewable resources. It contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend. It can be used in compression-ignition (diesel) engines with little or no modifications.

According to a USDOE/USDA life cycle analysis, biodiesel has the highest energy balance of any fuel. For every one unit of fossil fuel it takes to produce biodiesel, 3.2 units of energy are gained (using renewable fuel crops). That same study concluded that biodiesel also results in a 78 percent lifecycle reduction in carbon dioxide.

Ethanol alcohol fuel is usually mixed with gasoline at 85 percent ethanol and 15 percent unleaded gasoline to form what is called E-85. Currently, gasoline in Oregon has zero to 10 percent ethanol, with an overall average of 2 to 3 percent. No E-85 fuel is commercially available in Oregon.

Typically derived from distilling corn, ethanol is also a byproduct of starch manufacturing. Depending on the life cycle of the feedstock, how it is transported and the production process to make ethanol, ethanol from corn can reduce GHG emissions. Ethanol made from cellulose (e.g., woody crops, wood waste, switchgrass, agricultural residues, municipal solid wastes) generates substantially fewer GHGs than fossil fuels or ethanol made from corn, but the technology to produce cellulosic ethanol is not developed.

TRAN-4: Review and enhance state tax credits and local incentives for citizens purchasing high efficiency vehicles.

This action reviews and considers modifying the Business Energy Tax Credit and the Residential Energy Tax Credit programs to ensure that they are effectively promoting the purchase of more fuel-efficient vehicles. An incentive could be based on the fuel efficiency (miles per gallon) of the vehicle rather than a specific technology.

ODOE offers tax credits to assist the added costs of alternative fuel vehicles. These vehicles include those powered by ethanol, methanol, electricity, compressed natural gas, liquefied natural gas, liquefied petroleum gas, biodiesel, hydrogen, and hybrid vehicles.

Purchasing more efficient lower-emission gasoline-powered vehicles provides benefits similar to alternative fuels, most often at a lower first cost. The tax credit program could be reviewed to include fuel efficiency and polluting qualities of the vehicle, rather than the vehicle technology. The tax credit available to private citizens, now at $1,500 per vehicle, could be raised to parity with the credit available to businesses under the Business Energy Tax Credit program at about $2,000 per vehicle.

TRAN-5: Incorporate GHG emission impacts into transportation planning decisions.

Specific Recommended Actions:

- Develop a mechanism to better coordinate growth forecasts and Urban Growth Boundary decisions within each metropolitan area and adjacent "travel-sheds."
- Develop a method to account for GHG emissions and use it as a ranking criterion in transportation planning decisions. (e.g., MOBILE 6.2 software)
- Communicate to the Oregon Road User Fee Task Force the need to keep incentives in place for the purchase of fuel-efficient vehicles.

Incorporating climate change as a key criterion in Oregon Department of Transportation (ODOT) funding decisions would provide an opportunity to give priority to those service improvements and expansions that offer the greatest GHG reductions. Use of the MOBILE 6.2 air quality software could be required as a readily available tool for estimating likely GHG emission results.

The Oregon Road User Fee Task Force is charged with developing a road user fee that will eventually replace the gas tax. While a vehicle miles traveled fee might make sense from a road-user equity perspective, a switch to such a fee might influence consumers to purchase less fuel-efficient vehicles, because the cost impact of different fuel efficiencies (miles per gallon) will be less.

TRAN-6: Expand "Transportation Choices Programs" and "Travel Smart Pilots."

Specific Recommended Actions:

- Expand City of Portland TravelSmart programs. City of Portland programs include environmental and air quality, education, and transportation options.
- Expand CarpoolMatchNW.org statewide and enhance marketing. Encourage the use of ODOT's TripCheck program.
- Provide incentives for investment in station car services (car-sharing link to mass transit). Station service cars would allow access to 'car-share' vehicles at transit stations.
- Using existing transit and social service programs, promote the State's use of additional flexible federal funds to support the efforts of transit providers to coordinate elderly and disabled transportation options.

The Department of Environmental Quality (DEQ) manages the Employee Commute Options program and ODOE provides tax credits and technical assistance to businesses that encourage alternatives to driving alone, such as telecommuting (teleworking). Transportation Management Associations (TMAs) work with major employers to reduce single occupancy vehicle commuting. TMAs assist in coordinating vanpools, carpooling and formation of transit pass programs; these also offer information about transportation demand management options.

TravelSmart is a social marketing program that identifies individuals who *want* to change the way they travel, motivates them to think about their travel options, and provides them with information about how to use transit, bike, walk or carpool for some of their trips.

TRAN-7: Adopt state standards for high efficiency/low rolling resistance tires.

Specific Recommended Actions:

- Use the West Coast states' combined purchasing power to reduce petroleum dependence by obtaining "low-rolling resistance" (LRR) tires for motor pool fleets.

- Ensure state procurement by requiring state fleets to purchase LRR tires; encourage local governments to act consistently with and support state procurement on their behalf.
- Develop a marketing program with tire dealers and consumers to encourage the purchase of LRR tires. This effort might include a voluntary labeling program for tire fuel efficiency.
- Alternate 1: Establish West Coast mandatory labeling requirement by 2010.
- Alternate 2: Establish legislation to set LRR standards for tires by 2010.

Fuel efficiency is directly related to rolling resistance (RR). The greater the RR, the more fuel is burned. The average RR of replacement tires is about 20 percent higher than that of tires that automakers put on new cars. Ecos Consulting estimates the fuel efficiency savings of using LRR tires at 3 percent annually. They estimate a typical driver would save $87 to $260 on fuel at an incremental cost of $9 to $22 for four LRR tires.

The California Legislature passed legislation in 2003 requiring the State to implement by 2008 a replacement tire efficiency program that is designed to ensure that replacement tires sold in the state are at least as energy efficient, on average, as the original equipment.

TRAN-8: Reduce GHG emissions through changes in government fleet purchase and vehicle use.

Specific Recommended Actions:

- Use the West Coat states' combined purchasing power to obtain fuel-efficient vehicles for motor pool fleets; encourage local governments to act consistently with and support state procurement on their behalf.
- Seek a change in the implementation of the federal Energy Policy Act of 1992, which currently excludes hybrid vehicles as an allowable mechanism for compliance with the alternative fuels in state fleets requirement.
- As the fleet turns over, require all state vehicles to be low-GHG and the most efficient in their class.
- Coordinate emission standards for fleet vehicle specifications.
- Develop a model "Green Fleet" Policy Statement that describes policies and/or standards that consider best practices for fleets in a comprehensive way.
- Provide training for fleet managers on how to educate employees about fuel-efficient driving techniques, optimizing vehicle operation and maintenance, and reducing the need to travel.

Public fleets can lead by example in implementing effective purchasing policies and best maintenance practices. The actions above are intended not only to improve pricing and other factors for the three states' purchases, but also to have a positive impact on the market for efficient vehicles and replacement parts.

TRAN-9: State and local governments should switch to "clean diesel" fuel, vehicle purchases and retrofits.

Specific Recommended Actions:

- Support DEQ's efforts to create a buying club for ultra low sulfur diesel fuel, as well as its work to promote diesel engine retrofits to reduce black carbon (soot) emissions.
- Establish a state contract requirement for low-emission fleets and construction equipment.
- Clean up Oregon's school bus fleet by providing funding for replacement of older school buses, retrofit of newer school buses, and purchase of biodiesel fuel. This would have immediate positive impacts on children's health and safety and would result in CO_2 reductions, as well as black carbon emissions. EPA has allocated funds to retrofit school bus fleets under the Clean School Bus USA demonstration program (www.epa.gov/otaq/schoolbus/funding.htm).

DEQ is working to promote voluntary retrofit of diesel engines in both on- and off-highway situations. Users of heavy-duty diesel engines, who retrofit with emission controls, can qualify for a credit against Oregon income taxes of up to 35 percent of the retrofit costs. Retrofits would reduce emissions of black carbon, which contribute to the greenhouse effect.

TRAN-10: Adopt state and local incentives for high efficiency vehicles.

Specific Recommended Actions:

- Pursue legislative approval of a climate-friendly vehicle registration fee (2007).
- Encourage local governments to devise incentive and recognition programs for hybrid owners.

The State could shift the amount drivers pay to title and register their cars in a revenue neutral manner, raising the $55 title transfer fee and $27 per year registration fee for cars with below average MPG (EPA miles per gallon rating) and lowering the fees for more efficient vehicles. This would have mostly a symbolic effect as the increased cost would be about the cost of a fill-up. Raising the fee for less efficient vehicles, but maintaining the fee for more efficient vehicles, could have more impact. In the latter scenario, the additional funds could be used to fix Oregon's bridges and roads.

Local governments could offer revenue neutral incentives such as preferred or free meter parking, recognition decals and other incentives.

TRAN-11: Set and meet goals for reduced truck idling at truck and safety stops.

Specific Recommended Actions:

- Establish a core network of facilities along the West Coast Interstate 5 (I-5) corridor that use techniques to enable truck drivers to rest or "overnight" in their sleeper cabs; this would replace idling their truck engines.
- Support the Oregon Solutions Team on truck idle reduction.
- Support the West Coast Diesel Emissions Reduction Collaborative.
- Institute similar and compatible programs to encourage truck operators to use these facilities as they are established.
- DEQ and ODOE secure federal funding and carbon offset funding for alternatives to engine idling.
- Market existing incentives to support deployment of this technology.
- Increase the number of trucks participating in Oregon's "Green Light" program. Green Light allows trucks to pass over weigh-in-motion (WIM) scales and under transponder readers to pre-clear the weigh station, thus cutting down on idling.
- Review transponder and WIM requirements of Washington and California. Implement consistent equipment requirements along the West Coast.

Supporting the development of infrastructure will reduce diesel truck idling at truck stops and safety stops. Currently, technology exists to outfit truck stops with a custom heating, ventilation and air conditioning system that can be ducted directly to the truck, eliminating the need for idle power. Auxiliary power units are another solution to reduce idling of the main diesel engine.

Truck drivers idle their engines during their rest periods to provide heat or air conditioning for the sleeper compartment, keep the engine warm during cold weather and provide electrical power for their appliances. About 500,000 trucks travel 500 or more miles as their primary range of operation. Based on this travel distance, truck drivers will likely require an extended rest period and may idle their engines during this time. Some studies indicate that the typical duration rest period lasts from six to eight hours per day over 300 days per year.

The West Coast Governor's Global Warming Initiative sets a goal of having the I-5 corridor outfitted with electrified truck stops to reduce truck idling. The governors of Oregon, Washington and California have made this a priority goal for each of their administrations. The goal of this project is to establish a network of truck stop operators and truck fleet managers willing to develop the necessary infrastructure to reduce truck idling in Oregon along the I-5 corridor. This project will lay the groundwork for a core network of facilities to enable truck drivers to use their sleeper cabs and auxiliary appliances without idling.

An Oregon Solutions Team has been convened to implement idle reduction options for Oregon. The goal of the Team is to equip 600 parking spaces at truck stops along I-5 in Oregon with idle

reduction technology. This should reduce 24,000 metric tons of CO_2 annually. There are 1,977 commercial truck parking spaces on the Oregon segment of I-5 alone and about 5,000 commercial spaces across the entire State. As the advantages of idle reduction technologies become better known and tested, and as demand grows, the broader goal of the collaborative effort is to install this technology in the majority of truck stops in the State as well as throughout the West Coast. The Team partners include DEQ, ODOE, truck stop owners, Oregon Trucking Association, PacifiCorp, Oregon State University, Oregon Environmental Council and The Climate Trust.

The Oregon project is underway and funding comes from the following key partners:

- EPA is contributing $200,000.
- The Climate Trust will purchase CO_2 offsets for $2 million (plus another $200,000 in Washington).
- The Oregon Business Energy Tax Credit Program (administered through ODOE) will provide $2.3 million in credits.
- The Small-scale Energy Loan Program or SELP (also administered by ODOE) will provide loans for $1.4 Million.
- Technology providers IdleAire and Shurepower have agreed to contribute a portion of overall project costs, if they are selected as equipment providers, as a matching contribution valued at $1.6 million.

TRAN-12: Set up traffic flow engineering "Best Practices."

Specific Recommended Actions:

- Improve signal timing by leveraging The Climate Trust, Federal Highway Administration and City of Portland initiatives.
- Enforce speed limits.
- Apply Intelligent Transportation System solutions.
- Identify, prioritize and reduce recurring traffic congestion and optimize highway speeds to the preferred range.
- Analyze potential projects using value pricing (i.e., congestion pricing).

Truck and auto travel is most energy efficient when vehicles travel in the 40 to 50 mph range without frequent stops and starts. Traffic flow can be optimized through targeted infrastructure investments, traffic signal re-timing, value pricing, and investments in alternatives to the automobile. Projects that improve traffic flow through road widening or traffic management strategies will reduce fuel use in the short-term if vehicles operate at more efficient speeds with less braking and accelerating. However, increasing or improving road capacity may attract more drivers, thereby increasing vehicle miles traveled and eroding GHG benefits.

Intelligent transportation systems encompass a broad range of wireless and wireline communications-based information, control and electronics technologies. When integrated into the transportation system infrastructure and in vehicles themselves, these technologies help monitor and manage traffic flow, reduce congestion, provide alternate routes to travelers, enhance productivity, and save lives, time and money.

TRAN-13: Set and meet goals for freight (truck/rail) transportation efficiency; achieve this through equipment, coordination, and land use.

Specific Recommended Actions:

- Site industrial land/facilities along key freight corridors. Encourage warehouse and distribution center development in existing urban areas.
- Work with ports statewide to adopt "green port" goals and promote state and federal investment in rail/truck/barge mode split.
- Increase rail capacity.
- Support "ConnectOregon."

The State needs to play a larger role in addressing freight rail needs. Improvements for freight rail also would help address conflicts between passenger rail and freight rail needs. Actions include:

- Make strategic investments in multi-modal freight transportation options (e.g., rail, shipping, waterways and any of these in combination with road transport).
- Use Intelligent Transportation Systems (explained in TRAN-12 above) to maximize freight efficiency. Freight railroads move a significant percent of the nation's freight and connect businesses with each other across the country.

"ConnectOregon" is a concept where lottery-backed bonds are used to improve connections between the highway infrastructure and rail, port, transit and marine facilities across the state. Investing in rail and marine transportation systems preserves Oregon's highway investment because commodities that travel via rail and marine tend to be heavy and low volume. If those commodities can be moved by rail or barge, savings will be realized in the increased life-span of the state's highways.

TRAN-14: Establish a consumer awareness education link to transportation choices.

Specific Recommended Actions:

- Use and make available public awareness materials from USEPA/USDOT's It All Adds Up to Cleaner Air program through state and local governments, transportation providers and air quality agencies.

- Participate in the development of the second generation of It All Adds Up to Cleaner Air materials.
- Develop an educational campaign to promote fuel-efficient driving behavior and best practices auto maintenance to be used as part of driver education classes in public schools, Department of Motor Vehicles programs and Vehicle Inspection Program outreach.
- Offer drivers an opportunity to donate to the Climate Trust to offset their CO_2 emissions. Require that car registration materials (or car titling materials) include an educational brochure about fuel-efficient driving.
- Work with car dealers to promote the sale of GHG-efficient vehicles.
- Team up with gas stations to develop an anti-idling campaign, e.g., "Turn your key and be idle free."
- Team up with the automotive service industry to offer "green" auto maintenance options to drivers (e.g., regular maintenance, recycled oil, bio-products, etc.) either in conjunction with maintenance work or oil changes.

Develop an education program to raise public awareness about the connection between global warming and driving. Focus on the benefits of low-GHG vehicles and available incentives for their purchase, as well as ways to boost fuel efficiency through driving techniques and vehicle maintenance.

TRAN-15: Improve mass transit and inter-city transit links.

Specific Recommended Actions:

- The State should make a greater commitment to funding urban transit system expansion and operation as well as inter-city transit links (rail and bus).

Transit can play a key role in reducing GHG emissions and the State should make a greater commitment to funding urban transit system expansion and operation as well as inter-city transit passenger rail and bus. There are many parts of the state in need of better transit systems.

Biological Sequestration Measures to Mitigate Greenhouse Gases

Issue: Carbon dioxide is sequestered (captured and stored) in trees, soils and other biomass. Human activities can release this carbon or increase sequestration.

Solution: To increase sequestration or reduce emissions for forest and other lands, Oregonians need to maintain and increase good land use practices.

TABLE 1 (BIOSEQ)

Refer to Part One, Figure 8 in Section 4 for the cumulative impact of actions.

CATEGORY I: SIGNIFICANT ACTIONS FOR IMMEDIATE STATE ACTION		MMT CO_2E 2025	C/E?
BIOSEQ- 1	Reduce wildfire risk by creating a market for woody biomass from forests.	3.2	Y
BIOSEQ-2	Consider greenhouse gas effects in farm and forest land use decisions.	0.6	Y
BIOSEQ-3	Increase forestation of under-producing lands.	0.5	Y?
CATEGORY II: OTHER IMMEDIATE ACTIONS			
BIOSEQ-4	Expand the application of water-erosion reducing practices for cereal production.	0.2	Y?
BIOSEQ-5	Leverage the Conservation Reserve Program to expand reserved acreage.	0.2	N?
BIOSEQ-6	Establish a municipal street tree restoration program.	less than 0.1	N

In the table above, column three shows estimated CO_2 sequestration in million metric tons (MMT) in 2025. Column four asks if the action is cost-effective (C/E) - yes (Y) or no (N) - to the consumer over the action's lifetime. (This does not address whether it is cost-effective to Oregon and Oregonians broadly, considering the projected effects of global warming and the costs of adapting to those effects.) A question mark means that the estimates of cost-effectiveness are uncertain and more analysis is needed. Because actions interact, CO_2 savings cannot be added. Refer to Figure 8 in Part Two, Section 1 (Introduction to Recommended Actions) for the cumulative impact of actions.

Biomass — Suppression of Wildfires

Background: All plants use energy from the sun's light to make their own food in a process called photosynthesis. During photosynthesis, carbon dioxide absorbed through leaves is broken down by the sun's energy and combined with hydrogen from water to make sugars that plants live on. This process releases oxygen into the air. The carbon in the sugars is stored as biomass in the plant's leaves, branches, trunk, and roots. Plants break down the sugars into energy. This process, called respiration, releases CO_2 back into the air. Plants use much more CO_2 in making their food and storing it as biomass than they release during respiration. The remainder of the carbon is stored in their tissues.[21]

Carbon sequestration performed by plant and soil systems is called biological (or terrestrial) sequestration. Plants and soils fix the CO_2 and store the carbon in living and dead plant tissues and as organic material. Stored carbon can return to the atmosphere as CO_2 when plant biomass or soil organic carbon is oxidized or decomposes through processes such as burning or turning the soil over. When trees are harvested and manufactured into wood products, some carbon remains stored in lumber and other wood products until the wood is discarded and disposed. If it is burned, the stored carbon is released back as CO_2. Wood discarded into landfills continues to store carbon, but may contribute to other greenhouse gases (GHGs) from landfills such as methane.

Much work remains to reduce the risk of high carbon release during catastrophic wildfires. Expanding the amount of forest area that is treated and restored to healthier forest conditions will reduce the risk of extreme fires. It could also provide economic benefits by using hazardous wildfire material as biomass fuel through viable markets for chips and small diameter trees.

In addition, current treatments do not take advantage of small woody biomass that can be used for fuel in energy production, thus displacing fossil fuel CO_2 emissions. The CO_2 savings from increased renewable biomass projects are counted in the GEN-1 action in the Electric Generation and Supply section.

BIOSEQ-1: Reduce wildfire risk by creating a market for woody biomass from forests.

Dense growth has limited the size and resiliency of trees in some forested areas of the state. In the Blue Mountains of Eastern Oregon, for example, the health of large areas of forestland has deteriorated.

The condition of the forest in these overgrown areas is not natural. It is largely the result of fire suppression and past logging practices combined with vegetative expansion due to climate change. Thinning removes dead, suppressed and other competing trees. It improves the health of the remaining trees and changes the behavior of fires. Rather than stand-replacing crown fires that kill larger trees, fires would tend to be less intense, confined to the ground, and would remove under-story brush and small trees.

[21] The Bio-sequestration technical subcommittee of the Governor's Advisory Group did not look at forest management and forest conservation. The successor advisory group will consider incorporating the findings of the West Coast Regional Carbon Sequestration Partnership as it further develops Oregon's strategy to reduce greenhouse gases.

Carefully planned forest thinning activities can preserve wildlife habitat and minimize soil erosion. With less competition for nutrients and water, the remaining trees can grow and increase the amount of carbon stored in standing trees.

However, without a market for forest fuels and small diameter timber, biomass forest thinning is limited by federal and state funds. The alternative of also removing larger, healthy and more valuable trees could offset the cost of thinning, but would not sequester CO_2. There are not enough funds to thin most of the overgrown areas. Development of an economic biomass generation technology could increase the number of acres treated.

An additional 100 MW produced from woody biomass plants would result in the thinning of 2.4 million acres over 30 years. The average annual sequestration from reduced crown fires and improved forest health would be 3.2 million metric tons of CO_2. This CO_2 reduction is in addition to, and does not include, displacing fossil fuels with biomass fuels. The GHG benefit of displaced fossil fuels is included in GEN-1. Additional benefits from this action include rural economic development (1,600 to 2,000 direct jobs), reduced costs of fighting wildfires and avoided smoke pollution.

Viable markets for forest biomass could cover the cost of removing woody biomass from unhealthy forests. The key is to locate smaller biomass-fueled generating plants near forests to reduce hauling costs and to reduce harvest pressure on local forests. Otherwise, the cost of trucking the fuel would outweigh the value of the power generated. Also, diesel trucks emit CO_2, reducing the net reduction of CO_2 from sequestration.

Viable markets will require new smaller generation technologies (2 to 5 MW) and increased state or federal incentives for constructing these small facilities. There are technical and institutional issues with getting power onto the grid from these smaller sized plants. However, smaller plants could improve reliability of the power grid in rural areas.

Most importantly, electric generation using biomass from thinning overstocked stands is now eligible for the federal production tax credit. Previously this tax credit was reserved for wind and closed-loop, energy-dedicated, plantation biomass projects.

Several possible incentives could supplement the federal production tax credit. Biomass generation is eligible for state energy tax incentives and loans. The Public Utility Commission's Portfolio Advisory Committee could promote environmentally sound woody biomass projects in its mix of green-tag sales to PacifiCorp and Portland General Electric. In addition, the Energy Trust of Oregon might be able to accelerate efforts to use public purpose charge funds for small (under 5 MW) woody biomass projects.

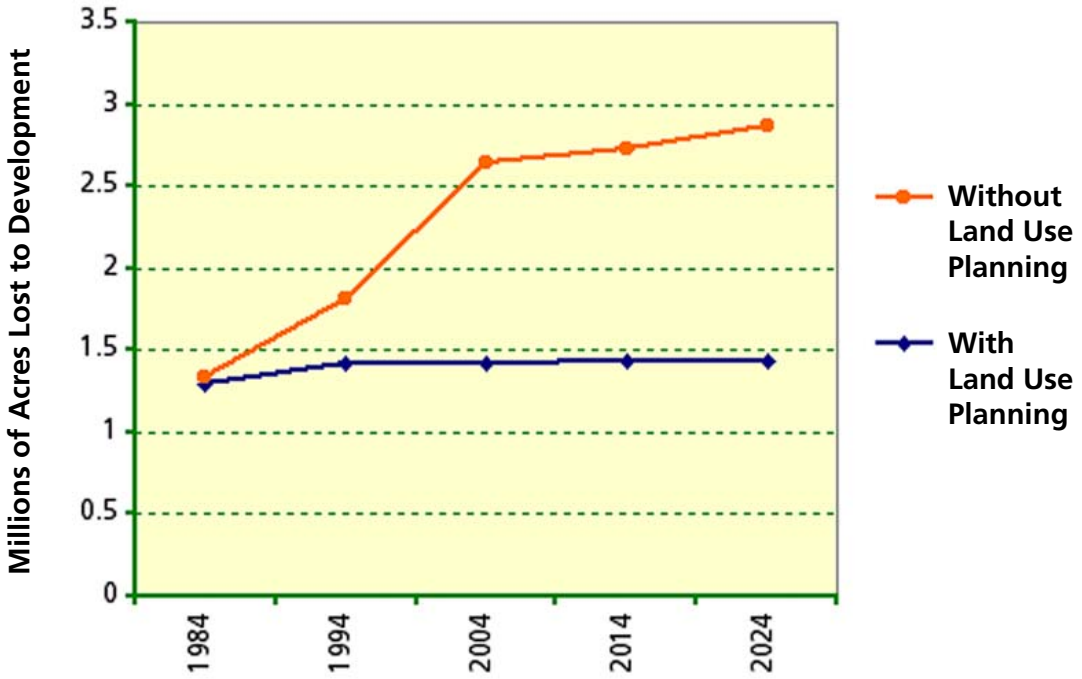
Land Use

Background: Since 1973, Oregon has maintained a statewide program for land-use planning (Oregon Revised Statutes (ORS) 197.010 – ORS 197.245). The foundation of the program is a set of 19 statewide planning goals (Oregon Administrative Rules (OAR) Chapter 660,

Division 015 – Statewide Planning Goals and Guidelines, Oregon Department of Land Conservation and Development; **http://www.lcd.state.or.us/goalhtml/goals.html**). Goals 4 and 5, respectively, address maintaining and conserving the forest and agricultural land base. Oregon's statewide goals are achieved through local comprehensive planning for city and county governments. This has led to a system for state-approved local comprehensive plans that cover the entire state.

Trend (Western Oregon): During the period 1974 to the present, urban growth boundaries and land use zoning in local comprehensive plans have prevented the loss of 1.2 million acres of forest and agricultural land to low-density residential or high-density urban development (Figure 1 [BIOSEQ]).

Figure 1 (BIOSEQ)
Trends in Loss of Forests and Agricultural Lands With and Without Land Use Planning



Adapted from Kline, Jeffrey D. 2004. Estimated forest and farmland conservation effects of Oregon's land use planning program, 1984-2024. [Unpublished]. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Projections through 2024 indicate that local comprehensive plans, if maintained consistent with current statewide planning goals and guidelines, will prevent additional forest and agricultural land conversions to development, though at a slower rate (Figure 1 [BIOSEQ]). Using average

carbon stocks of 35 metric tons/acre for forest and agricultural lands and 4.2 metric tons/acre for low-density residential and developed lands (adapted from Delaney 2004), Oregon's land use planning program has prevented 51 $MMTCO_2$ emissions over the 1974-2004 time period or 1.7 $MMTCO_2$ per year.

BIOSEQ-2: Consider greenhouse gas effects in farm and forest land use decisions.

The recommendation is to maintain Oregon's statewide program for land-use planning (ORS 197.010 – ORS 197.245; OAR Chapter 660, Division 015). Carbon dioxide emission reduction benefits from this measure are about 0.6 $MMTCO_2$ per year from avoided emissions by maintaining the forest and agricultural land base.

BIOSEQ-3: Increase forestation of underproducing lands.

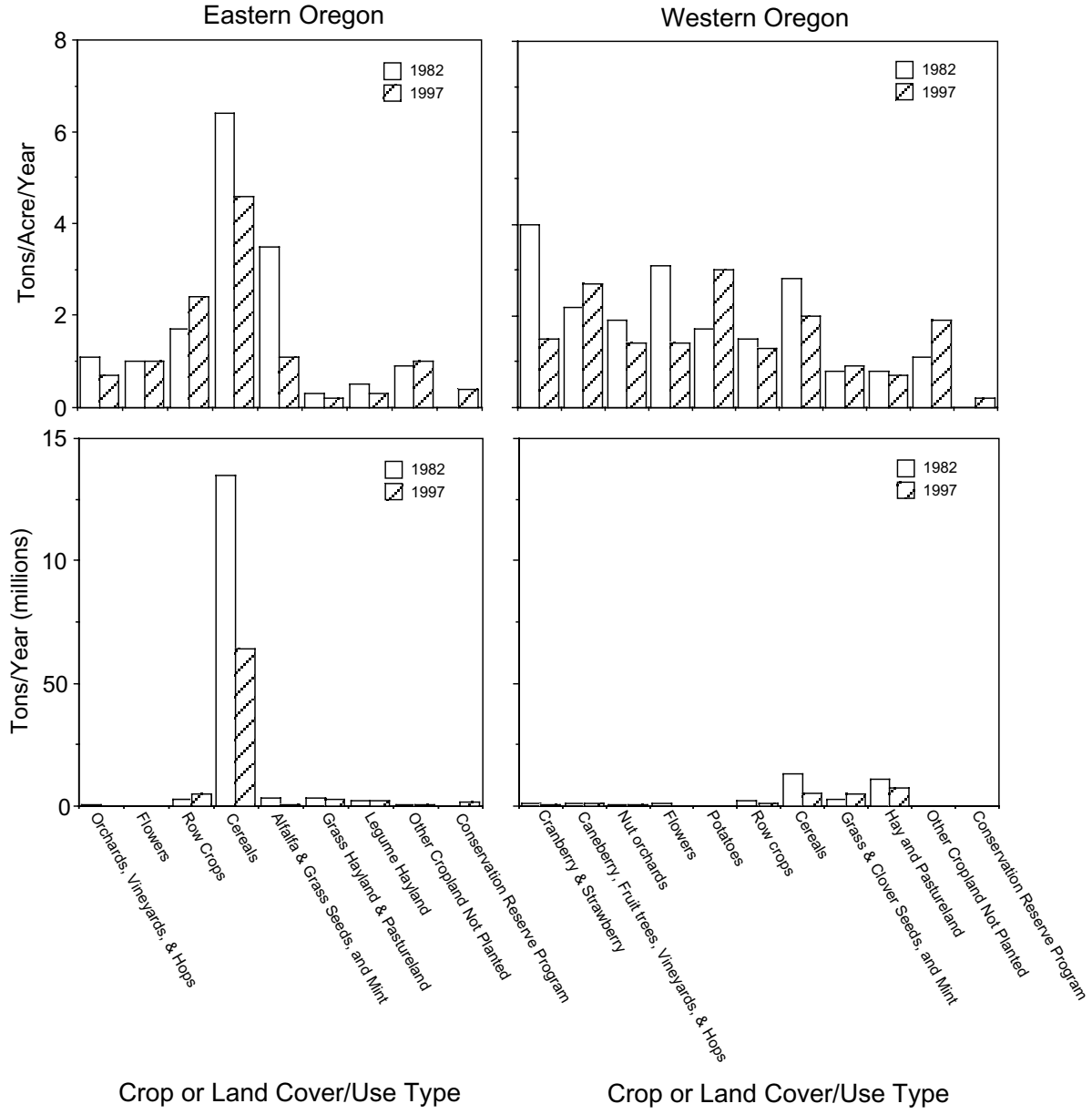
Convert marginal agriculture, pasture and unproductive brush lands (capable of growing forests) back into healthy, productive forests (both riparian and upland). Develop market mechanisms and accompanying carbon accounting mechanisms for the transfer of CO_2 emission offsets from non-federal forest landowners to emitting entities. Continue use of existing state and federal programs (e.g., Oregon's Reforestation of Underproducing Lands 50 percent Tax Credit and the Conservation Reserve Enhancement Program) as a means to provide landowners technical and financial assistance. Increase the current rate of accomplishment by 40 percent.

Carbon dioxide emission reduction benefits from this measure are 0.5 $MMTCO_2$ per year from delayed (beginning in year 2030) permanent carbon sequestration and storage in healthy, productive forests. Additional benefits include expanded timber supply, increased wildlife habitat, improved fish habitat and water quality.

Agriculture and Range

Background: A large proportion of stored carbon in agricultural and rangeland systems is found in the upper soil profile. Factors affecting the amount of stored carbon include the amount of CO_2 sequestered by agricultural crops or range grasses, the amount of biological oxidation of soil organic carbon to CO_2, and the physical loss of soil through erosion. Agricultural and range management practices can affect all three factors. The combined effects can result in a net sink (more CO_2 is sequestered and stored than carbon lost), a net source (more carbon is lost as CO_2 than is stored) or break-even (neither source nor sink).

Figure 2 (BIOSEQ)



Trends in water-erosion soil losses between 1982 and 1987 by crop or land use cover (data from U.S. Department of Agriculture, Natural Resource Conservation Service, National Resources Inventory).

Water-erosion soil loss is used as a surrogate indicator for trends in stored carbon in agricultural systems. Based on site specific capability, agricultural practices such as no tillage, reduced tillage, chemical fallow, and conservation retirement are likely to increase carbon storage over time. These practices reduce erosion and return enough carbon in organic matter to offset the carbon lost to soil oxidation. The amount of precipitation and soil water holding capacity influence the

carbon storage ability of rangeland systems. Areas of deep soils and good water holding capacity have more carbon storage potential.

Trend: Between 1982 and 1997, changes in agricultural management practices have generally led to a reduction in water-erosion soil losses for most crop types found in Oregon agriculture (Figure 2 [BIOSEQ]). Most notably, water-erosion soil losses from cereal production systems – by far the single largest source of water-erosion soil loss – have been cut by over 50 percent. Opportunities for enhancing this trend through an expanded application of water-erosion reducing practices are greatest for cereal production systems of the Columbia Plateau. In general, rangeland systems act as carbon storage sinks for most of the year. Through 1997, 486,600 acres of environmentally sensitive cropland have been enrolled in the Conservation Reserve Enhancement program.

BIOSEQ-4: Expand the application of water erosion-reducing practices for cereal production.

Develop new and expand the use of existing incentives for shifting from traditional winter wheat-summer fallow production systems to continuous winter wheat systems for lands capable of this type of system. Where appropriate, incorporate other practices such as reduced tilling. Concentrate efforts in the Columbia-Plateau Major Land Resource Area in Northeast Oregon.

CO_2 emission reduction benefits total about 0.2 MMT per year through avoided emissions and increased sequestration over an 80-year period. Additional benefits are reduced soil erosion and improved water quality.

BIOSEQ-5: Leverage the Conservation Reserve Program (CRP) to expand reserved acreage.

Continue to encourage landowners to convert environmentally sensitive cropland to permanent vegetative cover through the U.S. Department of Agriculture's (USDA) Conservation Reserve Program as administered by the Farm Service Agency. USDA Natural Resource Conservation Service provides technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning. Participating farmers receive an annual rental payment over a multi-year contract period. Financing for the Conservation Reserve Program should occur through the federal Commodity Credit Corporation. Developing incentives to maintain existing Conservation Reserve Program acres after existing contracts expire would extend GHG-reducing benefits.

CO_2 emission reduction benefits would be about 0.2 MMT per year through avoided emissions and increased sequestration over a 45-year period. Landowners would be compensated for opportunity costs through annual rental payments. Additional benefits would include reduced soil erosion, improved water quality, improved air quality and increased wildlife habitat. There is potential to put emphasis on restoration of native bunchgrass-sage habitats.

Urban Biomass Sequestration

Background: Urban forests provide many benefits to neighborhoods and communities including the filtering of air pollutants, stormwater runoff control, wildlife habitat, beauty and aesthetics, energy conservation, and carbon sequestration and storage. Urban forests play three important roles in reducing GHGs such as carbon dioxide.

1) Trees connect urban populations to an awareness of the environment and environmental issues such as global warming.
2) Trees provide shade to buildings, so a well-developed urban forest canopy reduces increased temperatures associated with pavement and urban development - both of which lead to reduced energy consumption.
3) Trees sequester and store carbon in the tree biomass.

When calculated solely for their carbon sequestration and storage benefit, renewing and expanding urban forest canopy through tree planting programs appears as a costly strategy due to the high costs of planting and maintenance with relatively modest carbon sequestration benefit. However, the role urban forests play in educating and connecting people with their environment, improved livability in communities and their role in reducing energy consumption are reasons for still including urban tree planting measures as an important part of GHG mitigation.

BIOSEQ-6: Establish a Municipal Street Tree Restoration Program.

Establish a Municipal Street Tree Restoration Program in the Oregon Department of Forestry and administer the program in cooperation with the Oregon Department of Transportation. Funding for the Municipal Street Tree Restoration Account would come by transferring 25 cents from vehicle registration fees collected under ORS 803.420. Funds from the Municipal Street Tree Restoration Account would provide grants to local governments for the purpose of planting street trees within treeless sites along urban street rights-of-ways.

Carbon dioxide emission reduction benefits from this measure are less than 0.1 $MMTCO_2$ per year from delayed (beginning in year 2020) permanent carbon sequestration and storage through increased tree biomass along urban street public rights-of-ways. All registered vehicles in Oregon would pay a fixed share of the cost ($0.25 per registration). This measure has high public education and awareness value due to the explicit connection and direct action on climate change. Additional benefits include reduced storm water runoff, improved neighborhood livability and increased urban forest canopy for wildlife.

Materials Use, Recovery and Waste Disposal Actions for Reducing Greenhouse Gases

Issue: The use of materials by Oregon households and businesses contributes to greenhouse gas (GHG) emissions, primarily carbon dioxide from energy use in the production and transportation of materials, and methane from the decomposition of wastes in landfills.

Solutions: To reduce greenhouse gas emissions, Oregonians can

- decrease the use of materials, particularly those with higher greenhouse gas emissions over their life-cycles;
- increase recycling and composting of certain materials;
- decrease burning of fossil-derived wastes such as plastics;
- reduce the emissions of methane from landfills; and
- recover energy generated during the combustion of wastes and methane at disposal sites.

This discussion evaluates actions relative to a common baseline and independent of other measures. Table 1 (MW) lists the measures that are recommended by the Advisory Group.

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 professional judgment.

Table 1 (MW)

CATEGORY I: SIGNIFICANT ACTIONS FOR IMMEDIATE STATE ACTION		MMT CO_2E 2025	C/E?
MW-1	Achieve the waste generation and recycling goals in statute.	5.2	Y
MW-2	DEQ should develop guidance to clarify alternative final cover performance at larger landfills: Demonstrate control of gas emissions comparable to geomembrane cover.	0.53	N
MW-3	Provide incentives for larger landfills to collect and burn a minimum percentage (65 to 80 percent) of methane generated.	@65 percent: 0.47 @80 percent: 0.88	N

CATEGORY II: OTHER IMMEDIATE ACTIONS			
MW-4	Provide incentives to increase salvage of reusable building materials.	0.02	Y
MW-5	Increase the "Bottle Bill" redemption value from 5-cents to 10-cents and expand the "Bottle Bill" to all beverages except milk, including juice, water, liquor, wine, tea and sports drinks; and consider alternative redemption methods.	0.05	?
MW-6	Develop statewide recovery infrastructure for consumer electronics waste, with shared responsibility among producers, retailers, nongovernmental organizations, and government.	0.03	?
MW-7	Change land use rules to allow commercial composting on land zoned High Value EFU (exclusive farm use).	less than 0.01†	Y
MW-8	Increase public awareness to discourage on-site burning of garbage, especially fossil-carbon materials.	0.02	Y
MW-9	Continue landfill regulation with additional reporting and analysis.	Unknown	Y
MW-10	Evaluate methane emissions from closed landfills and options to reduce such emissions.	Unknown	?

In the table above, column three shows estimated CO_2 equivalent savings in million metric tons (MMT) in 2025. Column four asks if the action is cost-effective (C/E) - yes (Y) or no (N) - to the consumer over the action's lifetime. (This does not address whether it is cost-effective to Oregon and Oregonians broadly, considering the projected effects of global warming and the costs of adapting to those effects.) A question mark means that the estimates of cost-effectiveness are uncertain and more analysis is needed. Because measures interact, greenhouse gas reductions cannot be added. Refer to Figure 8 in Part Two, Section 1 (Introduction to Recommended Actions) for the cumulative impact of actions.

†Actual greenhouse gas 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 year 2025.

Background

The goal is to identify and evaluate options that could reduce GHG emissions associated with the use and discard of materials by households and businesses in Oregon. Oregon can achieve these GHG reductions 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 are used and discarded in Oregon, which contributes to GHGs, is multi-faceted and complex. Some GHG emissions occur inside Oregon, while others occur in other states or even other nations. Some options that reduce emissions 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 GHG emissions, background on waste recovery and disposal in Oregon, and the accounting framework, refer to the document, "Briefing Paper: Materials and Greenhouse Gases," provided as Appendix D.

Projection of GHG Emissions

Waste generation is the sum of recovery plus disposal. According to 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 (disposal) held fairly constant throughout 1993-2002 ranging from 4.1 to 4.5 pounds per person per day.

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 33 different material categories. These are listed in the addendum to Appendix D. Using DEQ and EPA data, estimates were made of the rate of change in per-capita waste generation during the period 1993 to 2002 for these 33 different categories. These are adjusted to account for changes in reporting and assumptions regarding shifts of waste into the waste system (such as shifting waste from open burning, which isn't counted, to recycling, which is). 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.

The Advisory Group projects that per-capita waste generation, aggregated across all 33 material categories, will grow to 10.1 pounds per person per day in 2025 under the baseline, or a "business as usual" scenario. This assumes relationships between personal income and materials use/waste hold constant. It is based on projections of inflation-adjusted personal income from the Oregon Department of Administrative Services. 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 about 4.6 percent per year, from about 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.

For the sake of projections, it is further assumed that:

1. Per-ton emissions factors for materials production, transportation and end-of-life management of each material type (glass, corrugated paper, grass clippings, etc.) remain constant between 2003 and 2025.

2. Open burning of wastes continues to fall.
3. The disposition of all remaining wastes (between recycling, composting, energy recovery, and different landfills) remains fairly constant.

Under these assumptions, GHG emissions are projected to rise from 7.0 million metric tons of CO_2 equivalent ($MMTCO_2E$) in 2003 to 13.6 $MMTCO_2E$ in 2025. This represents almost a doubling of emissions between 2003 and 2025, or an average annual growth rate of about 3.1 percent under the business-as-usual scenario.

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 varies widely across different types of materials. For example, most of the GHG emissions associated with steel result from energy used during manufacturing, while most of the GHG 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 are, on average, 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.

Table 2 (MW) shows the contribution of different life cycle stages to the projected net emissions of 8.9 $MMTCO_2E$ in 2015 associated with the materials life cycle for materials used and discarded in Oregon. These are not included in Appendix B, *Inventory and Forecast of Oregon's Greenhouse Gas Emissions*.

Table 2 (MW)
Oregon Materials Life Cycle, 2015 (Baseline Scenario)

Negative numbers represent offsets. Positive numbers represent net emissions.

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

** 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 Versus Non-Regulatory Approaches

Several measures listed below are characterized as new regulatory requirements. All of the regulatory measures have costs associated with them. However, for some measures, the associated reduction in GHG emissions could be achieved through financial incentives in lieu of regulation. For example, while the State could require all large landfills to capture 65 percent of methane by 2010 through a statutory requirement, the State (or another party) could also provide financial incentives that, by fully or partially offsetting these costs, would achieve the same goal. In some cases, financial incentives (such as grants or tax credits) might be a better option than regulation, especially where the costs and benefits are not well established.

Uncertainty in Evaluating Measures

For the most part, the Advisory Group has relied on 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 GHG 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 impacts. For example, incentives for landfills to collect 50 percent of generated methane will have a different effect on emissions than an incentive for landfills to collect 80 percent of generated methane; and this 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, the largest in the state and the 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 GHG 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 GHG 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 and assumptions. Measuring actual methane emissions from landfills is quite difficult.

The GHG reduction impacts of individual measures are also influenced by whether or not additional measures are implemented. Estimates of reductions are not additive when multiple measures are implemented simultaneously. For example, the GHG 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.

Therefore, enhancing methane collection at landfills will reduce the GHG benefit of diverting highly putrescible wastes, such as food, away from those landfills and towards composting sites.

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. The cumulative net GHG reduction in 2025 of all of the measures recommended by the Advisory Group for implementation is about 6.0 $MMTCO_2E$.

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 Advisory Group, 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 that is not expected to decompose in a landfill (negative number). (An example of this would be that portion of dimensional lumber that does not decompose. The 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.

MW-1: Achieve the waste generation and recycling goals in statute.

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

Generation:

- 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

Recovery:

- 45 percent recovery rate in 2005
- 50 percent recovery rate in 2009

These two parallel sets of goals address waste generation (total discards, a rough proxy for material use) and the recovery rate (the fraction of discards diverted from disposal to recycling, composting, and certain energy recovery activities).

The waste generation goals were added to statute by the 2001 Legislature. DEQ and several local governments have a number of pilot projects in various stages of implementation and evaluation.

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 GHG 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 GHG 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.

Similarly, the GHG 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.

Accomplishing the waste generation goals is projected to result in much greater reductions in GHG emissions (5.0 $MMTCO_2E$) in 2025 than accomplishment of the recovery goals (0.25 $MMTCO_2E$). In part, this is because of how the goals are defined and the fact that Oregon is already very close to achieving the recovery goals, while achieving the generation goals would involve a larger quantity of materials. However, because the two goals are interactive, the combined reduction would be 5.19 $MMTCO_2E$.

In 2002, the State's recovery rate was 46.6 percent. In 2003 it was 47.3 percent. Achieving the recovery goals 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 GHG reduction potential only.

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. Increased environmental benefits of waste recovery programs as a whole would result if the following were included in program planning:

- Improved analysis and evaluation tools
- Education of private industry and government staff
- Directives from the Governor's office and/or Legislature to include environmental considerations other than recovery rates (such as GHGs)

It is not known at this time if the waste generation or recovery goals can be achieved without additional regulation and costs, but at a minimum, the Advisory Group recommends that both

sets of goals be achieved to the extent that they can be accomplished cost-effectively. Achievement of the recovery goals is highly dependent on strong market demand for recyclables, compostables and energy recovery. Some waste prevention and recovery activities will reduce costs to Oregon households and businesses. Waste prevention may create business opportunities for producers of some materials and services while reducing opportunities for others. Recovery also provides economic development opportunities. There are significant other environmental benefits and potential education and demonstration values associated with achieving these goals as well.

The State should create incentives that will contribute to achievement of the waste generation and recovery goals in a cost-effective manner. "Cost effectiveness" should recognize all costs, including externalities, and quantify them where possible. Achieving the waste generation and recovery goals can reduce GHG emissions and other environmental problems. Incentives should reflect (and monetize, if possible) the environmental and social benefits of achieving the waste generation, recovery and GHG reduction goals.

MW-2: DEQ should develop guidance to clarify alternative final cover performance at larger landfills: Demonstrate control of gas emissions comparable to geo-membrane cover.

Municipal solid waste landfills in wet climates are normally closed with a cover system that includes an impermeable geo-membrane barrier layer to reduce infiltration of precipitation into the landfill. Because methane cannot easily pass through such a cover, geo-membrane barriers have the added advantage of improving the effectiveness of methane collection systems. EPA and state 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 (geo-membrane) at reducing infiltration and controlling erosion. As a practical matter, alternative final covers are only feasible in dry areas east of the Cascades.

Under this measure, DEQ would revise its solid waste guidance for landfills subject to existing EPA New Source Performance Standards for landfill gas (40CFR60 Subpart WWW) so that alternative final covers at such landfills would also need to reduce GHG emissions comparable to a conventional (geo-membrane) cover. Such a guidance change would currently effect only four landfills in Eastern Oregon. No new legislation would be required. The DEQ believes comparable control of gas emissions could likely be achieved by incorporating a gas venting layer and/or compost layer into the alternative cover design, resulting in an estimated reduction of GHG emissions of 0.53 $MMTCO_2E$ in 2025. Greenhouse gas reduction benefits would be sustained for decades; much of the methane generation in eastside landfills occurs after individual cells are closed. This would increase landfill costs by about $14 million between 2010 and 2025.

Assuming that the costs are passed back to landfill customers through rates, this would increase garbage costs for users of these four landfills. Users of other large landfills would not see any new rate impacts, as their landfills are already using or planning to use the more protective geo-membrane covers.

MW-3: Provide incentives for larger landfills to collect and burn a minimum percentage (65 to 80 percent) of methane generated.

Under this measure, existing funding incentives would be leveraged, and additional funding would be provided, if necessary, to encourage larger landfills to increase methane collection or other methane controls.

For the purpose of this analysis, we have modeled this measure at two different levels: 65 percent and 80 percent by the year 2010. These percentages were applied to the eight landfills expected to be open in 2010, which are, or are eventually expected to be, subject to existing EPA New Source Performance Standards for landfill gas. 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 percent gas collection rates; two more are estimated at being between 65 percent and 80 percent; two are in the 20 percent to 40 percent range; and the last has minimal gas collection.

Setting a 65 percent collection goal would reduce emissions in 2025 by an estimated 0.47 $MMTCO_2E$, while an 80 percent goal would reduce 2025 emissions by 0.88 $MMTCO_2E$. Achieving the 65 percent goal at all eight landfills would cost about $3.4 million, while achieving the more ambitious 80 percent goal would cost about $4.9 million. It is unclear if existing incentives are sufficient to lead to these levels of additional GHG reductions; additional incentives may likely be required. Of course landfills that have already invested in advanced landfill gas collection systems, either because of regulation or on a voluntary basis (to capture energy), would not have as much opportunity to take advantage of this incentive. The incentive is targeted more at landfills that have below-average gas collection systems.

Some landfills with gas collection simply flare the methane, while others have installed energy recovery systems to use the methane to generate heat or electricity. The state Business Energy Tax Credit (BETC) is already available to help incent landfill gas energy recovery systems including collection systems above and beyond those required for compliance with environmental regulations. (Current environmental regulations require landfill gas collection and combustion, but do not address energy recovery. BETC cannot be used if gas is merely collected and flared, the current practice at some landfills.)

Because of the potent GHG impact of methane, which is 23 times as powerful as CO_2, most of the GHG benefit of this measure is associated with gas collection and combustion (converting methane to carbon dioxide), regardless of whether or not energy recovery is included. This alternative would supplement BETC with additional incentives in order to increase gas collection at those landfills with below-average gas capture rates.

Alternatively, the Legislature could establish mandatory methane collection goals for these landfills or direct the DEQ to establish such goals through rule. In this case, compliance would be paid for by customers of those landfills that have below-average gas capture rates. 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. 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.

MW-4: Provide incentives to increase salvage of reusable building materials.

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, molding 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 reusable building materials and resell them for reuse.

In this measure, the State would provide incentives, such as grants, to help establish an infrastructure of reusable building materials sites. Presumably, the incentives would primarily support capital and other start-up expenses, as revenue from the re-sale of materials should be sufficient to pay for ongoing operational costs. In addition to environmental and resource benefits, building material salvage provides more affordable materials to middle- and lower-income households. Material salvage programs can also provide living-wage jobs.

At a cost of about $2.3 million between 2010 and 2025, greenhouse gas reductions in 2025 are estimated at 0.016 $MMTCO_2E$.

MW-5: Increase the "Bottle Bill" redemption value from 5 cents to 10 cents and expand the "Bottle Bill" to all beverages except milk, including juice, water, liquor, wine, tea and sports drinks; consider alternative redemption methods.

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. Further, many beverage containers currently in use are not covered by the bottle bill, because they were not commercially available (or were uncommon) when the bottle bill was established in 1970.

This measure would make at least two changes to the bottle bill. First, it would change the deposit/redemption value of the bottle bill from 5 cents to 10 cents. Second, it would expand the bottle bill to cover a wider variety of beverage containers. As a result, the recycling of these containers would increase. Most of the associated reductions in GHG emissions result from energy savings when post-consumer aluminum, glass and plastic displace the production of virgin resources.

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 political feasibility, 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 unredeemed deposits (escheats), which are currently maintained by the distributors; and
- the addition of a processing fee to compensate redemption centers for their costs in handling bottle bill materials.

Bottle bill expansion would require statutory change and would face varying levels of political opposition, depending on the nature of the proposed re-design. Higher handling costs associated with processing the additional materials are projected to be roughly $3.5 million annually. GHG reductions in 2025 are estimated to be 0.050 $MMTCO_2E$.

MW-6: Develop statewide recovery infrastructure for consumer electronics waste, with shared responsibility among producers, retailers, non-government organizations and government (reuse and recycling).

Electronic waste ("e-waste"), such as computers, monitors, and televisions, is a rapidly growing waste stream in Oregon and the U.S. Options for end-of-life management of e-waste include disposal, stockpiling, recycling, and reuse. For personal computers (PCs), both reuse and recycling reduce GHG emissions. Because of the large amounts of energy used to manufacture a PC (particularly fabrication of silicon wafers), reuse has much greater GHG benefits than recycling, as long as the reuse displaces or delays the production of a new computer.

Oregon has been a participant in the National Electronics Product Stewardship Initiative (NEPSI), a four-year effort to negotiate a national end-of-life management program for e-waste, where responsibility for managing e-waste is shared between manufacturers, retailers, governments, consumers, non-governmental organizations (NGOs) and businesses. Although agreement has been reached on significant aspects of a national system, manufacturers have yet to agree on an up-front financing approach for the system. Electronics manufacturers held meetings in 2004 to develop a recommendation to bring back to the full NEPSI group for consideration. They were unable to reach agreement. The NEPSI process will produce a final report in early 2005 and various NEPSI stakeholders continue to work on state and national product stewardship solutions. The U.S. Environmental Protection Agency will hold an electronic waste summit in March 2005.

In Oregon the 2003 Legislature passed Senate Bill 867, establishing a statewide Task Force comprised of industry, governments and NGOs, to look at issues related to end-of-life management of e-waste in Oregon. The effort is intended to build upon the concept of product stewardship and the national NEPSI discussions, look at what currently exists and determine what measures would be needed to establish a sound reuse and recovery system for Oregon. The Task Force completed its effort in December 2004. The information gathered by this Task Force will inform any future legislation or efforts in Oregon to manage e-waste at end-of-life. A final Task Force report was published in January 2005.

In addition to the legislation passed in Oregon in 2003, the states of California and Maine have passed landmark legislation in the past year. The California legislation, which will be

implemented in 2005, addresses only cathode ray tubes (CRTs) and plasma screens as hazardous waste. It establishes an advance recovery fee on the sale of these devices in order to fund a government-managed recycling program for this specific waste stream. The Maine legislation, passed in the spring of 2004, is a producer responsibility approach requiring manufacturers to be responsible for paying for and providing the transportation and processing of discarded computers, CRTs, television and other computer peripherals through internalization of costs. Government is responsible for setting up the collection infrastructure. Washington also passed a "study bill" similar to Oregon's in the spring of 2004.

The design and funding of a statewide program in Oregon for reusing and recycling e-waste is a complicated issue. For the sake of the Governor's Advisory Group on Global Warming's recommendations, this report assumes a system of shared responsibility, where manufacturers help to pay for and/or operate the infrastructure for reuse and recycling of e-waste, without defining the details of how such a program would operate. Regardless, increasing the recycling and reuse of e-waste would reduce net GHG emissions, with a "middle of the road" estimate of 0.034 $MMTCO_2E$ in 2025. Other benefits include reducing disposal of toxins, increased computer ownership opportunities for lower-income households (via reuse) and potential economic development opportunities.

It is assumed that such a system would require new legislation and that this would require the cooperation of industry, nonprofits and the public sector. Costs of the program depend on its design and scope; at a minimum, collection infrastructure requires financing.

MW-7: 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 GHG 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). 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. In addition to these financial savings to Oregon businesses, expanding food waste composting provides economic development opportunities, GHG benefits and other environmental benefits. The GHG benefits are relatively small in earlier years, but continue for decades due to reduced methane generation at landfills associated with the avoided long-term decomposition of food wastes.

MW-8: Increase public awareness to discourage on-site burning of garbage, especially fossil-carbon materials.

Burning of garbage in burn barrels, burn piles and fireplaces is a source of GHGs and a wide variety of air toxics. It also can create fire risks. GHGs 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 in some areas. 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.

This measure is easy to implement, except for the additional funding required for coordination and promotion/education, and any local enforcement activities. Reducing burning of wastes has significant public health benefits above and beyond reductions in GHGs. GHG savings are difficult to project due to insufficient data on the quantity and composition of wastes burned, but are estimated to be around 0.02 $MMTCO_2E$ in 2025.

MW-9: Continue landfill regulation with additional reporting and analysis.

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.

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 GHG considerations in their procurement of disposal services.

MW-10: Evaluate methane emissions from closed landfills and options to reduce such emissions.

Oregon is home to many smaller landfills that are now closed and have no or very limited engineered methane controls. The quantity of methane emitted from these landfills is unknown, but was 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) 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, at a cost of about $50,000 to $100,000. 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. Statewide costs would potentially be in the millions of dollars, depending on the number of landfills involved and the scope of methane control measures recommended.

State Government Operations Actions to Reduce Greenhouse Gases

Issue: State agencies, through their internal management practices and external program operations or regulatory activities, can add to or reduce Oregon's greenhouse gas (GHG) emissions. Opportunities exist to reduce those GHG emissions and serve as examples for local governments, businesses and other organizations.

Solution: In support of the Advisory Group, state agencies evaluated how they can promote policies and programs that will move Oregon toward GHG reductions. They conducted their review in context of Governor Kulongoski's Executive Order EO 03-03 on sustainability, which he issued in June 2003 and which is also the basis for the Advisory Group's report on reducing GHGs.

The Executive Order and subsequent guidance outlined expectations for 20 state agencies to develop plans that would incorporate sustainability into their management practices. The Governor called for specific actions each agency could take and provided standards and guidelines. Throughout the document, activities were cited as areas of focus for the agencies. These included use of renewable energy, improved water efficiency, expanded materials reduction and recycling, new fleet management opportunities, and alternative fuels use.

While the link to climate change advantages was not a focus of the first Sustainability Plans specified by the Executive Order, the plans typically include GHG reduction activities. Therefore, the Sustainability Plans set in motion a mechanism for moving agencies toward GHG reductions in a united front. All state agencies will be expected to meet GHG reductions proportional to the goals stated in "Recommendation IA-1."

Table 1 (GOV)

GOV-1	State agencies should use their agency Sustainability Plans as the tool for agencies dynamic involvement in GHG reductions with respect to both their internal operations, and their external program or regulatory activities. Operational and other activities in the areas of electricity, natural gas, land use, transportation, land use, waste and water will be the particular but not exclusive focuses for reductions opportunities. Agencies should approximately calculate and report to the Sustainability Board the greenhouse gas effects of all actions that have potentially significant greenhouse gas emissions consequences: either emissions increases or reductions.
GOV-2	Through a collaborative effort, the Departments of Energy, Environmental Quality and Administrative Services should develop a process to educate agency personnel about opportunities for GHG reductions including how to set goals and calculate GHG reductions.

GOV-1: State agencies should use their agency Sustainability Plans as the tool for agencies dynamic involvement in greenhouse gas reductions with respect to both their internal operations, and their external program or regulatory activities. Operational and other activities in the areas of electricity, natural gas, land use, transportation, land use, waste and water will be the particular but not exclusive focuses for reductions opportunities. Agencies should approximately calculate and report to the Sustainability Board the greenhouse gas effects of all actions that have potentially significant greenhouse gas emissions consequences: either emissions increases or reductions.

Staff reviewed the agency Sustainability Plans and calculated GHG reductions that agencies might achieve through implementation of the plans. Unfortunately, most of the agency Sustainability Plans did not have activities for which GHG reduction calculations could be made with certainty.

The Sustainability Plan review showed that agencies were knowledgeable about how to move toward sustainability. What was missed in the first round, for purposes of the climate change work, is the link between those selected sustainability activities and GHG reductions and an understanding of the metrics used to calculate those reductions.

The Sustainability Plans are an effective mechanism to move forward the goals of GHG reductions. Table 2 (GOV) shows a summary of those activities where GHG reduction could be calculated. The table does not represent all agencies or all proposed action items. Please refer to www.sustainableoregon.net for a complete list of Sustainability Plans.

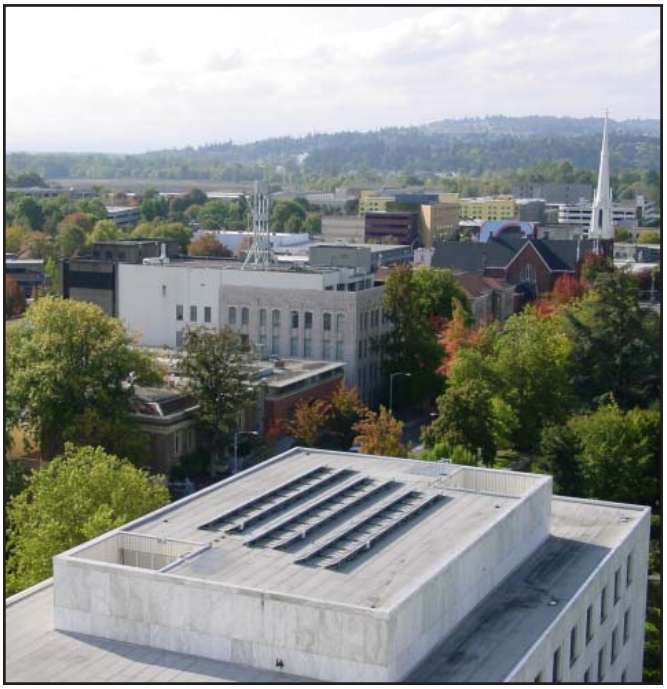


Table 2 (GOV)
Selected GHG Reduction Actions from Agency Sustainability Plans

Agency	Activity	GHG reductions (metric tons)
Energy	Truck stop electrification (with DEQ)	24,000
	High performance school plan	2880
	Train resource conservation managers at state agencies	4
	Technical assistance to agencies	216
	State Energy Efficient Design Program (new state buildings)	997
Housing and Community Service	Energy efficiency and weatherization	4600
Corrections	Solar hot water at Pendleton	1.3
	Geothermal closed loop water system in Lakeview	2800
	Burner controllers on boilers/tuning at various facilities	278
Consumer and Business Services	Extend life of personal computers	170
Administrative Services	Reduce non-renewable energy use by 10 percent below 2000 levels	1500
TOTAL		37,446

Note: This table identifies specific actions that state agencies will take as described in their Sustainability Plans and approved by the Sustainability Board. Not all agencies are listed here and these are not the only activities agencies will take. These are the only actions in the plans where GHG savings could be quantified and forecasted for the purposes of this report.

GOV-2: Through a collaborative effort, the Departments of Energy, Environmental Quality and Administrative Services should develop a process to educate agency personnel about opportunities for GHG reductions including how to set goals and calculate GHG reductions.

As noted, while Sustainability Plans can lead to GHG reductions, many current plans do not address that directly. By providing each agency a simple and uniform record-keeping program for GHG emissions, the agencies will be able to identify and pursue opportunities to reduce emissions.

SECTION 3

Conclusion and Next Steps

Oregon Choices

As Oregonians and Americans, we clearly have choices about how we will respond to the warming of our planet. We can choose a "business as usual" path of contributing ever-increasing greenhouse gas emissions to already high atmospheric concentrations – a path that American and international scientists consider dangerous and alarming. If we choose "business as usual," we leave a legacy for our children and grandchildren of a changing global climate that threatens human habitation and biological ecosystems – with much higher costs required to adapt to and remedy these changes than we will face if we act today.

Alternately, we can adopt the goals recommended in this report and the initial set of actions that will arrest and reverse Oregon's contribution to these atmospheric trends. In doing so, we will set our feet on a path to reduce emissions over time and stabilize the global climate conditions we bequeath to our children. Figure 8, in Part Two above, charts our choices and references potential actions to 1990 emission levels and to our proposed intermediate and long-term goals, although it shows we have not yet proposed actions to achieve the goals fully.

What Scientists Tell Us

Several thousand of the earth's scientists, working together as the Intergovernmental Panel on Climate Change, agree that global warming caused by GHG pollution from human activities represents a profoundly serious threat to human civilization and to even the most robust and insulated natural ecosystems. Their comments are echoed in the *Scientific Consensus Statement on the Likely Impacts of Climate Change on the Pacific Northwest* prepared by scientists at Oregon and Washington universities in the fall of 2004.

Emissions of CO_2 and other GHGs are materially altering the envelope of GHGs that now keep the earth warm enough to be habitable. It's like adding another blanket, and another, until the cumulative effects exceed the capacity of the earth's systems for absorbing the gases and dissipating the heat.

These same scientists can generally describe the effects on the earth of this gathering threat. These effects range from melting glacial formations and rising sea levels, to more severe storms, heat waves, more frequent and more intense forest fires, ecosystem disruptions, species extinctions, and mounting costs to cope with these changes in our world. Already, according to Northwest scientists, we've lost 50 percent of the snowpack in the Cascades since 1950, with global warming identified as the probable cause.

Economic Investments and Opportunities

The economic dimension of dealing with climate change can be stated as a series of "costs," but it can also be stated in a more affirmative way. Many actions proposed in this report carry price

tags, but they are generally in the nature of investments that can generate net economic returns to us over time. Most are investments we are experienced in making, from improving the efficiency of our homes, farms, factories and appliances to developing non-polluting new energy sources such as wind, solar, agricultural biomass and other renewable resources. These should remind us of our half century-long investment in hydroelectricity.

Other costs are similar to buying insurance policies against events that would otherwise cost far more to cope with. Avoiding the potentially destructive storms, floods and forest fires that are projected to accompany global warming would likely be less costly than the repairs we would need to make otherwise. These measures will bring the same welcome returns that past investments in flood control have earned.

Moreover, we believe there will be many economic opportunities for companies and communities that rise to the challenge, developing the practices and technology products that our trading partners in other states and countries also will need to cope. We have ample experience in Oregon with this outcome. Many companies here have built prosperous business lines in energy efficiency products and consulting practices, in developing renewable energy technologies, and in adapting the power system for optimal use. We believe Oregon's entrepreneurs, supported by Oregon's academic and technical capabilities, can prosper by positioning themselves at the leading edge of change.

Moreover, taking state action on global warming will position Oregon to trade freely with other countries acting similarly – a group which now includes most of our major trading partners in Asia, Europe and elsewhere. Most of these countries are party to the Kyoto Protocol on Climate Change, which will become effective international law in February 2005 for the countries that have ratified the Protocol.

Principles and Actions

The set of Principles (Section 2.1 in Part One) used to guide our efforts placed primary emphasis on real, measurable and meaningful reductions in the state's GHG emissions. We also emphasized the need to focus first on the most cost-effective actions and those that create investment and entrepreneurial opportunities. We agreed we would not take actions that could impair reliability in our electrical and other energy supply systems, and we believe that many of our recommendations will actually enhance this quality. Our principles create the right direction and focus for Oregon.

We also have proposed a set of actions – some very specific, others more in the nature of changing course – that collectively will meet our first goal of reversing the upward trend of Oregon's GHG emissions. The list of actions we choose or must take over the next fifty years is far from complete, since many needed actions and opportunities will only reveal themselves as we proceed. New, more cost-effective technologies and applications will emerge. Improved scientific understanding will open new doors. Our purpose is to set a firm course on the road to emissions reduction, understanding that our successors will have their turn at the wheel as well. We have assembled a first set of recommended actions to meet our goals and make the most of our opportunities.

Oregon's Role

We recognize that Oregon's contribution to both the problem and its solution is a small part of the whole. We can't succeed without complementary activity on the part of states and nations whose emissions dwarf our own. Fortunately, many countries that have ratified the Kyoto Protocol and other U.S. states are embarking on their responsibilities in parallel with Oregon. So we can anticipate cooperating states – beginning with our neighbors in Washington and California who have joined to form the West Coast Governors' Global Warming Initiative – and competitors as we look for ways to profit from our enterprise. Both should be welcome.

There is a next set of tasks for the Governor's next "advisory group" – further development of some of our more complex recommendations. This new group must also consider what Oregon must do to adapt to the unavoidable warming conditions from GHG emissions that have already accumulated over the past 150 years and that will continue to accumulate for some time.

But first we must decide, as an Advisory Group, a Governor and a state, whether we are prepared to adopt meaningful carbon reduction goals as proposed and to take the actions that will be required to meet those goals.

There couldn't be more of Oregon's future riding on the outcome.