

Select Bioenergy Bibliography for Educators

Websites:

National Renewable Energy Laboratory (2008). Video: Converting Biomass to Liquid Fuels.

http://www.nrel.gov/learning/re_biofuels.html

A 5 minute online video that gives a nice overview of what is cellulosic ethanol, the production process, and the areas of scientific research needed to create the fuel. GLBRC is working in these same areas.

US Department of Energy Office of Science (2007) Biofuels for Transportation.

<http://genomicsgtl.energy.gov/biofuels/transportation.shtml>

An FAQ-style page with overview material such as "What is biomass?", "How much ethanol can we get from an acre of Bioenergy crops?", "Can one gallon of ethanol displace one gallon of gasoline?" Links to many other quality resources available from the Department of Energy.

Energy Information Administration Official Energy Statistics from US Government

<http://www.eia.doe.gov/>

An updated source of information on energy consumption and production in the US and around the world.

EIA Biofuels Data. Ethanol Statistics.

http://www1.eere.energy.gov/biomass/biofuels_data.html

Updated biofuels data from the US Department of Energy. Reports biofuel prices, production levels and availability.

Fields of Energy video: The Minnesota Department of Agriculture

<http://www.mda.state.mn.us/kids>

A free DVD with student hosts. Two short segments show how corn ethanol is made and the research into cellulosic ethanol. These two segments are currently available online as well.

DOE Joint Genome Institute (JGI)

<http://www.jgi.doe.gov/education/bioenergy/>

Explains the sequencing and genomic work related to bioenergy. It includes some activities for students to learn techniques, animations, and some basic descriptions. A good link not only for teachers, but for scientists who do not work in this area if they need additional information. Please note, you need to scroll to the bottom to see many of their shorter explanations, as well as looking at those on the left side of the page.

Articles:

Cleveland, C. J. (2008). Fundamental principles of energy. Encyclopedia of Earth. T. Lawrence.

http://www.eoearth.org/article/Ten_fundamental_principles_of_net_energy

This is a broad and wide-ranging article that covers topics including the physics of energy, climate and the earth's energy balance, and control of energy resources as a cause of violent conflict. There is an extensive list of "further reading".

Hill, et al. (2008). "Land clearing and the biofuel carbon debt." *Science* 319(5867): 1235-1238.

Land use for the production of biofuels can have a significant impact on global CO₂ emissions and corresponding climate change. The authors of this semi-technical article describe the variation in this effect and detail a global set of biofuel production cases. Of particular interest is a bar graph of nine different biofuel/land use systems and the years needed to repay the corresponding carbon debt for their use. This article is scientifically dense and is likely best for advanced high school students.

Field, C. B., J. E. Campbell, et al. (2008). "Biomass energy: the scale of the potential resource." *Trends in Ecology & Evolution* 23(2): 65-72.

For those interested in the food versus fuels debate, this scientific article looks at the global base of abandoned cropland and the corresponding productivity of these areas. This article is scientifically dense and is likely best for advanced high school students.

Hill, J., E. Nelson, et al. (2006). "Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels." *PNAS* 103(30): 4.

What are the net energy balances, and the energy inputs and outputs for biofuels? This article details a life-cycle analysis of both corn grain ethanol and soybean biodiesel biofuels. While this article is technical, with some guidance, it should be understandable by high school students.

Martin, A. (2008). *Fuel Choices, Food Crises and Finger-pointing*. New York Times. New York, New York.

This article from the New York Times does a good job of laying out the complexities of the food versus biofuel crop production debate without oversimplifying. It should be readable by high school students.

Monahan, P. (2008). "Biofuels: An Important Part of Low-Carbon Diet." *Catalyst* 7(2)

<http://www.ucsusa.org/publications/catalyst/biofuels-an-important-part-of.html>.

This article assesses sustainability of biofuels and also address the creation of biofuels. It is written in a way that it could be understood by high school students.

Rubin, E. M. (2008) *Genomics of cellulosic biofuels*. *Nature* 454

An overview of the most common microorganisms in biofuels research and status of genome sequencing.

Robertson, G. P., V. H. Dale, et al. (2008). "Agriculture - Sustainable biofuels Redux." *Science* 322(5898): 49-50.

The 2008 Farm Bill provides a subsidy for the production of cellulosic ethanol. The large group of authors associated with this article looks at the sustainability implications of this subsidy, and detail environmental and ecological research that they feel is needed. This article is likely readable by high school students.

Rosenthal, E. (2008). *New Trend in Biofuels Has New Risks*. New York Times. New York, NY.

This is a short and easy read on the problems of using invasive plant species as biofuels crops. It should be readable by high school students.

Yuan, J. S., K. H. Tiller, et al. (2008). "Plants to power: bioenergy to fuel the future." *Trends in Plant Science* 13(8): 421-429.

The authors of this article review different bioenergy crops, and biotechnology-based improvements for sustainable bioenergy, and they detail the advantages to using lignocellulosic biomass for ethanol production (higher net energy gain and lower production costs). They also examine how biotechnology can be used to address the challenges faced by bioenergy crop production. There is a useful table that summarizes different bioenergy crops and platforms. This article is likely best for advanced high school students.

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