



# New Hampshire Agriculture in the Classroom

**Growing Our Fuel**

**January 2015**

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## Notes from Hampshire New

New Hampshire has their own great example of a vehicle using biodiesel fuel. Dartmouth's Big Green Bus was created in 2005 when a group of Frisbee players needed an inexpensive means of transportation to tournaments around the country. So they bought an old school bus, painted it green, converted it to run on waste vegetable oil and hit the road. Over time, it has evolved

## Ethanol

Ethanol, a renewable fuel made from plant materials, has been around for decades. Ethanol is primarily produced from feedstocks or raw materials which are starch or sugar-based with corn leading the way. The sugar is easy to extract from corn which then goes through a fermentation reaction and a purification process, ultimately converting it into ethanol.

Currently, 95% of the gasoline produced in the United States contains ethanol. It is commonly included at a rate of about 10%, but some grades go as high as 90%. These grades are designed to oxygenate the fuel and reduce air pollution. The higher percentage ethanol fuels are targeted at today's flexible fuels vehicles.

According to the Alternative Fuels Data Center, a gallon of ethanol contains less energy than a gallon of gasoline resulting in lower fuel economy. However, "on a life cycle analysis basis, corn-based ethanol production and use reduces greenhouse gas emissions by up to 52% compared to gasoline production and use." (1) We do need to keep in mind that 40% of the corn grown in the United states finds its way into ethanol feedstocks taking it away from our food supply or land that could be used for other crops.

## Algae Fueling Your Vehicle

What you may think of as "pond scum" may actually be the next innovation in fuel production. A number of large companies have invested millions of dollars to explore the potential of tapping into algae as a source of fueling our vehicles. Like any other plant, algae needs sun, water and carbon dioxide. Unlike many plants, it doesn't need soil, it can thrive in waste or salt water, it absorbs carbon dioxide, it doesn't take up precious farmland and up to 60% of its mass comes from oils. One acre of soybeans can produce up to 60 gallons of fuel in a year, but an acre size algae pond is capable of producing from 1,400 to 3,000 gallons of fuel each year.

Researchers at Utah State University have created a portable floating pond so it can be tested in different environments such as wastewater treatment facilities, drainage ponds and

into a "classroom on wheels model".



[www.thebiggreenbus.org](http://www.thebiggreenbus.org)

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## Calendar

### Farm & Forest Expo

February 6th & 7th, 2015  
Raddison Hotel  
Manchester, NH



### NH Science Teachers Association Spring Conference

April 11, 2015  
Pinkerton Academy  
Derry, NH

### NH Assoc for Education of Young Children Annual Spring Conference

April 18, 2015  
Plymouth State College

### National Ag in the Classroom Conference

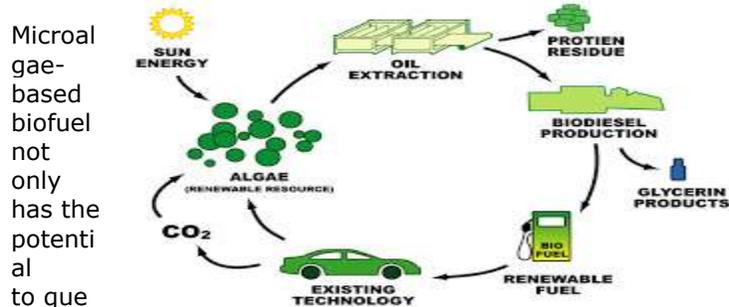
June 16-20, 2015  
Louisville, KY

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possibly the ocean. Once the algae is collected, it is spread out on plastic to dry for 24-hours, milled into a green powder, the oil is extracted from the powder and converted into biodiesel fuel. Most vehicles already have the technology necessary to use this type of fuel.



Microalgae-based biofuel not only has the potential to queue a sizeable chunk of the world's energy demands, say Utah State University researchers. It's a potential game-changer. "That's because microalgae produces much higher yields of fuel-producing biomass than other traditional fuel feedstocks and it doesn't compete with food crops," says USU mechanical engineering graduate student Jeff Moody. courtesy of *Through the Looking Glass*

While primarily still in the research stage, microalgae-based biofuel could make its debut within a few years. As with most new technologies, it is a matter of funding and constructing sites capable of mass producing this fuel.

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## Classroom Connection

### Renewable Fuels

The National FFA Organization, the Renewable Fuels Association and the Renewable Fuels Foundation have created a six-unit curriculum to help students understand ethanol, its effects, production and impact. Targeted towards middle school and high school.

**Biomass Energy and Algae Biofuels** lesson plan developed for high school AP Environmental Science classes

**National Geographic video** - Energy 101: Algae-to-Fuel

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## Resources

(1) "Ethanol Benefits and Considerations." Alternative Fuels Data Center: . Web. 19 Dec. 2014. [http://www.afdc.energy.gov/fuels/ethanol\\_benefits.html](http://www.afdc.energy.gov/fuels/ethanol_benefits.html).

"Through the Looking Glass: Algae in Your Gas Tank?" Through the Looking Glass: Algae in Your Gas Tank? Web. 19 Dec.

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