

Renewable Energy Certificate

Certificate

Applied Engineering Program Cluster

School of Agriscience and Technologies

Program offered at Madison Campuses

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

About the Certificate

The Madison College Renewable Energy Certificate is designed to provide students with the theoretical knowledge necessary for a career in energy management and 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 12 credits of coursework. Students may choose from online and face-to-face courses in several areas of emphasis including: transportation, photovoltaics, solar thermal, wind, or biomass.

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 Renewable Energy 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 courses are developed and taught by renewable energy experts who are members of the Consortium for Education in Renewable Energy Technology (CERET). Through this collaborative relationship, Madison College is able to offer students the opportunity to enroll in cutting-edge courses taught from locations across the United States. Face-to-face courses are delivered in a full-day intensive format often taught during weekends, winter break, spring break and/or summer sessions.

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

10-480-100 Solar & Other Renewable Energy Systems (online) 4 credits
The student will learn and demonstrate the principles of energy efficient and solar design analysis and construction. Students will analyze the solar energy systems and will calculate solar savings fractions, backup heat needs, and economic analysis. The student will investigate the technologies and applications of other non-polluting and renewable forms of energy including wind power, photovoltaic and alternative transportation vehicles.

10-481-110 Energy Management (online) 4 credits
The student will perform critical examinations 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.

Curriculum

	Credits	Hrs/week Lec-Lab
<i>Choose a minimum of 3 credits from among these online courses:</i>		
10-480-100 Solar & Other Renewable Energy Systems	4	4-0
10-481-110 Energy Management.....	4	4-0
20-623-290 Renewable Energy for International Development.....	3	3-0
Total	at least 3 credits*	

<i>Plus at least 3 credits from among these online courses:</i>		
10-482-130 Solar Electric Fundamentals and Grid-Direct Design .2	2	2-0
10-482-134 Grid-Direct Solar Electric Systems and Code Criteria .2	2	2-0
10-482-136 Battery-Based Design.....	2	2-0
10-484-160 Introduction to Biomass Energy	3	3-0
Total	at least 3 credits*	

<i>Plus at least 1 credit from among these face-to-face courses:</i>		
10-482-100 PV Design and installation	2	2-0
10-482-131 Basic Photovoltaics and Site Assessment.....	1	1-0
10-482-132 Intermediate Photovoltaics.....	1	1-0
10-482-133 Advanced Photovoltaics Installation	1	1-0
10-482-135 Advanced Photovoltaic Elective.....	1-3	1-3-0
10-482-151 Wind Site Assessor Training.....	1	1-0
10-482-152 Wind Systems Repair/Maintenance.....	2	2-0
10-482-153 Introduction to Wind Turbine Installation	1	1-0
10-482-154 Advanced Wind Electives	1-3	1-3-0
10-483-110 Solar Water Installation	1	1-0
10-483-141 Solar Domestic Hot Water and Site Assessment	1	1-0
10-484-121 Introduction to Ethanol Fuel.....	1	1-0
10-484-123 Intro to Hybrid Electric Vehicles.....	1	1-0
10-484-130 Introduction to Biodiesel Fuel	1	1-0
10-484-161 Anaerobic Digester Technology.....	1	1-0
10-484-162 Wood Combustion Heating Systems	1	1-0
Total	up to 5 credits, a maximum of 4 MREA credits*	

*Students must complete a total of 12 credits to earn the certificate

10-482-100 PV Design and Installation 2 credits
This workshop is designed to offer students a higher level of lecture and hands-on learning that will prepare them for field installations and other advanced workshops. Students will learn how to correctly size and select PV system components. Participants will identify and interpret NEC codes that pertain to the installations. Our outdoor training roof enables our instructors to teach safety, system design and layout, component selection, wiring techniques, installation techniques, and troubleshooting. Prerequisite: 10-482-131, 10-482-132

10-482-130 Solar Electric Fundamentals and Grid-Direct Design (online) 2 credits
This course will provide an overview of the three basic PV system applications, primarily focusing on grid-direct systems. The goal of the course is to create a fundamental understanding of the core concepts necessary to work with all PV systems, including: system components, site analysis, PV module criteria, mounting solutions, safety, and commissioning. The course will also cover the basics of sizing a residential grid-direct system, wire sizing, over current protection, and grounding.

10-482-131 Basic Photovoltaics and Site Assessment 1 credit
Students will learn the basics of photovoltaic system components and the steps necessary to performing a site audit prior to an installation of a PV system. Focus is put on the defining the solar window, system siting and sizing, load analysis and energy efficiency.

10-482-132 Intermediate Photovoltaics 1 credit
This course is designed for students to get a basic understanding of PV system design and installation principles. Hands-on activities will introduce basic installation techniques. This class is recommended to students planning to take advanced PV workshops. Topics include batteries, wiring configurations, system diagramming, installation techniques and system maintenance. Prerequisite: 10-482-131



Program Courses (continued)

10-482-133 Advanced Photovoltaics Installation 1 credit
This course will involve students in the hands-on installation of a utility intertie PV system with battery back up on a dual axis mast tracker. Prior knowledge of PV systems and components is required. This class is designed for individuals and professionals who are planning on installing PV systems. Topics include safety, system design and layout, National Electric Code, component selection, wiring and installation techniques. Prerequisite: 10-482-131, 10-482-132

10-482-134 Grid-Direct Solar Electric Systems and Code Criteria (online) 2 credits
This workshop will build upon the core concepts from 10-482-130 and continue to emphasize grid-direct systems. The course will focus significantly on the National Electrical Code (NEC), including grid interface calculations, grounding considerations, and advanced component specification. Students will learn to evaluate system performance under various operating conditions. Commercial system design elements, such as inter-row shading, inverter selection, and data monitoring solutions will also be covered. Prerequisite: 10-482-130

10-482-135 Advanced Photovoltaic Electives 1-3 credits
These Advanced Photovoltaic Courses from the MREA, SEI, and Madison College can be taken with permission from project administrators.

10-482-136 Battery-Based Design (online) 2 credits
Apply the National Electrical Code (NEC) to battery-based systems to ensure safe, code-compliant design and installation. Students will work through step-by-step design process for battery-based applications, including stand-alone (off-grid), grid-tied with battery back-up, and hybrid systems. Topics such as load analysis, component selection, battery safety, voltage drop, and commissioning procedures will be presented. In addition to sizing exercises and calculations, students will explore additional design considerations unique to battery-based systems. Prerequisite: 10-482-130

10-482-151 Wind Site Assessment 1 credit
Students will learn how to evaluate a site's wind energy potential, determine wind speeds at proposed heights, make a load profile for a client's energy needs, determine appropriate tower heights and estimate kWh output for a system based upon wind resources. The course will lead students through the background information required to perform wind site assessments for the Focus on Energy program, other state incentive programs, and for the home or business owner to assess their site. This class will prepare students for the Wind Site Assessor Certification Test administered by the Midwest Renewable Energy Association.

10-482-152 Wind Systems Repair and Maintenance 2 credits
Students will visit a number of area wind turbines and learn how to do system repairs and annual maintenance. Machines from 1kW to 20kW will be covered. Work will include freestanding, guyed and tilt-up towers. This is a working class, with optional tower climbing.

10-482-153 Introduction to Wind Turbine Installation 1 credit
Students will assemble and erect a short, 60-foot guyed tilt-up tower that was constructed at the previous "Wind Turbine Design and Construction" course at the MREA, along with the wind turbine that was built there. We will also install a temporary battery-based power system and hope for some wind! It's suggested that students who take Wind Turbine Design and Construction also take this installation class. It will be a "crash course" on wind turbine installation basics, wind turbine siting, tower safety, and tilt up tower design.

10-482-154 Advanced Wind Electives 1-3 credits
These Advanced Wind Courses from the MREA and MATC can be taken with permission from project administrators.

10-483-110 Solar Water Installation 1 credit
This course is a hands-on workshop that includes both theory and installation practice. Two systems will be installed on a training roof-drainback and pressurized closed-loop systems. This class will qualify students to be on the Focus on Energy Full Service Installer List. Prerequisite: 10-483-141

10-483-141 Solar Domestic Hot Water and Site Assessment 1 credit
Students will learn the basics of how Solar Domestic Hot Water Heating Systems work and their economic impacts with emphasis on northern climate systems. Students will also perform solar domestic hot water heating site assessments for residential applications. This class will prepare students for entry level work in the solar water heating field and will help facilities managers, architects, planners, home owners and government officials to understand the workings and benefits of solar domestic hot water systems.

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.

10-484-123 Intro to Hybrid Electric Vehicles 1 credit
This course will provide a general overview of hybrid electric vehicles. Topics covered will include hybrid propulsion systems, battery chemistry, high voltage safety, regenerative braking, and electric motors and generators.

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.

10-484-160 Intro to Biomass Energy (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.

10-484-161 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.

10-484-162 Wood Combustion Heating Systems 1 credit
Students will learn how to burn wood cleanly and efficiently. The use of wood in residential heating systems is covered with attention given to firebox insulation, primary and secondary combustion air, fuel bed construction, burn zones, baffles and heat/transfer/distribution.

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).

Career Potential:

- Wind Turbine Technician/Installer
- Solar Hot Water Technician/Installer
- Photovoltaic Technician/Installer
- Anaerobic Digester Technician/Installer
- Biofuel Refinery Operator/Technician
- Building Operator/Technician
- Power And Utility Technician
- Legislative Research Technician
- Energy Manager/Analyst
- Energy Auditor
- Energy Broker/Marketer
- Resource Conservation/Efficiency Manager

More detailed and updated information on this program may be available at: madisoncollege.org. The college reserves the right to make changes in the regulations and courses announced in this publication without notice.

Madison Area Technical College provides equal opportunity in education and employment.

Rev. 10/11