56.

Tranpsortation

Transportation is a major contributor to **air pollution**, with motor vehicles accounting for a large share of nearly all the major pollutants found in the atmosphere. The amount of CO2 emissions alone resulting from the transportation sector has risen steadily over the last few decades despite the fact that cars emit 95% less pollutants than they did 30 years ago. The transportation sector currently contributes about 31.89% of carbon dioxide emissions. Curiously, buses only account for 1.38% of the carbon dioxide emissions from passenger vehicles.

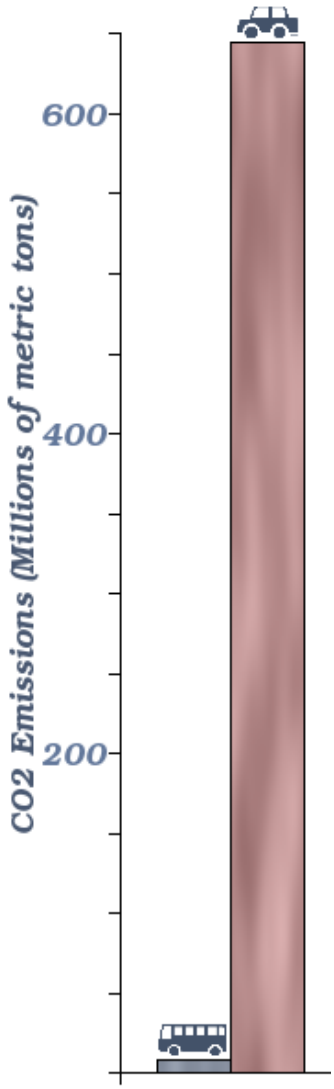
Traditionally, **water quality** concerns have focused mainly on bacterial pollution, oxygen depletion, sediment and toxic run-off from industry. Though the transportation sector's direct role in water pollution does not seem to be well defined by the EPA, its contribution through the increase of greenhouse gases is a bit more apparent. Sulfur Dioxide and Nitrogen Oxide emissions from combustion of fossil fuels combine with water droplets in the air to form acid rain. Acid rain changes the chemical balance of rivers and streams, adversely affecting aquatic life. Virtually no fish can survive in acidic waters with a pH below 4.5.

Land use and transportation systems are inextricably linked together. Historically, transportation facilities have often been constructed without any consideration for adverse environmental impacts.

The impervious nature of transportation facilities such as roads and parking lots can cause serious environmental problems. Studies indicate that in watersheds such as the Pittsburgh region, as little as 10% impervious cover can alter the volume, pattern and timing of hydrological flows. Changes in water flow can increase the likelihood of flash flooding and land slides. In urban areas such as Pittsburgh, impervious surfaces also cause urban contaminants to flow directly into the rivers.

57.

What's in car exhaust?



Hydrocarbons

Hydrocarbon emissions result when fuel molecules in the engine do not burn or burn only partially. Hydrocarbons react in the presence of nitrogen oxides and sunlight to form ground-level ozone, a major component of smog. Ozone irritates the eyes, damages the lungs, and aggravates respiratory problems. It is our most widespread and intractable urban air pollution problem. A number of exhaust hydrocarbons are also toxic, with the potential to cause cancer.

Nitrogen Oxides (NOX)

Under the high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various nitrogen oxides, collectively known as NOX. Nitrogen oxides, like hydrocarbons, are precursors to the formation of ozone. They also contribute to the formation of acid rain.

Carbon Monoxide

Carbon monoxide (CO) is a product of incomplete combustion and occurs when carbon in the fuel is partially oxidized rather than fully oxidized to carbon dioxide (CO). Carbon monoxide reduces the flow of oxygen in the bloodstream and is particularly dangerous to persons with heart disease. human health, but it is a "greenhouse gas" that traps the earth's heat and contributes to the potential for global warming.

Carbon Dioxide

In recent years, the U.S. Environmental Protection Agency (EPA) has started to view carbon dioxide, a product of "perfect" combustion, as a pollution concern. Carbon dioxide does not directly impair human health, but it is a "greenhouse gas" that traps the earth's heat and contributes to the potential for global warming.

58.

Choice of Fuel

Usage of the different fuels is often dependent on the function of the engine. High performance engines that require a lot of power are likely to use petrol, whereas vehicles used for hauling loads over long distances are likely to use diesel engines due to their high torque at highway speeds.

Petroleum Engines:

Though conversion is not a task for an average user, natural gas and hydrogen engines are very similar to gasoline engines and run on the same principle of ignition by electric spark. The advantage of using natural gas and hydrogen is that these gases burn a lot cleaner than petroleum. Ideally, complete combustion of Hydrogen gas gives off only water vapor. Unfortunately much of the commercially available hydrogen is still produced from fossil fuels.

Diesel Engines:

Diesel engines can readily be used with Biodiesel, a carbon-neutral alternative to fossil fuel based diesel. Biodiesel, which is made by processing vegetable oil and fats, is non-toxic and biodegradable. Due to its high flash point (160°C), biodiesel is considered non-flammable by the Occupational Safety and Health Administration. This property makes it relatively safe to produce in your own home.

Gas-Electric Hybrids:

Gas-electric hybrids use gasoline or diesel to power an internal combustion engine as well as electric batteries to power electric motors. These vehicles use kinetic energy to produce electricity through regenerative braking and store it in the batteries. Regenerative braking works by using the motors as generators to convert the energy from the motion of the car into electrical energy. This process effectively reduces the speed of the vehicle while storing the excess energy in the batteries.

Diesel vs Petroleum

Diesel engines tend to run slower (fewer rotations per minute) and cooler than petrol engines and are thus more fuel efficient and last longer than petrol engines. Despite the fact that the diesel engine itself is much heavier than a gasoline engine, a small diesel powered sedan can get up to 49 miles per gallon whereas a comparable gasoline powered car would get about 36 miles per gallon.

59.

Environmental Benefits of Biodiesel

There is also a relationship between the fuel consumption and emissions. The average gasoline car produces 214g/km of CO2 whereas the average diesel car produces 169g/km. On the other hand, diesel engines do produce more particulates that gasoline engines.

- Biodiesel reduces emissions of carbon monoxide (CO) by approximately 50 % and carbon dioxide by 78 % on a net life-cycle basis because the carbon in biodiesel emissions is recycled from carbon that was already in the atmosphere, rather than being new carbon from petroleum that was sequestered in the earth's crust. (Sheehan, 1998)
- Biodiesel contains fewer aromatic hydrocarbons: benzofluoranthene: 56 % reduction; Benzopyrenes: 71 % reduction.
- It also eliminates sulfur emissions (SO2), because biodiesel does not contain sulfur.
- Biodiesel reduces by as much as 65 % the emission of particulates, small particles of solid combustion products. This reduces cancer risks by up to 94 % according to testing sponsored by the Department of Energy.
- Biodiesel does produce more NOX emissions than petrodiesel, but these emissions can be reduced through the use of catalytic converters. The increase in NOX emissions may also be due to the higher cetane rating of biodiesel. Properly designed and tuned engines may eliminate this increase.
- Biodiesel has higher cetane rating than petrodiesel, and therefore ignites more rapidly when injected into the engine. It also has the highest BTU content of any alternative fuel in its pure form (B100).
- Biodiesel is biodegradable and non-toxic .Tests sponsored by the United States Department of Agriculture confirm biodiesel is less toxic than table salt and biodegrades as quickly as sugar.
- In the United States, biodiesel is the only alternative fuel to have successfully completed the Health Effects Testing requirements (Tier I and Tier II) of the Clean Air Act (1990).

60.

Other Alternatives & Carnegie Mellon Fuel Use

Another alternative to petrodiesel for diesel engines is the use of straight vegetable oil (SVO). Though use of SVO requires modification of the vehicle's fuel system, the ability to recycle free used vegetable oil makes it well worth it.

Straight vegetable oil has many of the same advantages of biodiesel, though the particulate emissions are slightly higher. For detailed information on using straight vegetable oil as a diesel alternative, see http://journeytoforever.org/biodiesel_svo.html

Fuel use at Carnegie Mellon:
Carnegie Mellon has 73 over-the-road vehicles and 19 off-road vehicles. Four of the off road vehicles are electric powered as of 2006. The vehicles consume a total of approximately 46,000 gallons of fuel annually.

If alternative fuels were readily available, the university fleet could be configured within a short period of time to consume the following mix of fuels:

l E-85 - 23,000 gallons annually
l Biodiesel - 16,000 gallons annually
l Gasoline - 7,000 gallons annually

Unfortunately, as of April 2006, these alternative fuels and infrastructure for distribution are not readily available for consumers in the Pittsburgh region.

Capital Technologies out of Carnegie Mellon University has developed a new process for creating biodiesel that is more efficient than previous methods. This method doesn't use a caustic catalyst and reduces the processing cost to 13 - 19 cents per gallon above the cost of the organic oil.

61.

Alternatives to Driving

Biking!!

Aside from being the cheapest, biking is among the most pleasant, efficient and environmentally friendly ways to get around sparse cities. Pittsburgh is continuing to become a biker-friendly city through the cooperation of the city council and non-profit organizations such as Bike Pittsburgh.

The bicycle co-op Free Ride, is an organization through which you can get free bicycle repair training and even earn a bike in exchange for a few hours of work. Free Ride's Earn-a-bike program is a fun, FREE and easy way to get a high quality used bike. For more information on Free Ride, visit www.freeridepgh.org.

Take the Bus

Taking a bus is another cost effective and environmentally friendly way to get around. As a student, the Allegheny Port Authority charges a $35 flat fee for bus rides for the entire semester. Whether or not you ride the bus, this fee is charged to your student account. Our campus is conveniently located along several major bus routes, thus making this an easily accessible form of transport.

Car-pooling

Carpooling is another way to reduce the cost of transportation. The increase in fuel consumption by a car due to an additional passenger is negligible, thus the cost per person of operating the car is significantly less when the car is full to capacity. Misc-market provides a convenient forum through which you can find a ride.

Action Items

☐ **Pedo-odometer**
Track how many miles you walk this week vs how many you drive. Compare this to what you do at home. Is there a difference? Why?

☐ **Green Bikes**
Start a green bikes program just for your house. You could work the Earn-A-Bike program of Free Ride to acquire several bicycles, paint them a nice, easily identifiable green, and leave them on the bike racks outside your building for anyone to use. Once people are done with them, they just need to return them to the bike racks for someone else to use.

☐ **Ride in Critical Mass**
Pittsburgh critical mass meets at 5:30 at the Carnegie Museum dinosaur the last Friday of every month to take to the street in a mass of bicycle riders. The aim is to remind people that bikes are an efficient means of transport and that bikers deserve a place on the roads.
The next couple of events are April 28th and May 26th.

☐ **Public Transit Survey**
Survey how many people used public transit this week and keep track of numbers, ask again the next week-why were numbers so high or low?

☐ **Discuss on the Bus**
Take a ride on the bus with your peers and casually discuss transportation issues

☐ **Volunteer**
Introduce people to the concept of volunteerism. Encourage people who are here over the summer to sign up to volunteer with Car-Free Pittsburgh (www.carfreepittsburgh.org)

63.

Action Items
(continued)

- **Tire Pressure Check**
  Go around and check peoples tire pressure, by asking them first of course. For those whose pressure is not as indicated on the tire, leave a note indicating what the pressure was and some information on the relationship between tire pressure and fuel economy. According to the EPA, your gas mileage drops by 1% for every 2 psi under your recommended tire pressure. To borrow tire gauges contact Deb Lange at dlange@cmu.edu

- **Are You From Around Here?**
  Make a list of products made in Pittsburgh like Heinz Ketchup, go to the supermarket to do your research. Find which shampoo, cereal, razer, bottled water etc company is closest to Pittsburgh. Promote using these items because they use less energy being transported, even if they arrive in hybrid cars!

By Eco-Rep
Jesse Mwaura
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