Carbon and global warming - Renewable fuel standards proposal

House Bill 2338 would mandate a 10 percent greenhouse gas reduction below the 2017 levels by 2028 by requiring the use of renewable fuels. The proponents argue:

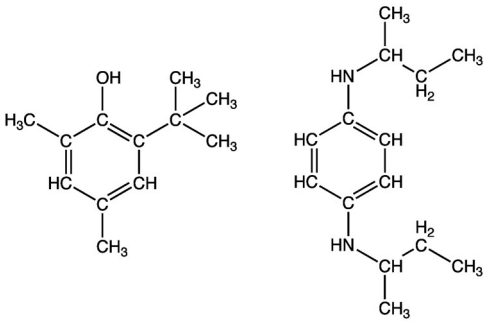
- More opportunities for farmers because it will increase demand and prices;
- Recycling our used cooking oils and fat from meat; and
- It reduces CO2 pollution

...It sounds good…except,

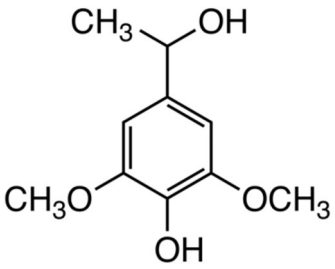
Let's look a little closer…since global warming is about a common molecule, CO2, maybe we should go back to school and remember more about CO2 and the element, carbon.

In Washington state, 99% of all vehicles on the road today are internal combustion engines. Fuels for internal combustion engines are all carbon based:

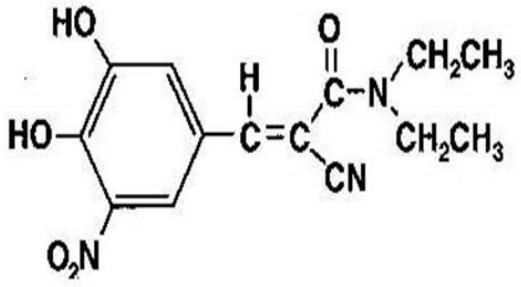
Gas: C4-C12



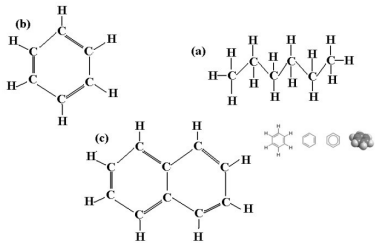
Ethanol:



Cooking Oil



Bio-diesel

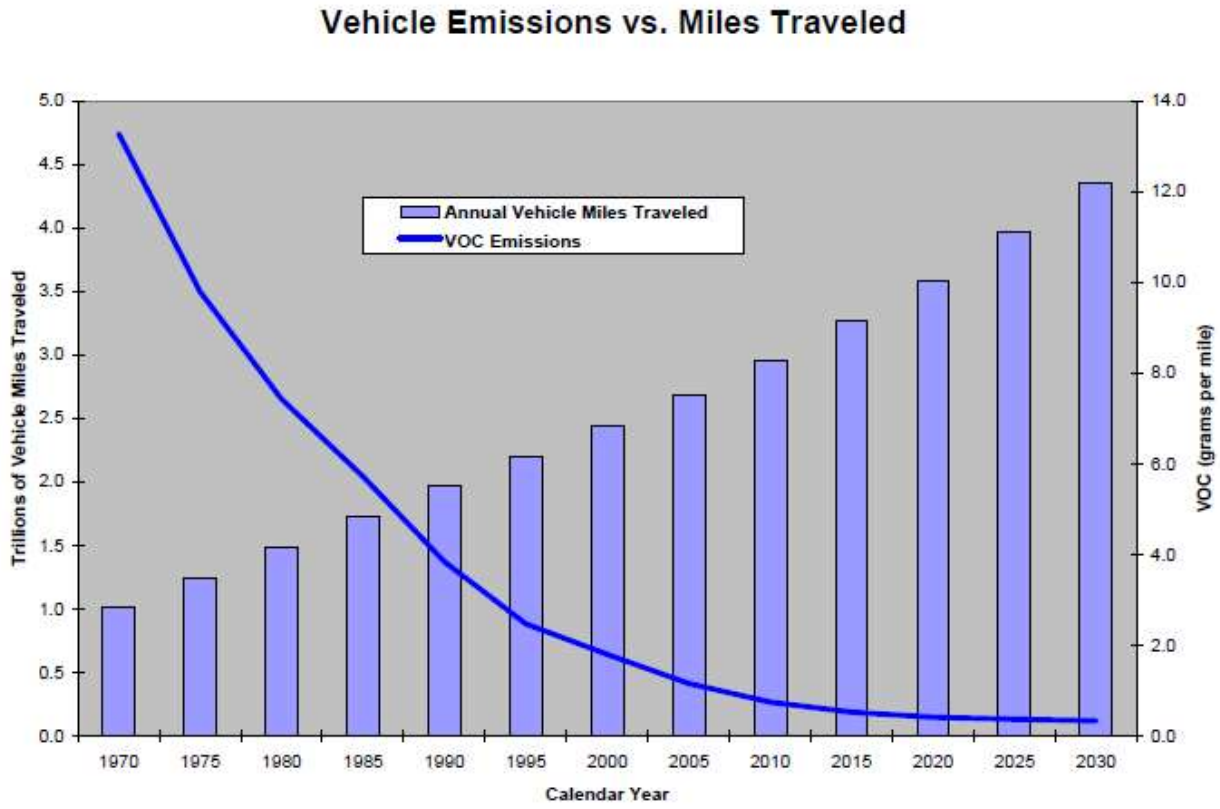


They are all hydrocarbons because they are composed of carbon and hydrogen. They are all designed to combust in the cylinder of an internal combustion engine….so what happens to all of those hydrocarbons when they burn?

Organic Molecules with (C,H and O) + O_2 ⟶ CO_2 + H_2O + Heat

One fuel is not specifically “cleaner” than another when they are burned in an engine…

However, engines are designed to meet the most stringent air emissions standards and are engineered for petroleum-based fuels. Some newer vehicles are designed to run efficiently with a number of fuel formulations, including ethanol, bio-fuels and pure petroleum fuels. All of these products are hydrocarbons.



Graph Courtesy of United States Environmental Protection Agency; Clean Air Act Overview

Nevertheless, no matter which fuel you put in the tank, your tailpipe will expel carbon dioxide (CO2), water (H2O) and heat.

Every molecule, whether it is derived from petroleum or plants contains carbon and hydrogen. Even plant-based fuels are still hydrocarbons. When you burn them in the engine of your car, you are adding oxygen into the intake manifold, igniting the fuel and oxygen mixture with sparkplugs in the cylinders and chemically converting the hydrocarbons into carbon dioxide and water.

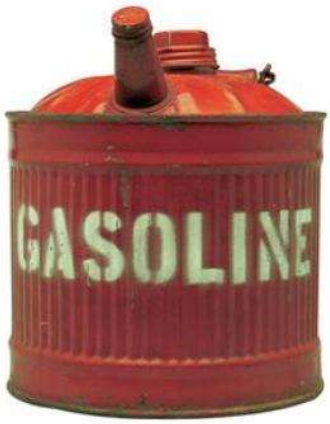
Now, let's look at the Math: Is it carbon neutral?

What is the real carbon math? We know farming for biofuel production is resource intensive - fuel, labor, fertilizers and crop protection products, manufacturing and processing, and distribution. All of these products take fuel to deliver and supply the farmers. Farming is a very carbon intensive process that converts petroleum-based supplies into food, or in our example, fuel.

Most importantly, it means we will be redirecting the use of our agricultural lands and technology from high value food production to carbon intensive fuel manufacturing.

We need to ask ourselves:

- ✓ How much fuel does it take to make one gallon of renewable fuel?
- ✓ How much carbon does it take?



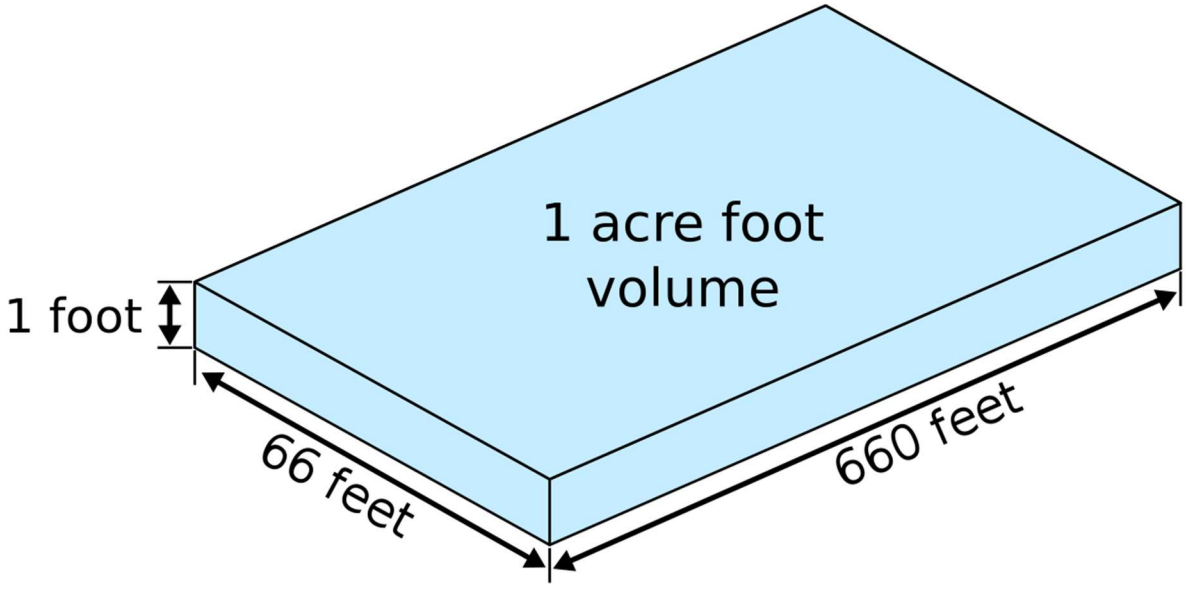
It takes two years of a production cycle to grow one canola crop. These are the steps:

- Seedbed preparation, assuming no-till which is the most environmentally friendly.
  - Post harvest of wheat crop:
    - 3-4 operations to control weeds during fallow year
    - Rainfall from two years stored to provide soil moisture for one crop
  - Planting
    - Purchase seed…count the two years to produce the seed
    - Cost of fuel to deliver seed to distributer and to the farm gate.
    - Fungicide package for seed, all petroleum based plus shipping
    - Fertilizer, purchase following delivery, calculate fuel input plus the product is petroleum based
    - Seed, with no-till drill (heavy) must use 300 hp tractor, calculate fuel.
    - Fall herbicide, carbon molecules, all shipped with fuel
    - Spring herbicide, carbon molecules, plus shipping
    - Harvest! Combines, bank-out wagons pulled by tractors, and trucks to ship to local elevator.
  - The total fuel = 5 gallons per acre per 2000 pounds raw seed at 44 percent oil extractions and 12 lbs per gallon= between 36 and 73 gallons oil

But what was the carbon cost in the process?

Water is a valuable resource for the carbon cycle in nature:

Now let's look at water. For canola, it comes from rainfall, the scarcest of all resources in dryland agriculture systems, especially if you assume a hot planet:



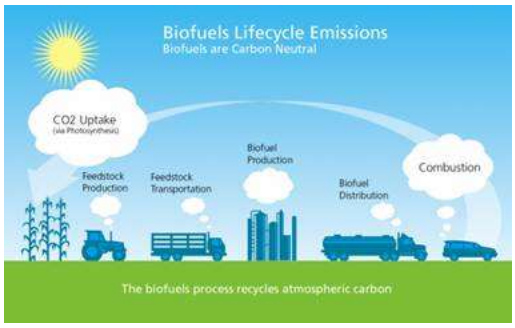
- The total water used= 2 years rainfall = 32 inches = 27154 g/in x 32in = 868,928 gallons of water per acre
- Total Canola Production in Washington State: 31,000 acres
- Total water used: 26,936,768,000 gallons of water
- Total Production: 58,900,000 lbs = 25,000,000 gallons oil
- Enough oil to transport every person in Washington 5.35 miles

Now back to the carbon costs:

- Then the canola crop is shipped from the farm to the elevator, where it takes energy to put it in the bin.
- Then it is unloaded out of the elevator and loaded on rail to go to processor, potentially at Gray's Harbor, or more likely to be processed over-seas, at the plant in Singapore?
- The processing takes inputs of energy and fuel for delivery of the products used in manufacturing and operations of the refinery.
- End-product is shipped using fuel to the convenience store for distribution to the customer.

- Key Questions:
  - Is this a good use of our scarce water resources?
  - Is burning a high value food for fuel good public policy?
  - Is converting our valuable cropland into an oil field good public policy?
  - Is there an honest way to calculate carbon emissions and the environment's ability to sequester and reverse air quality?

The renewable fuel standards policy suggests that the carbon sequestration in growing fuel crops negates the carbon emissions from the tailpipe and thus they can deem "renewable fuels as carbon neutral".



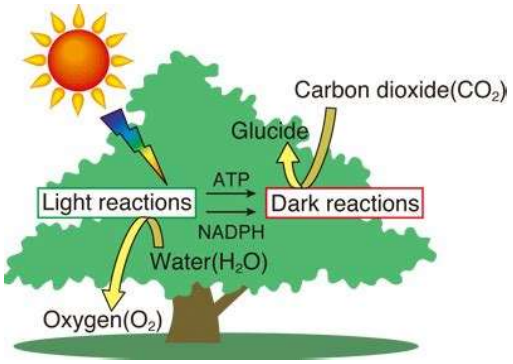
The reality is that there are already crops growing and sequestering the carbon emitted by internal combustion engines.

  - Large landscapes of trees and forests, and large urban green spaces also sequester carbon.
  - Seattle is a wonderful Urban Forest Environment where the large tree-scape needs to be measured for its carbon sequestration and air quality contributions that offset the carbon from commuting traffic.
  - The equation is whether the fuel burned from petroleum or food crops gives any different CO2 emissions. The answer is **no**. The carbon emitted from fuel combustion is identical.

- Regardless of the source of carbon, if CO2 is now considered “air pollution”, then the use of food for fuel will not help.

Let’s talk about carbon sequestration in growing plants:

Light and dark reactions of photo-synthesis:



In summary: Photosynthesis is the chemical process where plants can capture and organically fix the energy of the sun. The chemical reaction can be described by the following equation:

Carbon dioxide + water+ light energy = sugars + oxygen

The main product of photosynthesis is a carbohydrate such as sugar or starch and oxygen is released into the atmosphere. (The earth’s atmosphere is currently 20 percent oxygen.)

Through the process of photosynthesis, green plants absorb solar energy and remove carbon dioxide from the air in order to produce sugars. At night and in the winter, plants use these sugars and release the energy for their metabolism. They release some of the carbon dioxide from metabolizing the sugar stored from photosynthesis.

They store carbon from the CO2 in the air as the woody structures that allow them to stand upright and in their seeds. The moist parts of the plant are filled with the sugars they created for food.

This is called “carbon sequestration”.

The “renewable fuel standards” counts the year the fuel crop is growing as compensation for reducing CO2 and thus favors the use agricultural resources to produce fuel over the extraction of petroleum resources for fuel.

If we looked at the issue honestly, we would recognize that the sequestration cycle ends at harvest. Once the crop is harvested, the carbon is released in the composting of the residue, and the burning of the seed oil in our cars where combustion releases CO2, water and heat.

If real sequestration is a serious concern, we would have many other policy choices:

- We could measure the carbon sequestration that is naturally occurring in our urban and rural forest and count that value when we are considering expensive policy alternatives. There may be more carbon sequestered than carbon emitted and no expensive mandate to our transportation fuels would be necessary.
- We should count the investment and compliance of the auto manufacturing industry over the decades of clean air regulation and measure the enormous progress the industry has made to reduce emissions. The trucking industry testified that the fleet is 98% cleaner today than it was prior to the adoption of tier 4 engines that emit cleaner air from the tail pipe than what goes into the intake manifold.
- We could enhance green spaces and urban forestry for carbon sequestration around heavy transportation corridors.
- We could revitalize the state's forests, where 1/3 of the state's land is covered in trees, the largest of the sequestration species.
- We could further enhance sequestration by restoring our timber products industry, sequestering permanently the carbon stored in the wood by building homes, schools and other structures that last long after the natural tree may have aged and become unhealthy.
- We can expand irrigation to our state's farmland where crops can be grown annually and we can establish many more perennial crops, like orchards and vineyards can be sustained in the arid parts of Eastern Washington.
- We can widen the commute times by changing to flexible work schedules to reduce congestion and carbon intensive, inefficient stop and go operation of vehicles.
- Increase broadband fiber so more folks can work from home or commute fewer days per week.
- Build fiber in rural communities so they can develop meaningful economies and good jobs for entrepreneurs and formerly urban non-place-bound people.
- Expand the size and number of commuting corridors so engines are running efficiently and commute times are reduce, which would equal less carbon emission. (vehicle-minutes running reductions)

If you want to talk about no-carbon energy:

- We can stop being bureaucrats and count the hydroelectric dams producing the abundant energy for our state as truly renewable and recognize that Washington State is a carbon negative state.
- We can believe in Nuclear Technology. After all, we were the first to make something of Einstein's theories of Quantum Mechanics.

Bottom Line: Burning food for fuel does not reduce carbon dioxide.

We must leave the energy resources of high value, carbon intensive agricultural crops available to provide caloric energy to feed a growing world population.