Wisconsin Energy Institute
UNIVERSITY OF WISCONSIN–MADISON

U.S. DOE-SUPPORTED RESEARCH
AT THE WISCONSIN ENERGY INSTITUTE (WEI)

$28 MILLION
DOE FUNDING AT THE WISCONSIN ENERGY INSTITUTE IN 2016

$63.5 MILLION
DOE FUNDING FOR ENERGY-RELATED RESEARCH AT UW–MADISON IN FY2017

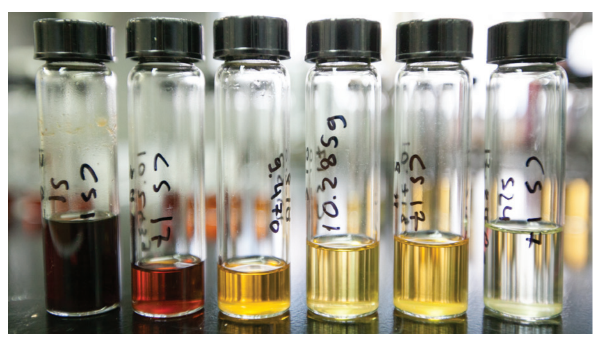
WHO WE ARE

The Wisconsin Energy Institute (WEI) is the collaborative home of energy research and education on the University of Wisconsin–Madison campus. At WEI, researchers are tackling one of the most critical challenges of our time – the transition to greater energy efficiency and new clean energy systems and solutions.

Led by scientists and engineers committed to crossing traditional research boundaries, WEI is making major breakthroughs in three primary areas of interdisciplinary research: electricity systems, transportation and fuels, and energy and society. WEI also works closely with industry leaders to ensure that its technologies strengthen the nation's economy, create jobs, and improve the health and wellbeing of its citizens.

Whether unlocking the power of advanced biofuels, rethinking the electric grid, or bringing together critical stakeholders, WEI is proud to be transforming the way we source and use energy and enhancing our understanding about energy and its impact on the world.

GLBRC: CONVERTING CELLULOSIC BIOMASS TO ADVANCED BIOFUELS & BIOPRODUCTS



GVL, a green chemistry solvent, proves an incredibly efficient method for deconstructing cellulosic biomass.

The Great Lakes Bioenergy Research Center (GLBRC) is one of three bioenergy research centers established in 2007 by the U.S. Department of Energy (DOE)'s Offices of Science within the Biological and Environmental Research program and was renewed for five more years in 2013. With more than 400 scientists, students, and staff representing a wide array of scientific disciplines, GLBRC performs the basic research required to convert cellulosic biomass to advanced biofuels and biochemicals. Working in collaboration, GLBRC researchers support the development of a robust pipeline from biomass production through pretreatment and final conversion to fuel, with sustainability providing a unifying focus. This development includes designing sustainable biofuels landscapes, harnessing the power of non-food crops, exploring biological and chemical routes to biofuels, leveraging genome-enabled technologies, and transitioning basic research into new biofuels technologies. A leader in the field of cellulosic biofuels, GLBRC is providing the basic knowledge that the emerging biofuel industry needs to develop new bio-based products, methods, and tools. Led by the University of Wisconsin–Madison (WEI), with major partner Michigan State University, GLBRC also collaborates with other member institutions from academia, government, and industry.

CONVERTING BIOMASS INTO HIGH-VALUE CHEMICALS

Supported by funding from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), UW–Madison researchers are partnering with experts from other institutions to develop high-value commodity chemicals from biomass that can be used to make different kinds of plastics and plasticizers. Compared to biofuels, which have a value of $600 to $700 per ton, these new biochemicals could be valued at more than $5,000 per ton. This three-year project requires elaboration of the basic scientific principles involved in converting biomass into useful chemicals that are otherwise petroleum-derived, as well as developing efficient processes that can be scaled up in order to make bio-based production more competitive with petroleum refining.

IMPROVING NUCLEAR FUEL TESTING AND SAFETY

Supported by funding from the U.S. Department of Energy's Office of Nuclear Energy, UW–Madison is leading a collaborative effort to improve real-time testing and instrumentation for transient nuclear reactor experiments. The research group combines the nuclear engineering and experimental expertise of four universities, a leading national laboratory, and an international partner.

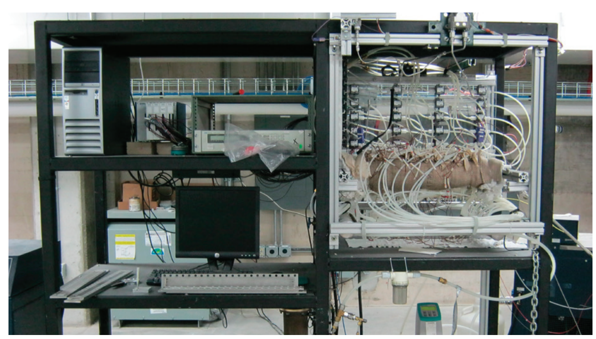
Transient testing, or short-interval testing, of nuclear fuel involves placing the fuel rod material into the central region of a test reactor core. These reactors are capable of simulating a wide range of transient behaviors that simulate accident conditions requiring the reactor to produce short bursts of intense, high-power neutron flux and gamma radiation. Such experiments provide useful data about fuel behavior under conditions that nuclear facilities must be built to tolerate. This research provides innovative instrumentation development that can validate experimental research that increasingly relies on modeling and simulation; aids in the development of new fuels that can be used in existing and future nuclear reactor designs; and tests the safety of new materials under simulated accident conditions for improved performance and safety.

MODELLING THE EVOLUTION OF THE U.S. ELECTRICAL POWER GRID

Funded by the U.S. DOE's Advanced Research Projects Agency–Energy (ARPA-E), a collaborative team led by UW–Madison is developing data sets for large-scale models of the rapidly evolving U.S. electrical power grid. Federal regulations severely limit access to any real-world data that could be used to guide malicious attacks on electric power infrastructure. That same data, however, could be tremendously useful for understanding how best to improve the grid. The research team will develop data sets for "realistic but not real" grid models, enabling researchers to explore concrete grid-related questions such as how to effectively integrate solar and wind energy, improve energy storage technologies, and enhance electric energy markets without compromising grid security.

DESIGNING CONCENTRATING SOLAR POWER PLANTS THAT MAKE SOLAR ENERGY COST-COMPETITIVE

A collaborative team led by UW–Madison, and funded by the U.S. DOE's Office of Energy Efficiency and Renewable Energy (EERE), aims to advance the technology of utility-scale concentrating solar power (CSP) plants. CSP plants use large solar collectors to focus and transfer the sun's heat to a fluid whose thermal energy can be converted to electricity. The team is studying an advanced power cycle called "supercritical carbon dioxide" in order to improve the energy conversion and lower the cost of the power cycle in CSP plants; doing so could reduce the overall cost of CSP-generated electricity.



UW-Madison researchers conduct heat transfer experiments in the supercritical carbon dioxide test facility.

ENHANCING THE EFFICIENCY OF CONCENTRATING SOLAR POWER TECHNOLOGY

With funding from the U.S. DOE's SunShot Initiative (Office of Energy Efficiency and Renewable Energy) and in collaboration with Purdue University and the Georgia Institute of Technology, UW–Madison researchers are developing an advanced heat exchanger for concentrating solar power (CSP) technology. This multi-disciplinary team aims to develop a scalable manufacturing process for generating new, more robust materials for this critical component of CSP plants and other large-scale power plants, a measure that would help make CSP electricity cost-competitive with fossil fuel-derived electricity. In CSP plants, the heat exchanger must be capable of handling fluids under high pressure at 800 degrees Celsius, and yet current heat exchangers cannot withstand that kind of pressure or heat. The researchers are developing a manufacturing process to economically produce a high-temperature, stiff ceramic-rich composite that has been shown to withstand much higher temperature conditions at elevated pressures. The team also plans to demonstrate the scalability of the new manufacturing method and the material's suitability for the heat exchangers.