

# Madison Area Technical College

## Bioenergy Certificate

Effective: 2012-2013

Program Number: 90-480-2

### Certificate

Applied Engineering Program Cluster

School of Applied Science, Engineering, & Technology

Program offered at Madison Campuses

For information call: (608) 246-6800 or  
(800) 322-6282 Ext. 6800

### About the Certificate

The Madison College Bioenergy Energy Certificate is designed to provide students with the theoretical knowledge necessary for a career in renewable energy technology. Students acquire hands-on skills in troubleshooting, maintenance, installation, operation and repair and replacement of related equipment. The certificate requires a minimum of 15 credits of coursework

Certificate credits may be combined with additional coursework to enhance traditional diploma, degree, transfer and associate programs at Madison College. The credits also may be combined with additional training, job experience and/or professional examinations to qualify for certification by national renewable energy institutions.

Incumbent trade workers and technical professionals are also encouraged to investigate how a Bioenergy Certificate may relate to their current work or business practices. Online, weekend, and summer class schedules accommodate high school and post-secondary educators in the science and technical education fields.

### Certificate Application Process

To apply, see: Apply Online (on the Madison College website). [Create an ApplyWeb account](#) and follow the [instructions](#) to complete the [Online Certificate Application](#) before the [application deadline](#). Submit the \$15 non-refundable fee (payable by credit card, debit card or electronic check) with your application. Applicants may submit more than one certificate application per term using the Online Certificate Application; the same fees apply for each additional application.

### Unique Requirements for Completion

The certificate will be awarded upon completion of the requirements with a minimum of a 2.0 grade average and no course grade lower than a C. The certificate will be awarded when completion of all requirements is verified after the semester the last course has been completed.

### Program Courses

#### 10-482-155 Electricity for Renewable Energy 3 credits

The student will learn practical DC/AC concepts including electrical quantities and components in measurement instruments for AC and DC circuits. Students analyze and construct circuits and measure voltage, current, resistance, and power for both AC and Dc sources. Covers fundamentals of NEC wiring, soldering, and relay ladder logic.

#### 20-806-XXX Introduction to Renewable Energy-Online 3 credits

This course provides an introduction to renewable energy technology. The course is grounded in the fundamentals of energy, power, and the first and second laws of thermodynamics. A scientific approach is used to examine various energy sources, including fossil fuels, nuclear, biomass, biofuels, solar, hydro, wind, geothermal, and ocean/tidal power. Various types of energy storage technology are also examined. Science and engineering challenges are examined for each energy technology, along with economic and environmental impacts. This course is suitable for any student with an interest in renewable energy, particularly those pursuing studies in scientific, technical, and engineering fields.

## Curriculum

	Credits	Hrs/week Lec-Lab
<i>This prerequisite course:</i>		
10-482-155 Electricity for Renewable Energy .....	3	3-0
<i>A minimum of 6 credits from these core courses:</i>		
20-806-XXX Introduction to Renewable Energy -Online .....	3	3-0
10-481-110 Energy Management and Economics .....	3	3-0
10-484-160 Introduction to Biomass Energy- Online .....	3	3-0
<i>Plus additional credits from these courses to reach a total of 15 credits:</i>		
10-484-163 Introduction to Biofuels-Online.....	2	2-0
10-484-161 Anaerobic Digester Technology.....	1	1-0
10-484-164 Biomass Systems, Nutrient Management, and Recycling.....	1	1-0
10-484-130 Introduction to Biodiesel Fuel .....	1	1-0
10-484-121 Introduction to Ethanol Fuel.....	1	1-0
20-623-290 Renewable Energy for International Development.....	3	3-0
<b>Total</b>	<b>15</b>	<b>credits</b>

#### 10-481-110 Energy Management and Economics 3 credits

The student will perform critical examination of energy consuming facilities both domestic and commercial for the purpose of identifying energy conservation opportunities. In addition the student will identify various energy conservation techniques as well as equipment which can be installed to further conserve energy.

#### 10-484-160 Introduction to Biomass Online 3 credits

This course provides an overview of energy production from biomass resources. The course explores the fundamentals of plant growth, energy yield, economics, production, and processing methods for both herbaceous and woody crops. Technologies covered include combustion, gasification, pyrolysis, fermentation, transesterification, and anaerobic digestion. Value-added bio-refining products are also examined, along with the environmental impacts of biomass energy.

#### 10-484-163 Introduction to Biofuels Online 2 credits

An introduction to solid, liquid and gaseous fuels derived from all sources. This course will cover the history of fuel use, placing petroleum into its proper context of being just one of the many alternatives being exploited by humans to fulfill current demands. Topics include the history of fuel and petroleum, peak oil, economics of petroleum and biofuels, engine design and fuel requirements, agriculture and fuels, wastes, conventional ethanol production, cellulosic ethanol, algae, other alcohols (biobutanol, etc.), biodiesel, biogas (anaerobic digestion), gasification, pyrolysis, fuel quality, environmental impacts, energy independence and national security.

#### 10-484-161 Anaerobic Digester Technology 1 credit

Provides participants with an understanding of basic heat transfer properties as well as the biological and chemical reactions that take place in anaerobic digestion systems. Participants will also develop an in-depth knowledge of the design of anaerobic digestion systems, troubleshooting and repair methods, and workplace safety.

#### 10-484-164 Biomass Systems, Nutrient Management, and Recycling 1 credit

Excess nutrients, particularly nitrogen (N) and phosphorus (P), are the major pollutants in lakes and estuaries and the second leading source of pollution in rivers according to the U.S. EPA, yet all living flora and fauna need nutrients to grow and thrive. This course will discuss how to balance the inputs and outputs within a healthy ecosystem. In this weekend short-course, we will explore conventional practices, next-generation solutions, and practical ways to recycle these major agricultural inputs. Our focus will be mostly 'on-farm' with field trips as well as guest speakers from academia, agriculture, public and private sectors. This course is relevant for everyone who has a stake in the U.S. food-chain.



## Program Courses (continued)

**10-484-130 Introduction to Biodiesel Fuel 1 credit**

This course will provide a general overview of biodiesel fuel. Production and quality control of biodiesel fuel will be explored, and students will have the opportunity to synthesize a small scale batch of biodiesel. Topics covered will include transesterification chemistry, separation techniques, ASTM fuel testing, engine performance, and exhaust emissions.

**10-484-121 Introduction to Ethanol Fuel 1 credit**

This course will provide the student with a general overview of ethanol fuel. Topics covered will include fermentation and distillation chemistry, ASTM fuel testing, engine performance, and exhaust emissions. An introduction to E85 fuel systems will also be included.

**20-623-290 Renewable Energy for International Development (hybrid) 3 credits**

This course provides an examination of energy and economics in developing countries with special consideration given to renewable energy sources. The course will combine 10 days of travel and study abroad in a developing country along with 8 weeks of online instruction. Students will learn to specify, design, and install renewable energy systems for deployment in developing countries. Field work will include design and construction/installation of one or more residential scale renewable energy systems (e.g., solar electric systems, solar hot water systems, solar ovens, micro-hydropower, small scale wind generators, and household methane biogasifiers).