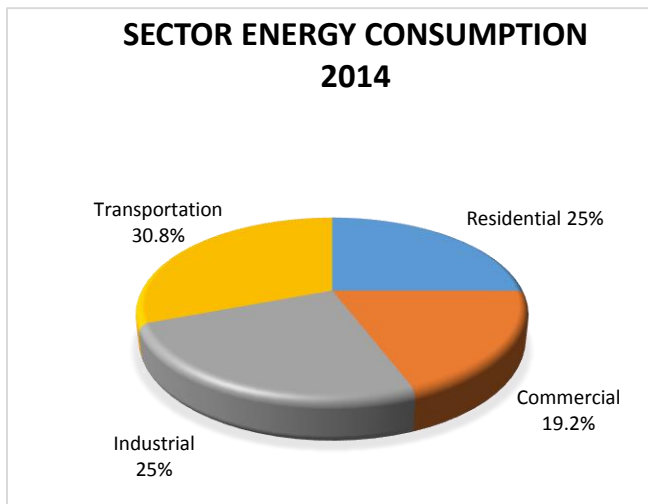




RENEWABLE FUELS

BACKGROUND BRIEF

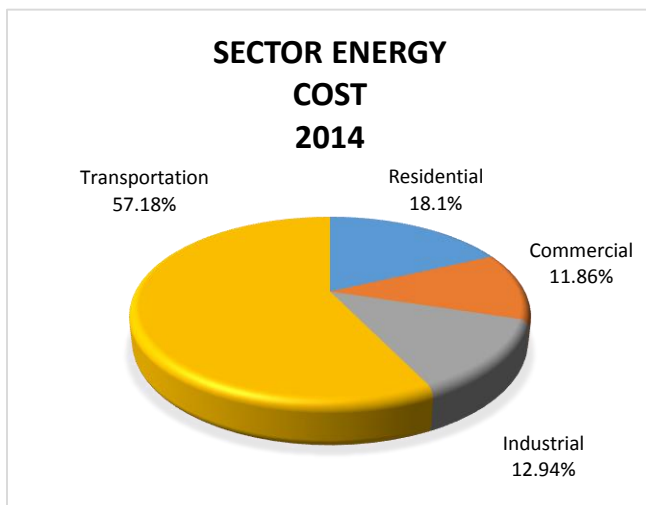
Transportation accounts for approximately 31 percent of energy use in both Oregon and the United States (figure 1). In 2014, gasoline and diesel cost Oregonians about \$7.7 billion, accounting for 57 percent of all the money spent for energy in all sectors (figure 2).



In 2005, petroleum (gasoline plus diesel) accounted for 98.3 percent of Oregon highway transportation fuels. Ethanol demand was 1.5 percent of the fuel and was used primarily as an additive to clean up emissions from gasoline. The remaining use was made up of compressed natural gas (CNG) and liquid propane gas (LPG).

In 2014, total transportation highway fuel use had dropped 3 percent from 2005 levels. Petroleum gasoline and diesel products accounted for 91 percent of demand. Ethanol and biodiesel now have a significant share of

Oregon's road use fuel at 7.1 percent and 1.6 percent respectively (see figure 3 on next page).



In 2005, all transportation fuel was imported into the state except for a small percentage of electricity generated in-state for electric vehicles. By 2014, of the more than 149 million Gasoline Gallon Equivalents (gge) of ethanol consumed in Oregon, about 40 million gallons were produced at the Pacific Ethanol plant in Boardman.

Issues surrounding energy security, fossil fuel emissions and health effects of fossil fuels have made alternative fuels an attractive option. Additionally, a major advantage of using biofuels such as ethanol and biodiesel is that they can be blended with fossil fuels and

require only minor adjustments in existing infrastructure. However, there are concerns that biofuels produced from crops such as corn may compete with food sources and that the energy intensity to produce this type of fuel is high.



OREGON TRANSPORTATION FUEL USE AND MIX FOR 2005 AND 2014

Fuel Type	2005		2014	
	GGE – Gas Gallon Equivalent		GGE – Gas Gallon Equivalent	
Gasoline	1,536,836,639	70.9%	1,346,740,245	64.09%
Diesel	593,882,504	27.4%	565,022,034	26.89%
Ethanol	31,343,197	1.45%	149,637,805	7.12%
Biodiesel	850,455	0.04%	33,970,417	1.62%
CNG	1,403,773	0.06%	2,762,717	0.13%
LPG	1,157,656	0.05%	929,178	0.04%
Electricity (GGE)	1,135,327	0.05%	2,188,929	0.10%
Petroleum	2,130,719,143	98.3%	1,911,762,278	90.98%
All Others	35,890,408	1.7%	189,489,045	9.02%
Total	2,166,609,551		2,101,251,324	

Figure 3: Oregon Transportation Fuel Use and Mix

ETHANOL

Ethanol is a renewable fuel made from various plant materials, primarily corn. More than 95 percent of U.S. gasoline contains ethanol at a 10 percent blend, mostly due to the U.S. Renewable Fuels Standard. Oregon's renewable fuel standard requires nearly all gasoline sold to be a 10 percent ethanol blend.

A higher blend of ethanol known as E85 is also available in Oregon. This fuel must be used in flexible fuel vehicles, which can run any combination of gasoline and ethanol blends. E85 is available at five public retail locations in Oregon. Additionally, five fleets dispense this fuel into their own vehicles: the state of Oregon via the Department of Administrative Services, the Department of Transportation, and the Department of Forestry; Eugene Water and Electric Board; the Veterans Affairs Portland Campus.

Several steps are involved in making ethanol available as a vehicle fuel:

- Feedstocks are grown, collected, and transported to an ethanol production facility.
- Ethanol is made from these feedstocks at a production facility along with byproducts such as animal feed and corn oil. The fuel is then transported to a blender/fuel supplier.
- Ethanol is mixed with gasoline by the blender/fuel supplier and distributed to fueling stations.

Experts expect that in the future cellulosic (non-edible plant material) ethanol will become the dominant source of biofuel. Cellulosic feedstock has several advantages over sugar and starch feedstock including: cellulose cannot be used as food, so there is no potential for conflicts with



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food resources; there are a wide variety of potential sources (i.e., trees, orchard clippings, corn stover, rice hulls, switchgrass, etc.); and finally, one of the cellulosic components, lignin, has a high-energy content that, once separated, could be used to provide the energy required to convert the cellulosic material to a usable form of fuel. However, currently more energy-intensive processing is required to extract sugars from the cellulosic portions of plants.

In the last few years, five cellulosic ethanol plants have opened in the United States. Several of these are no longer operating, but at least two plants are currently manufacturing cellulosic ethanol (although neither of these is located in Oregon). Production of this type of ethanol has been trending upward, and in 2015, 2.2 million gallons of cellulosic ethanol was produced in the U.S.

There is particular interest in cellulosic ethanol in Oregon because Oregon's soil and climate is better suited to growing woody plants than other ethanol feedstock. A cellulosic ethanol demonstration project in Boardman, Oregon was built by ZeaChem, Inc. The company developed a cellulose-based biorefinery platform capable of producing advanced ethanol, fuels, and chemicals from poplar trees grown in eastern Oregon. The project produced some ethanol, but it was deemed uneconomical and has since shut down. No future cellulose-based ethanol plants are currently being planned in Oregon.

BIODIESEL

Oregon consumed 520,863,000 gallons of on-highway diesel in 2014. The state Renewable Fuel Standard requires five percent of diesel consumed in state must be biodiesel, which accounts for just over 26 million gallons. Another 3.5 million gallons of biodiesel was consumed in the state through higher blends such as B20, which is a mix of 20 percent biodiesel and 80 percent conventional diesel. Nearly seven million gallons of B20 is produced in-state and the remainder is shipped by rail to local terminals from the Midwest. Most of the in-state production comes from SeSequential Biofuels in Salem, which has a production capacity of 15 million gallons per year. Currently SeSequential sells their fuel at 62 locations in Oregon. Several fleets such as Oregon Department of Forestry, Oregon Department of Transportation, Eugene Water and Electric Board, Organically Grown, and the City of Portland use high blends of biodiesel in their fleets.

Biodiesel is produced from a diverse mix of feedstocks including recycled cooking oil, agricultural oils, and animal fats. As an example, SeSequential produces most of its fuel from waste vegetable oil feedstocks generated by restaurants and food processors around the region.

RENEWABLE DIESEL

Hydrogenation-derived renewable diesel (HDRD), also known as green diesel, is the product of fats or vegetable oils—alone or blended with petroleum—refined by a process called hydrotreating. This fuel is cleaner and has a lower carbon footprint than petroleum-based diesel, and it can also operate at colder temperatures than standard diesel or biodiesel. Because HDRD meets the petroleum diesel American Society for Testing & Materials (ASTM) specification, it can be used as a direct substitute for petroleum-based diesel and is not subject to blending limitations that apply to biodiesel. Several fleets in Oregon have been using the fuel since September 2015. Most of the renewable diesel consumed in Oregon is imported and currently only in limited quantities.



RENEWABLE NATURAL GAS/BIOGAS

Renewable natural gas consists of biogas (methane) from landfill recovery, waste water treatment plants, anaerobic digesters at dairies, food processing, or waste processing facilities. Oregon currently has several of these facilities producing methane and converting it to electricity. Many facilities and entities, such as Clean Water Services in Washington County and Columbia Boulevard Waste Water Treatment Plant in Portland, are now analyzing the possibility of converting their waste methane into a higher value transportation fuel instead of electricity. However, making biogas into a transportation grade fuel requires additional refining and processing of the biogas in order to meet EPA transportation fuel standards. Additional challenges for use of renewable natural gas as a transportation fuel concern price structures and access to pipelines, including standards for biogas quality.

RENEWABLE FUEL STANDARDS

A Renewable Fuel Standard (RFS) requires a certain percentage of renewable fuels to be used in the transportation fuel mix by a specific date. The federal RFS, included in the federal Energy Independence and Security Act of 2007, requires at least 36 billion gallons of renewable fuels be included in U.S. transportation fuels mix by 2022, 60 percent of which must be from advanced biofuels (i.e., biofuels not produced from corn starch and that achieve 50 percent reduction in greenhouse gas emissions). It is not certain if the U.S. is on track to achieve this goal.

Oregon also adopted a RFS in 2007 (House Bill 2210) for ethanol, biodiesel, and renewable diesel. The Oregon RFS required all motor gasoline (with some exceptions) to be E10 (10 percent ethanol, 90 percent gasoline) as soon as Oregon's production capacity for ethanol reached 40 million gallons per year. This capacity was met in September 2007 when Pacific Ethanol opened its ethanol production facility in Boardman. The diesel portion of the standard was implemented in two phases. By 2009, all diesel sold in Oregon had to be B2 (two percent biodiesel, 98 percent diesel), with a few exceptions. Once Oregon production capacity reached 15 million gallons, the standard increased to B5 (five percent biodiesel, 95 percent diesel). In August 2010, SeQuential-Pacific Biodiesel in Salem reached that capacity and the B5 standard was implemented in April 2011.

CLEAN FUELS PROGRAM

The 2009 Oregon Legislature passed House Bill 2186 establishing a low carbon fuel standard to reduce carbon emissions by 10 percent in the transportation sector over a ten-year period. The bill contained a provision that included a sunset of the program in 2015. Senate Bill 324 (2015) extended the timeline for achieving the 10 percent reduction to 2025 and removed the sunset.

Legislation	Year Enacted	Summary
Biofuels Production Property Tax Exemption	2005	Property used to produce biofuels, including ethanol and biodiesel, may be eligible for a property tax exemption if located in a designated Renewable Energy Development Zone. The Oregon Business Development Department



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		must receive and approve an application from a qualified rural area to designate the area as a Rural Renewable Energy Development Zone. (Reference ORS 285C.350 through 285C.370)
Renewable Fuel Standard (RFS)	2007	Established minimum requirements for biodiesel, ethanol, and other renewable diesel to be included in Oregon's diesel and gasoline supplies.
Biomass Collector Credit	2007	Tax credits to encourage production and use of alternative fuels for producers and collectors of biofuel raw materials. This program is scheduled to sunset with the 2017 tax year, with the exception of animal manure used in a biodigester, which will sunset with the 2021 tax year.
Ethanol Exemptions	2008	Exempted certain non-road uses, including airplanes, water craft, Class I and Class III off-road vehicles, antique vehicles, racing vehicles, snowmobiles, and tools from ethanol blending requirements established in the RFS.
Diesel Additives	2010	Allowed addition of diesel additives between October 1 and February 28 to prevent congealing.
Energy Incentive Program Alternative Fuel Infrastructure	2011	Business owners and others may be eligible for a tax credit of 35 percent of eligible costs for qualified alternative fuel infrastructure projects. Qualified infrastructure includes facilities for mixing, storing, compressing, or dispensing fuels for vehicles operating on alternative fuels. Qualified alternative fuels include electricity, natural gas, gasoline blended with at least 85 percent ethanol (E85), propane, and other fuels that the Oregon Department of Energy approves. The credit is available through December 31, 2017 when the program is scheduled to sunset. (Reference ORS 315.336, 469B.320, and 469B.323)
Biodiesel Tax Exemption	2013	Biodiesel blends containing at least 20 percent biodiesel derived from used cooking oil are exempt from the \$0.30 per gallon state fuel excise tax. The exemption does not apply to fuel used in vehicles with a gross vehicle weight rating of 26,001 pounds or more, fuel not sold in retail operations, or fuel sold in operations involving fleet fueling or bulk sales. The exemption expires after December 31, 2019. (Reference ORS 319.530)
Clean Fuels Program	2009 - 2016	HB 2186 (2009) required DEQ to implement a low carbon fuel standard if the program was technically and financially feasible. The bill included a sunset provision. The sunset date was removed in 2015 with the passage of SB 324, and the program began January 1, 2016. The program will lower carbon emissions in the transportation sector over a ten-year period.

Figure 4: Renewable Fuels Legislation