



## Office of Biological and Environmental Research Climate — Biofuels — Environmental Stewardship Every Day is Earth Day

Celebrations of Earth Day began almost 40 years ago and mark the beginning of the modern environmental movement. Although considerable progress has been achieved, there is still more work to accomplish. The nation's scientists, industry, and government have turned their attention in one direction — energy. The challenge of meeting growing energy demand while reducing our dependence on fossil fuels and imported oil and cutting greenhouse gas emissions is among the greatest of our time.

The Office of Biological and Environmental Research (BER) in the Department of Energy's (DOE) Office of Science is in the unique position to draw a connection between climate and renewable, sustainable energy. This office funds science that advances world-class biological and environmental research to predict the effect of greenhouse gas emissions on the Earth's climate, to develop biofuels in a secure and sustainable manner, and to develop tools to monitor and contain the spread of contaminants in the environment.

### Climate Change

Climate is a complex system that involves the interaction between the atmosphere, biosphere, and ocean. BER is at the forefront of enabling scientists to better understand and predict future climate conditions.

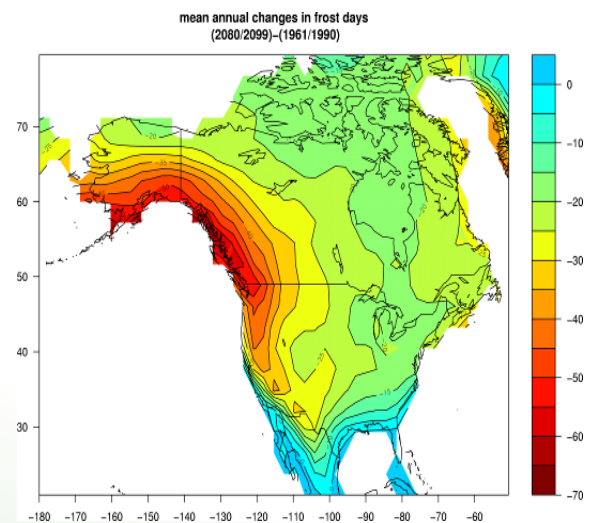
Climate predictions are made using computer models. Data collected from around the world are entered into the models to predict changes in parameters, such as temperature, precipitation, and growing season, to name only a few. In the past, these models failed to properly incorporate cloud dynamics, limiting the value of the model predictions.

BER's **Atmospheric Radiation Measurement (ARM)** program provides continuous field measurements of cloud formation at a series of fixed and mobile locations around the world. These data will improve on how clouds are incorporated into computer models to produce more accurate predictions of climate scenarios around the world.

### Biofuels

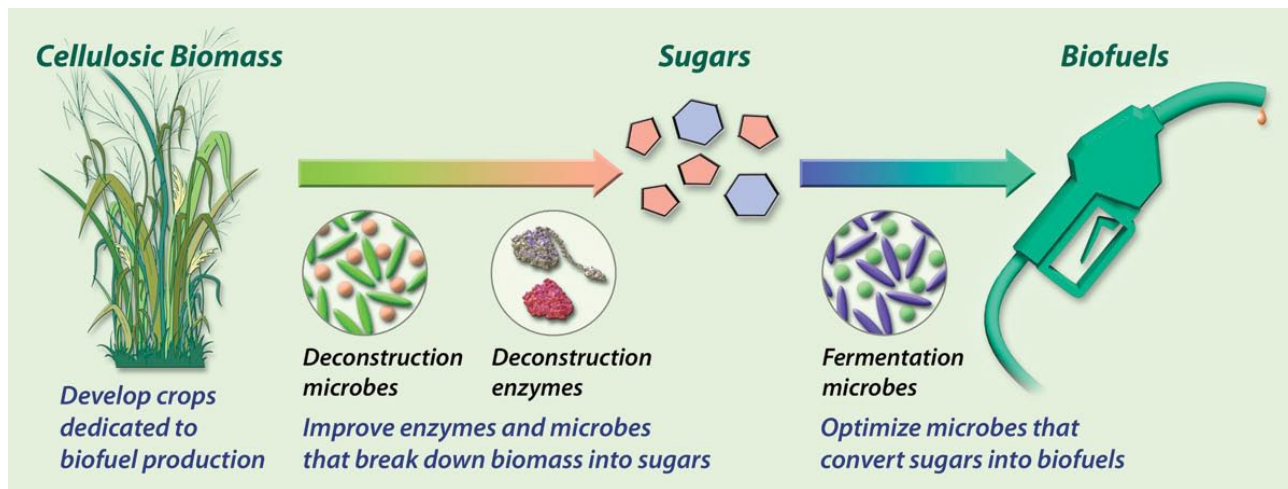
Biofuels produced from nonfood plant material can provide the opportunity to reduce the nation's dependence on fossil fuels, cut greenhouse gas emissions, and strengthen our Nation's energy security. BER is funding three DOE **Bioenergy Research Centers**, located in Oak Ridge, TN; in Madison, WI; and near Berkeley, CA.

Each DOE Bioenergy Research Center (BRC) will advance this burgeoning area of science with the discoveries needed to lay the scientific groundwork for new technologies that will permit commercialization and use of these biofuels by the broader public.



Future changes in frost days predicted from a climate model

The BRCs benefit from the partnerships between collaborators from universities, DOE National Labs, private companies, and not-for-profit organizations to meet this pressing challenge. The Centers' mission is to reengineer the biological process to develop new, more efficient methods for converting nonfood plant material into ethanol or other biofuels that will substitute for gasoline.



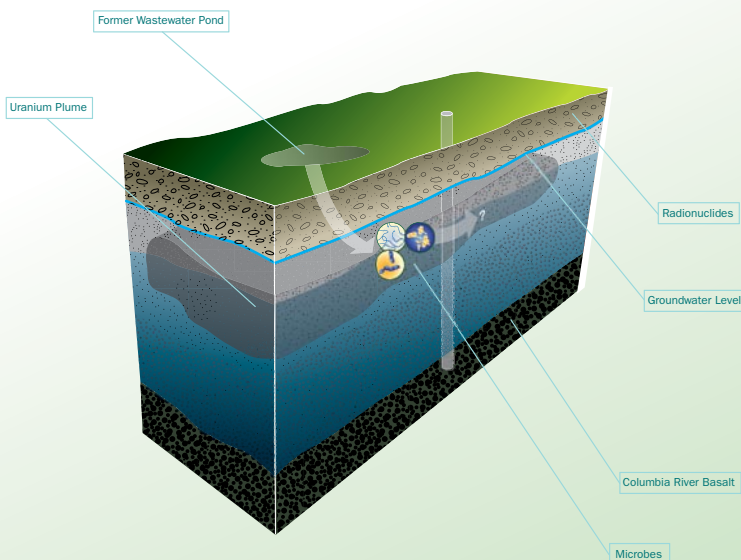
The process of converting nonfood plant matter to biofuels.

## Containing Contaminants

The Manhattan Project and the ensuing quest to develop nuclear technology has had environmental consequences — contamination of surface soils and subsurface sediments at some DOE sites. BER advances the fundamental science needed to prevent the transfer of contaminants and provide long-term stewardship of nuclear waste disposal.

Tiny organisms play an important role in the remediation process. Naturally occurring microorganisms can transform contaminants, preventing the chemicals from spreading underground. BER's **Environmental Remediation Sciences** program is evaluating a variety of microbes collected from uranium-contaminated sediments at the Hanford Site in southern Washington, where plutonium was produced from 1943 to 1989.

*Geobacter* is one microorganism that has been found to be abundant in sediments at both contaminated and pristine sites. This amazing microbe can use metals and radionuclides, such as uranium, to drive cell metabolism. *Geobacter* acts by pulling the contaminant out of solution and precipitating crystals on its outer shell. The genomes of *Geobacter* and many other microbes collected from the site have been sequenced to determine the best candidates to remediate subsurface contamination of highly radioactive wastes.



Microbes cleanup waste from past nuclear processing.

The Office of Biological and Environmental Research within the Department of Energy's Office of Science has continued to advance world-class biological and environmental research programs and scientific user facilities for over 50 years. For more information visit: [www.science.doe.gov](http://www.science.doe.gov) and [www.science.doe.gov/Program\\_Offices/BER.htm](http://www.science.doe.gov/Program_Offices/BER.htm)