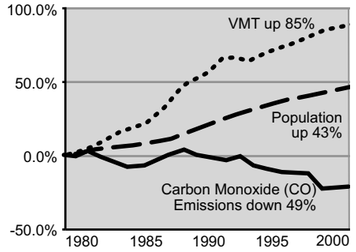
Story of Progress

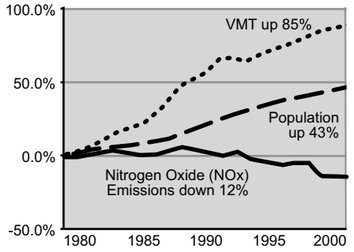
In Washington State, the annual amounts of key pollutants focused on in the Clean Air Act regulatory scheme have dropped even as the state's citizens and businesses have registered large increases in driving. Transportation agencies like WSDOT also play a role in the scheme of regulation by evaluating proposed transportation projects to assure that emissions of regulated air pollutants will not lead to local areas of non-attainment of the applicable standards for public health protection.

The graphs below show overall air emissions experience in Washington State since 1980 for carbon monoxide, nitrogen oxides, and total hydrocarbon emissions.

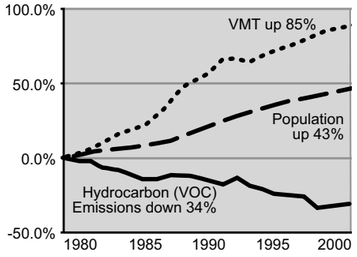
Change in Population, Vehicle Miles Traveled and Carbon Monoxide Emissions (CO) from 1980



Change in Population, Vehicle Miles Traveled and Nitrogen Oxide Emissions (NOx) from 1980



Change in Population, Vehicle Miles Traveled and Hydrocarbon Emissions (VOC) from 1980



Source: WSDOT

What can we do today?

Rideshare programs, transit, bicycle and pedestrian access are some of the ways WSDOT works to reduce motor vehicle travel. Typically transportation agencies apply incentives or disincentives that encourage less driving. There is much work to be done in coordination with local governments and the legislature if we are to be successful in reducing VMT. Meanwhile make sure your vehicle is well maintained and tires properly inflated. A well maintained vehicle is hugely more environmentally friendly and efficient than the same vehicle out-of-tune.

WSDOT is a member of the state agency task force that is advising the West Coast Governors' Global Warming Initiative. Multi-state workgroups have been formed to address the following topics:

- Hybrid Vehicle Procurement: Combined purchasing of fuel-efficient vehicles and low-rolling resistance tires for motor pool fleets.
- Ports & Highway Diesel Emissions: Reduce the use of diesel generators and engines by ships at port and trucks at rest areas and truck stops.
- Renewable Energy: Remove barriers to and encourage the development of renewable electricity generation resources and technologies.
- Energy Efficiency: Improve efficiency standards.
- Measurement: Develop consistent and coordinated greenhouse gas emission inventories, protocols for standard reporting, and accounting methods for greenhouse gas emissions; and collaborate on improved scientific tools to more precisely measure the impact of climate change.

In addition to the dozens of recommendation being considered, WSDOT will be suggesting that improved inspection and maintenance measures should be considered to control emissions from existing on-road vehicles.

For more information contact:

Mia Waters
Air Quality, Acoustics & Energy Programs Mgr.
Environmental Services
206/440-4541

watersy@wsdot.wa.gov

Washington State Department of Transportation

Notes and resources:

[1] Health Effects Institute, *Research on Diesel Exhaust and Other Particulates,* (2003)
[2] EPA, Regulatory Impact Analysis – Control of Emissions from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements, p. 5. http://www.epa.gov/otaq/regs/ld-hwy/tier-2/frm/ria/r99023.pdf.
On-Road Diesel information source: http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/2298962181981d7585256e4d00690cdc?OpenDocument
[3] EPA, "Latest Findings and Trends on National Air Quality: 2002 Status and Trends," February 2004.
[4] Asif Faiz, Christopher Weaver and Mike Walsh, "Air Pollution from Motor Vehicles: Standards and Technologies for Controlling Emissions" The World Bank, 1996. Page 41.
[5] Northwest Environment Watch, *"Cascadia Scorecard: Seven Key Trends Shaping the Northwest",* 2003 p. 31.
[6] Elizabeth Kolbert, "Car of Tomorrow" *The New Yorker*, August 11, 2003 v79 i22 p036.
[7] Hamlet, Alan, et al. "Effects of Climate Change on Water Resources in the Pacific Northwest: Impacts and Policy Implications." Climate Impacts Group and University of Washington, July 2003

We all hear a lot about air quality--

both the local effects of pollution and the global problems of greenhouse gases and climate change. We at WSDOT want to provide you with our perspective on some of the issues.

Air emissions associated with transportation – from cars, trucks, buses, cargo vessels, ferries and trains – are the state's largest source of local air pollution and greenhouse gases. Compared to Washington some other areas of the country have overall higher emissions levels per capita and a lower transportation sector share because they use fossil fuels for electric power generation to a much greater extent than we do. This does not detract from the importance of what can and must be done to better protect air and atmospheric quality.

Regulation of air emissions by EPA has led to huge air quality gains across America since the 1970's. But some issues of concern have not yet been addressed as effectively as they must. The transportation/air quality picture demonstrates two crucial and problematic trends.

- Fuel efficiency for our cars and trucks has improved but little in recent years, even though technology offers breakthrough opportunities.
- Vehicle miles traveled by every class of vehicle has been climbing in response to population and economic growth and changing habits and patterns of personal and freight mobility.

Progress on air quality issues must be built on greater efficiency in the vehicles we use and appropriate constraints on the overall volume of our fossil-fueled transportation uses. These actions will be tied to progress in regulation, to progress in technology, and to progress in the choices made about transportation by individuals and communities.

Employed as part of an integrated transportation program, large improvements in the environment can be obtained from technology and regulation. These will buy time for longer term changes in transportation demand and movement to sustainable transportation systems.

Washington State Department of Transportation

Washington State Ferries is taking steps towards cleaner, healthier air.

The entire fleet is switching to cleaner fuels. This year, ferries will run all boats on low sulfur diesel. This one huge step will reduce particulate emissions by 30 percent fleetwide.

Ferries is cutting fuel consumption by revising routes and schedules, and by upgrading to more fuel efficient equipment.

Two new fuels will be tested for emission reductions and for performance and engine-wear. Ultra-low sulfur diesel fuel and biodiesel made from renewable vegetable oils will be put to work in controlled tests.

More information is available at:

www.wsdot.wa.gov/ferries/environment/fuel/

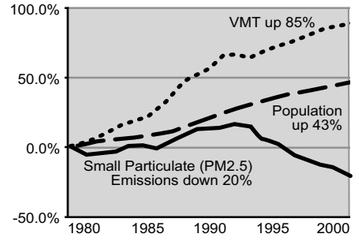
Washington State Ferries

Diesel, $PM_{2.5}$ and the Protection of Public Health

Diesel exhaust is an important air quality issue. The chemistry of diesel combustion is complex. Among many candidate concerns, today's most prominent air quality issue associated with diesel is the very small particulate matter, smaller than 2.5 microns in size, resulting from diesel combustion. Diesel is not the only culprit in $PM_{2.5}$ generation. Other sources include agricultural burning, forest fires, construction activities and factory and utility smokestacks. But diesel is big.

$PM_{2.5}$ can be inhaled deeply into the lungs. Its long term and short-term health effects are matters of widespread concern in the public health community. Although there is broad debate about the precise conclusions to be drawn from research and investigations, the American Lung Association, believes that $PM_{2.5}$ is especially harmful to people with heart disease and respiratory problems. These concerns are in addition to long-standing suspicion that excessive exposure to diesel exhaust is implicated in other adverse health outcomes, including lung cancer.[1]

Change in Population, Vehicle Miles Traveled and Small Particulate Emissions (PM2.5) from 1980



Source: WSDOT

Even as research and evaluation continues on the health effects of diesel exhaust, there is broad consensus on the desirability on reducing diesel emissions especially to reduce $PM_{2.5}$ exposures. Steps already taken in the regulatory arena have had good effects here in Washington State, as seen in the accompanying graph.

$PM_{2.5}$ is going down because of federal emission regulation affecting engines and fuels

$PM_{2.5}$ emission leveled off in the late 1980s and then began declining since the early 1990s. That decline is tied mostly to federal regulatory changes in fuel and diesel engine performance standards for heavy-duty trucks. In 1988 new electronic exhaust and fuel efficiency equipment was required. In 1993 permissible sulfur content for all diesel fuel used for on-road driving was reduced from 5000 to 500 parts per million. Some further particulate emission reductions in 1994 were achieved with the urban bus program that helped to retrofit bus engines to meet new emissions standards. [2]

$PM_{2.5}$ will continue to be reduced as new regulatory standards take effect

Additional particulate reductions, especially for $PM_{2.5}$, are coming in the near future. Between 2004 and 2006 the permissible sulfur content in gasoline will decline from about 350 parts per million to 30 parts per million. EPA estimates that the change in gasoline sulfur levels will reduce annually about 4,300 premature deaths and 2,300 cases of bronchitis. In 2006 EPA will require sulfur levels in on-road diesel fuel to decline from 500 ppm to 15 ppm and in 2007 new heavy duty diesel engines will be required to include exhaust systems that will filter out over 90 percent of the soot and toxic chemicals that come out of the truck stack. This change is anticipated to reduce annually about 8,300 premature deaths and 360,000 asthma attacks, in addition to many other health benefits. Between 2008 and 2010 off-road construction equipment, marine vessels, and railroads will be required to use lower sulfur diesel, which will reduce another 12,000 premature deaths by the year 2030. As a package of controls that affect transportation, these will move the nation toward dramatic improvement in the air environment over the next five to six years.[3]

There are opportunities to do more!

Conversion of diesels used in transportation to low sulfur or ultra low sulfur at an even faster rate than required by regulation is a step that may be attractive to fleet operators and transit systems. Steps in this direction are being taken around the country. Washington State Ferries is taking such actions in 2004 at a cost of only about a penny per gallon more.

In long distance trucks, diesels are often left at idle for long periods of time to power truck electrical systems even while trucks are not on the road. A number of steps to reduce diesel idling are being taken and considered around the country. Washington State should join these initiatives.

The technology gains that enable the newest trucks to operate at such dramatically lower levels of emissions than older trucks should be extended. Older vehicles should be retired or retrofitted. Major gains in $PM_{2.5}$ emissions can occur by expediting the updating of the in-service vehicle fleet.

Cleaner Emissions, Better Fuel Efficiency

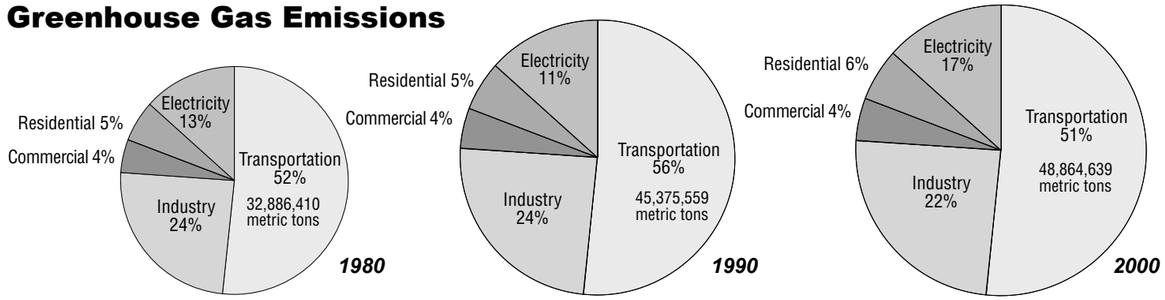
Washington State's average weekly fuel consumption per capita is about 8.4 gallons, or five percent below the national average but almost four times the rate in Germany [5]. Overall usage has not changed much over the last decade. Neither has efficiency. The average passenger car today gets about 21.9 miles to the gallon, compared to 20.2 a decade ago. Less efficient vans, SUV's and pick-ups (17.4 mpg on average) have become a much larger share of the vehicle fleet. Heavy trucks have actually seen average mileage decrease slightly in the past decade, and are now at 5.8 mpg. (Diesel engines are more efficient than gasoline engines per work unit and produce less CO_2 but more NOx and PM).

Get traffic moving: road-building solution to bottlenecks and chokepoints.

New roads that target bottlenecks and assist public transit, as part of an integrated plan to improve traffic congestion, ease pollution and improve safety, will help. Studies link congested stop-and-go driving to sharp increases in emissions of carbon monoxide, dioxide, hydrocarbons and particulates from heavy- and light- duty trucks, as well as from cars.[4] Cars and diesel trucks are much less fuel efficient and much worse pollution generators in congested stop-and-go driving than in free-flowing traffic at moderate speeds.

Reducing traffic bottlenecks and chokepoints so that vehicles spend less on-road time stuck in traffic, burning unnecessary gallons of fuel, would be a step ahead.

Greenhouse Gas Emissions



Carbon Dioxide ($C0_2$) Emissions in Washington State by Source

Source: Washington State University Energy Program

Better control of greenhouse gas emissions is at the very top of the global environmental agenda. A century of sustained increases in carbon dioxide from operating of internal combustion engines around the world has been a big factor in the greenhouse effect. Because Washingtonians rely so little on fossil fuel for their electric power generation, per capita generation of carbon dioxide is less here than in many other states. But, with the "electricity" share of the pie so small in relation to other states, the "transportation" share is high.

The opportunities to constrain carbon dioxide emissions from motor vehicles lie in:

- increasing fuel efficiency
- converting to less polluting technologies
- holding down vehicle miles traveled.

Basically, we need to use less fuel, use fuel that is less carbon-intensive, and place a high value on fuel-efficiency in new vehicle technologies. One way that other states (such as California and Massachusetts) are moving toward these goals is by adopting Low Emission Vehicle Programs that target tailpipe emissions for steady declines, and force a higher percentage of advance technology vehicles to be sold in their states.

New and Emerging Vehicle Technologies

Changes in vehicle technologies play a big role in reducing CO_2 emissions by addressing fuel efficiency, economy and fuel source. The good news is that there are options allowing us both to conserve and diversify our fuel sources. Many technologies that improve fuel efficiency also reduce exhaust emissions.

Hybrid technology combines the extended range and readily available gasoline or diesel fuel source of the internal combustion engine with the energy and environmental benefit of an electric vehicle. The introduction of hybrid cars now offers consumers a choice of dramatically more efficient automobiles. Hybrid buses are being tested in King County and elsewhere.

Cleaner gas cars are moving closer to the main stream of auto production. Ten automakers have "Partial Zero Emissions Vehicles", or PZEVs, lined up for sale in California. See details at *www.driveclean.ca.gov*

Alternative fuel cars, buses, and trucks are available as well. Fueled by biodiesel, methanol, natural gas, or propane, these vehicles produce fewer pollutants and greenhouse gases. They also help promote renewable energy sources and reduce our dependence on imported oil.

What about hydrogen? *Hydrogen fuel cell technology* is now gaining support as a step away from gasoline-dependent vehicles. One of the most common substances on earth, hydrogen is an energy carrier, not a source. It exists almost exclusively in combination with other substances. As a result, it must be extracted, a process that can itself require a considerable amount of energy. (In the case of hydrogen obtained from water, the energy consumed by electrolysis is actually greater than the energy produced by a fuel cell.) There is much debate about where the energy to fill hydrogen fuel cells should come from and what the true life cycle environmental costs will be of hydrogen vehicles (coal fired power plants or renewable energy sources like solar and wind).[6]

The movement to hydrogen technology may take decades and require substantial investments in fuel production and distribution. WSDOT has joined with California, Oregon and British Columbia to explore the possibilities of creating a "The Hydrogen Highways" along I-5 in time for the 2010 Olympics. In the meantime, major gains can be achieved with technology now ready to be used in our transportation system. Here lie real and immediate opportunities for achieving major reductions in emissions of greenhouse gases.

Greenhouse Gases and Global Warming

There is strong consensus among scientists that human alteration of the atmosphere -- increased emission of water vapor, carbon dioxide and methane -- has stimulated the "greenhouse effect" that facilitates the passage through the atmosphere of the sun's radiant energy while absorbing the earth's lower wave-length radiant energy, leading to warmer atmospheric temperatures.

Global warming will be serious business in the Pacific Northwest. It's chief impact, according to experts at the University of Washington, will be to shorten the duration of each spring/summer melt from mountain snowpack. This will alter our regions hydrology in numerous ways with many highly disruptive consequences for the flora and fauna of the area, including humankind.[7]