

Although the recovery of materials from the waste stream is increasing, the amount of waste generated indicates that Oregonians are consuming more and more natural resources per person each year. In 1992, each Oregonian generated 5.7 pounds of solid waste per day. By 1998 that amount had increased to 7.2 pounds.

As of 1996, the majority of Oregon's municipal waste was generated in the Portland metropolitan area (48 percent), Lane County (10%), and Marion County (8%). The next highest waste generation areas were Deschutes, Douglas, Jackson, and Linn counties. As a result of more stringent federal municipal landfill requirements, approximately 30% of the landfills that were operating in 1991 have closed. Oregon continues to have 65 municipal disposal facilities operating with overall adequate disposal capacity.

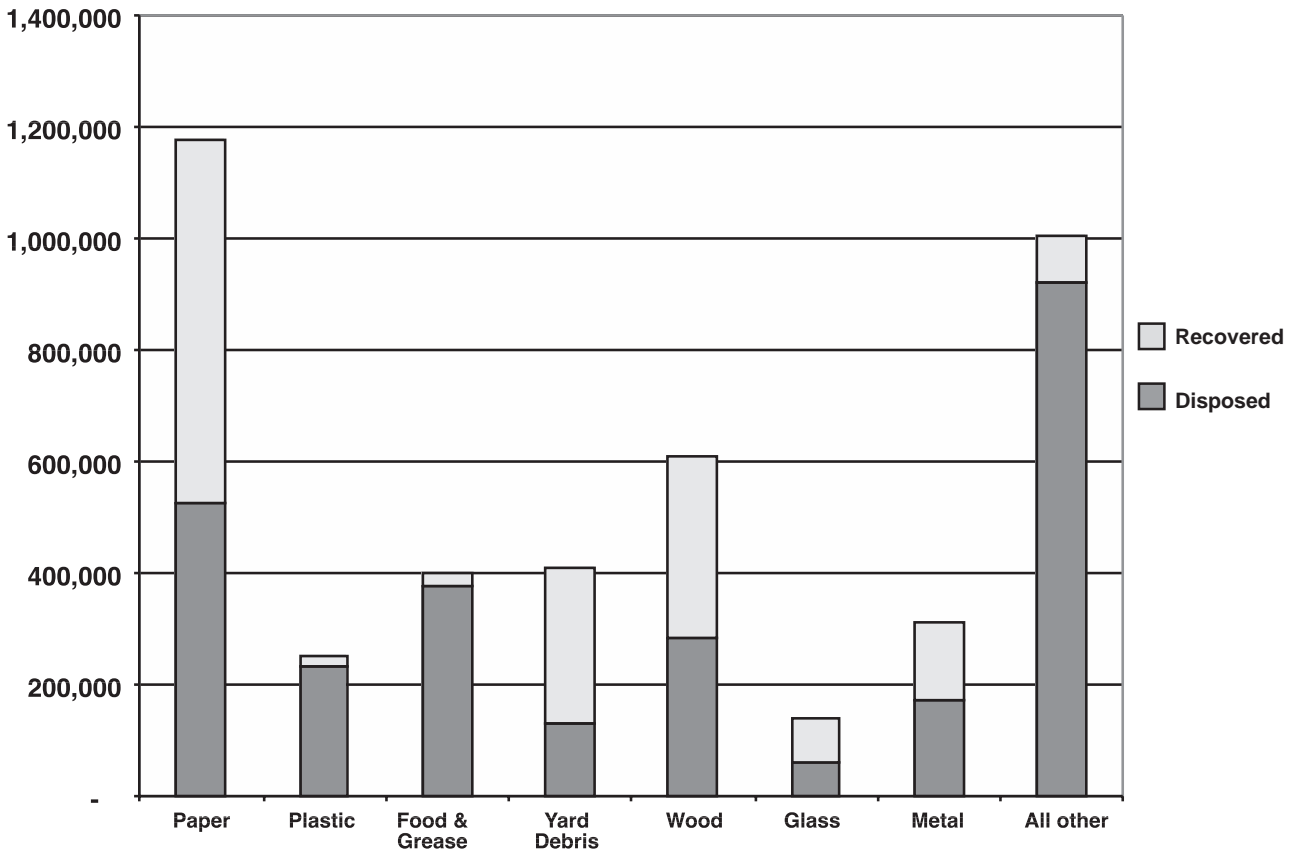
Assuming that Oregon's population will continue to grow, the economy will remain strong, and Oregonians will continue to consume at current high levels, the state will find it increasingly difficult to meet federal clean air and water requirements, protect salmon and other endangered species, and do its share to contain the emission of greenhouse gases in the future. While the state's recycling and recovery programs are effective at collecting common recyclable materials, they don't

focus on increasing the efficiency with which the state's economy uses and consumes natural resources nor do they address the toxicity issues associated with solid waste generation and recovery. Therefore, they are not likely to lead to reductions in the generation of waste and its associated potential environmental impacts.

Hazardous waste generation and management

In Oregon, businesses that generate hazardous waste are regulated according to the quantity of hazardous waste they produce. Large Quantity Generators (LQGs), which generate at least 2,200 pounds of hazardous waste per month, are subject to the most stringent waste management requirements. Small Quantity Generators (SQGs), which generate between 220 and 2,200 pounds of hazardous waste per month, are subject to less stringent management requirements. Businesses that generate less than 200 pounds of hazardous waste each month are considered Conditionally Exempt Generators (CEGs) and, as such, are not subject to the same waste management standards of a regulated generator. Conditionally Exempt Generators are not required to report on the wastes they generate or to register with the DEQ (although commercial hazardous waste transporters often require these businesses to register

Figure 3.13-6. Recovery and disposal of various materials (in tons)



with DEQ in order to obtain an identification number used when sending their wastes off-site). Therefore, in reviewing hazardous waste trends and impacts in Oregon, it is important to recognize that waste generation and management data does not include waste generated by CEGs, non-registered businesses or other unregulated generators. In addition, because these generators have fewer restrictions regarding where they can take their wastes for disposal, the cumulative impact of many small businesses taking wastes to municipal landfills, rather than to a fully licensed and engineered hazardous waste landfill, is unknown.

As the population and economy have grown in Oregon, the number of businesses generating hazardous waste has increased, from approximately 2,500 generators in 1991, to 3,500 generators in 1998 (see **Figure 3.13-7**). While the number of Large Quantity Generators in the state has remained fairly constant (between 200 and 225 businesses), the number of Conditionally Exempt Generators registered with the DEQ has nearly doubled during this same period, from 1,623 in 1991 to 2,817 in 1998. The increased number of Conditionally Exempt Generators reporting to the DEQ is believed to be due, in part, to the waste minimization and toxics use reduction achievements of larger quantity generators. Thus, generators that were generating greater quantities of waste are now, after minimization efforts, generating a small enough quantity of waste to reduce their generator status. This may explain the decreasing numbers of Small Quantity Generators. The increased number of Conditionally Exempt Generators in the state may also likely to reflect the success of small business education and technical assistance outreach efforts. Inform-

ing businesses of proper waste management methods results in more businesses registering with DEQ as hazardous waste generators in order to take advantage of more protective disposal or management options. Washington and Multnomah Counties accounted for over 84% of the hazardous wastes generated between 1990 and 1996.

Non-wastewater hazardous waste includes a wide range of industrial wastes, such as: spent cleaning solvents, discarded paints, degreasers, spent acids and caustics, containerized gases, industrial sludges, chemical by-products and even chemical products containing toxic materials that have expired or have been damaged and are no longer useful. Non-wastewater hazardous waste volumes generated from industrial processes have remained relatively constant between 1991 and 1998. Hazardous waste generated in Oregon may also come from remediation of contaminated sites, cleanup of spills or other one-time events. This waste stream is both highly variable and unpredictable from year to year. All of these non-wastewater hazardous wastes are required to meet the management and disposal requirements of state and federal hazardous waste regulations to ensure protection of human health and the environment.

While the volume of non-wastewater hazardous waste generated by industrial processes has remained relatively constant from 1991 to 1998, hazardous waste discharged as wastewaters, which account for 99% by weight of the hazardous waste generated in the state, has increased dramatically (**Figure 3.13-8**). These wastewaters are not required to be managed as hazardous waste, and while they are required to be treated to meet Clean Water Act limits on certain constituents, they may

Figure 3.13-7. Registered hazardous waste generators in Oregon

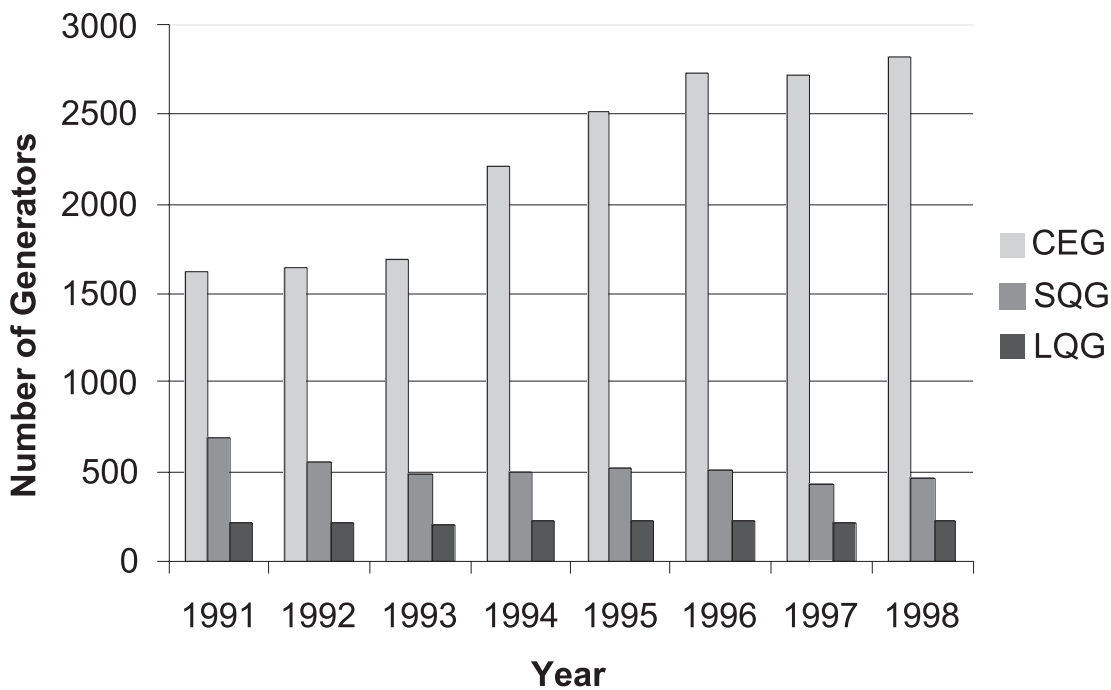
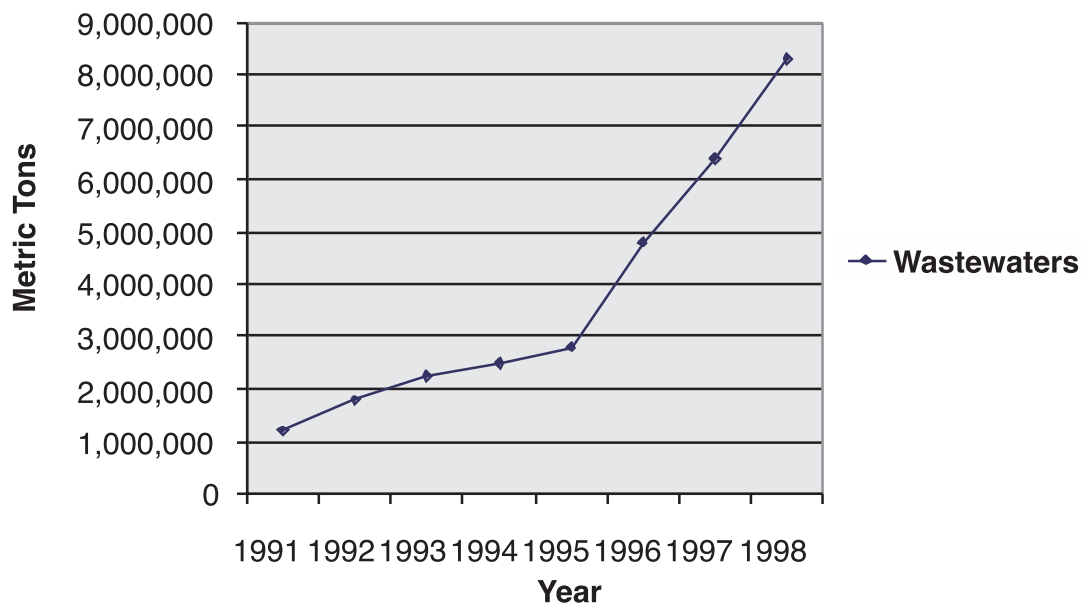


Figure 3.13-8. Hazardous wastewaters generated in Oregon



contain numerous unregulated constituents for which the discharge levels and environmental impacts on aquatic ecosystems are not well understood. This 1998 total volume of wastewaters, some 8,314,000 metric tons, was reported by 50 facilities is equivalent to the volume of 95 thousand rail tank cars. It is important to note that this data reflects only self-reported wastewaters under Oregon's hazardous waste reporting requirements. It is possible that this data may be under-reported or non-inclusive of the entire universe of facilities generating hazardous wastewaters.

Energy use

The production and use of non-renewable energy is often results in multiple adverse effects on the environment. In many cases, air and water emissions are a side-affect of energy use. Energy use is an indicator of both the overall and localized environmental impacts on communities and an indicator of the efficiency of local economies.

In 1997, about 60% of the Oregon's electricity supply came from hydropower. About 30% came from coal, 5% from natural gas and 3% from nuclear power. A little more than 1% came from other renewable sources including wood, methane gas from landfills and wastewater treatment plants and municipal solid waste.

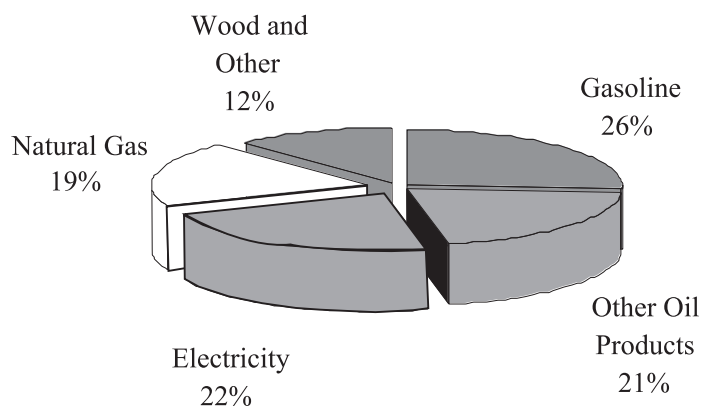
Since 1991, about 3,000 megawatts of new generating capacity have been added to the Pacific Northwest region. Although two-thirds the new generating capacity has come from fossil sources, a substantial amount (970 megawatts) came from water, wind and solar energy and the combustion of landfill gas, wood, pulping liquor and municipal solid waste.

In 1997, Oregon households, businesses, and manufacturing firms spent more than \$5.5 billion on electricity and fossil fuels. About 47% of the energy used in 1997 came from petroleum products. Electricity accounted for about 22% of total energy use and natural gas accounted for about 19 percent of total energy use. **Figure 3.13-9** shows the percentage of total energy used in 1997 for each energy source.

Transporting people and goods by car, air, ship, truck, and rail accounted for the largest share - 43% - of Oregon's 1997 energy consumption. Household travel alone accounted for about 26% of Oregon's total energy use.

Oregon households used about 15% of total energy to heat and light homes, heat water, and power appliances. Home heating by electricity, natural gas, oil, or wood is the largest single use of energy for most households.

Figure 3.13-9. Oregon energy use by source



Farms, governments, commercial businesses, schools, and hospitals used about 11% of Oregon's 1997 total energy consumption. Energy used to light, heat, cool, and ventilate buildings represents about two-thirds of the energy used by these groups.

From 1990 to 1997, Oregon's use of all forms of energy grew by about 3%. That compares to a 14% increase in population over the same time period. During that time period, petroleum use grew by about 8%, electricity use by about 11%, and natural gas use by about 48%.

The greatest risk to energy use is continued inefficiency combined with increased population and economic growth. Attendant risk is the continued high consumption of energy on an individual level, particularly in urban areas.

Renewable energy

Oregon has a longstanding policy of promoting greater use of renewable energy sources. These non-fossil sources of energy include water power, biomass, and wind, solar and geothermal. Using renewable sources has two main benefits. One, renewable sources of energy generally have less harmful social and environmental impacts than other sources of energy such as petroleum, natural gas and coal. Two, managed right, renewable sources have lower long-term costs than other sources of energy to produce electricity.

Renewable energy sources have long been a major part of Oregon's energy supply. Hydropower is the mainstay of the state's power system, providing more than half of our electricity. Wood, mill residues and pulping liquor – a byproduct of pulping in the paper industry – are sizable sources of energy for steam, heat and power generation at Oregon's pulp and paper plants and lumber mills. Hundreds of thousands of Oregon households burn wood for part or all of their heating needs, and some 17,000 Oregon households use solar or geothermal energy for space and water heating.

Renewable sources are used in three types of applications: electricity generation, direct use and alternative fuels to power vehicles. Recent new regional generating facilities that use renewable sources include Oregon's first modern wind facility, located on Vansycle Ridge in Umatilla County, and the Wyoming Wind Energy project near Arlington, Wyoming, owned by PacifiCorp and the Eugene Water and Electric Board.

One emerging trend is distributed generation – the generation of electric power in smaller facilities located near the place of use. One example of distributed generation is an innovative demonstration project at Portland's Columbia Boulevard Wastewater Treatment plant that uses biomass-derived methane gas to generate electricity. It uses the methane in a fuel cell, a generating device that produces electricity through an electro-chemical reaction, without combustion, similar to the

chemistry of a battery. Another example is the City of Ashland, Oregon, which has recently received a grant from the Bonneville Environmental Foundation to develop 25 kilowatts of solar-photovoltaic capacity. The city envisions the installation of photovoltaic systems on institutional structures in the city, such as government buildings and schools.

The potential for development of electric generation from Oregon's renewable energy sources is vast. Except for hydropower and the use of wood, only a small fraction of the potential has been tapped. Further development hinges on lower capital costs and higher generating efficiency as a result of breakthroughs in technology.

Under the electric industry restructuring bill enacted in 1999, the state's two largest private utilities, Portland General Electric and PacifiCorp, must offer their residential customers a portfolio of rate options, including a rate that reflects significant new renewable energy resources. In addition, the utilities will collect a public purpose charge from their customers. This is expected to result in a fund of \$10 million per year for ten years to stimulate the development of new renewable energy resources. The fund will become available in 2001.

Direct use of renewables

The primary direct uses of renewable energy sources by Oregon industries and households are space and water heating and the production of process steam. Biomass, solar and geothermal sources provide direct use alternatives to fossil energy sources. The combustion of biomass supplies heat and process steam at 73 industrial sites and six pulp mills in Oregon. In the residential sector, an estimated 22 percent of Oregon households use wood heating as either their main method of space heating or as a back-up heat source.

About 400 billion Btu of heat energy is supplied to Oregon through direct use of geothermal energy in locations where the underground resource is close to the surface such as in Klamath Falls.

Direct use of solar energy includes water heating and passive solar design. Oregon has recently adopted certification standards for all solar hot water systems eligible for state income tax credits to assure consumers of safety, durability and reliability. Direct use of solar energy has a significant potential to reduce heating costs. Solar design techniques such as placement windows and the addition of thermal storage can meet 20 percent of heating demand in new Oregon homes.

Transportation fuel

Oregon uses more energy to meet transportation demands than for any other single purpose. Overall, transportation use accounts for about 39% of all energy use in the state, and 96 percent of transportation energy is supplied from petro-

leum sources. Today, the use of renewable sources to supply transportation energy is practically negligible.

Federal carbon monoxide standards require the use of oxygenated fuels in Portland and surrounding areas, Jackson County, Grants Pass and Klamath Falls during the winter months. As a result, Oregon consumes an estimated 14 million gallons of ethanol yearly compared to the state's annual consumption of 1.5 billion gallons of gasoline.

The state's first ethanol production facility is in the planning stages. In addition, new vehicles that use electricity, fuel cells and hybrid engines combining gasoline and electric motors are expected to enter the Oregon market within the next two years. Renewable energy sources potentially could power these new types of vehicles.

Carbon Dioxide

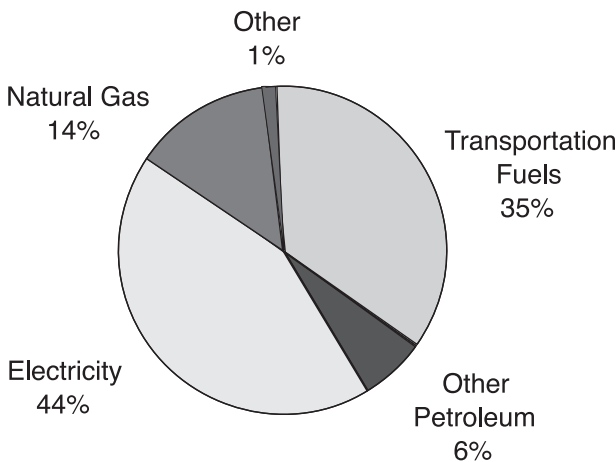
Most scientists concur that increasing greenhouse gas emissions from human activities are altering the world's environment. This could lead to significant environmental change and economic damage. Although there are numerous greenhouse gases that result from human activity, the release of carbon dioxide (CO²) from burning fossil fuels is the major source.

Oregon's CO² emissions

Oregon's CO² emissions in 1997 were 63 million short tons, 27 million tons from the use of electricity generated by fossil fuels and 23 million tons from household and business travel. Use of natural gas in homes, businesses and industry generated approximately 9 million tons of CO² (Figure 3.13-10).

In Oregon, CO² emissions rose 13% from 1990 to 1997. This compares to an 11% increase nationally. On a more positive note, Oregon's per capita CO² emissions dropped 1% during the same period. Several factors beyond economic and population growth contributed to our increasing CO² emissions.

Figure 3.13-10. Sources of Oregon's carbon dioxide emissions



We are using existing coal and natural gas plants more fully than before and most of our new generating capacity is coming from natural gas-fired plants. Although the new plants are much more efficient than traditional fossil-fueled plants, they still contribute significant amounts of CO². In addition, a few years ago Oregon also replaced the energy from the closed Trojan Nuclear Plant mostly with fossil-fueled power. The increased use of fossil fuels for electricity generation results in CO² emissions growing at a higher rate (21%) than the increase in our use of electricity (14%), compounding the CO² effects of electricity use.

Emissions from use of gasoline in the state increased 9% between 1990 and 1997, and diesel fuel-related CO² emissions grew 5%. Each mile we drive in a gasoline-fueled car puts about a pound of CO² into the air.

Oregon also had a significant increase in the direct use of natural gas from 1990 to 1997. The switch from oil to natural gas reduces CO² emissions; nevertheless, combined CO² emissions from natural gas and oil still increased in total (22%).

Impacts of climate change

The climate change from increasing CO² emissions and other greenhouse gases from human activity could have a significant impact on Oregon's ecosystems and the natural resources base of our economy.

A study that the Climate Impacts Group at the University of Washington published in November 1999, looked at scenarios of the consequences of climate change in the Pacific Northwest in 2050. Computer models predict that the Northwest will become gradually warmer and wetter, with most of the precipitation increase in the winter. The average of seven models estimates that temperature will increase by more than 5°F by 2050, precipitation will increase 5%, average snow depth will decrease by 33%, and annual stream flow will decrease by 11%.

Wetter winters will most likely mean increased flooding of rivers and more landslides on steep coastal bluffs and developed hillsides. The region's warm, dry summers may see some increase in rainfall, but the gains will more than be offset by soil moisture losses from increased evaporation by 2050.

Loss of moderate-level snow pack from warmer winter temperatures will have enormous and mostly negative impacts on the region's water resources, forests, and salmon. There will be less snow pack in the mountains, and the peak runoff on the Columbia River is likely to occur in May, rather than June, with lower flows and shortages later in the summer. Changes in water flow and temperature will affect salmon and other fish, leading to spawning and rearing difficulties. Warmer summers with higher evaporation will cause more drought-stressed trees, leading to reductions in forested areas

from pests and increased forest fires. Demand for irrigation and municipal water will increase at a time when reservoirs have insufficient water.

Actions

Avoiding CO² emissions in the first place is the most reliable way to address climate change. The Oregon Office of Energy has strong energy efficiency programs for homes and businesses. It offers tax credits and loans for energy conservation, for transit, and for recycling. For example, over the past two years, 30,000 Oregonians have bought high efficiency dishwashers, clothes washers, refrigerators, and water heaters in response to Oregon's tax credit. Oregon's 1999 electricity-restructuring bill also provides for a continuation of efficiency programs funded by utilities for 10 years.

Furthermore, Oregon requires new power plants to meet a CO² emissions standard. New plants must offset a significant portion of their CO² emissions. A key element of meeting the CO² standard is the role of the independent Oregon Climate Trust, which acts as a third-party to purchase CO² offsets with funds power plant developers provide. The Oregon Climate Trust also has a mission of educating citizens about climate change. An immediate benefit to Oregon from its regulation of CO² emissions has been \$1.5 million in funding provided by the Klamath Cogeneration Project to the Oregon Forest Resources Trust. This provides funding for almost 3,000 acres of new forest lands in the state.

Oregon faces threats to its environment and economy from climate change. Even with Oregon's leadership to require new power plants to offset their CO² emissions, with its transportation and land use planning that results in less need to drive, with its tax credits and loans to support home and business energy conservation, mass transit, telework, recycling, and renewable energy development, Oregon's CO² emissions are growing more rapidly than the rest of the country. We have begun with the right steps, but there is much more to do before we turn around the rate at which we are changing our climate.

Conclusions

Based on the data, there appears to be an increasing trend in most of the categories of pollution and waste, with the possible exception of air emissions, and toxic releases into potable water and land (we did not have yearly trend data on energy use or CO² but know that CO² emissions rose 13% and total energy use grew by about 3% from 1990 to 1997 - rates slightly below that of population growth). Total toxic releases into potable water showed an exceptional decline. However, land releases indicate only a minimal decline.

While not necessarily caused by these factors, the increases in pollution and waste generally match Oregon's increasing population and economic growth. This is not to suggest that each person or entity generates the same amount of pollution and waste per year. Some sources generate significant amounts of pollution and waste and others very little (although almost every Oregonian contributes to these totals). In addition, the risks to environmental or economic sustainability or human health do not necessarily grow at an equal level with the growth in pollution and waste. The effects of each type of pollution or waste may vary widely. For example, one ton of newsprint waste does not have the same impact on the environment as one ton of chromium sludge. However, that aggregate pollution and waste is growing at about the rate of population and economic growth suggests that Oregonians are not successfully managing these pressures on the environment.

This information suggests that even with the environmental policies and programs that exist in Oregon, most forms of pollution and waste are rising and may continue to grow as the economy and population grow. If Oregonians want to reverse these trends, new policies and approaches may be needed.