

Renewable Energy Certificate

Certificate

Applied Engineering Program Cluster

School of Applied Science, Engineering, and Technology

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.

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 encouraged to investigate how a Renewable Energy Certificate may relate to their current work or business practices. Some classes are delivered in online and/or intensive short-course formats, and some classes may be offered during evenings, weekends, winter break, spring break and/or summer sessions.

Admission Requirements

To review program admission requirements and application processing dates visit the programs website at: <http://madisoncollege.edu/program-info/renewable-energy-certificate>.

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 in which the last course has been completed.

Program Courses

10-140-112 Renewable Energy for the Developing World 3 credits

Students participate in a 10 day in-country service learning project in a developing world country, continuing with eight weeks of online coursework to extend their knowledge of energy production and use in the developing world.

10-414-100 DC/AC Circuits for Industry 3 credits
Study of practical DC concepts with and introduction to AC concepts. Course topics include electrical quantities and components and measurement instruments with an emphasis on DC circuits. Students analyze and construct circuits and measure voltage, current, resistance and power for both AC and DC sources. Studies principles of electricity AC components and circuits. Coverage includes combination circuits that contain Resistive Inductive and/or Capacitive properties. Emphasis on circuit troubleshooting and efficiencies. Course introduces theory and application of three-phase circuits, single phase, transformers, generators, and motors. Covers fundamentals of NEC wiring, soldering and relay ladder logic.

10-481-110 Energy Management 3 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

The courses listed below outline the requirements for completion for students officially admitted in the 2015-2016 academic year. Requirements for completion may vary depending on the semester in which a student is admitted. Current/continuing students should consult their Academic Requirements report available through their student center account for specific requirements, as requirements are subject to change.

		Credits	Hrs/week Lec-Lab
<i>Choose at least 6 credits from among these Core courses:</i>			
20-806-291	Introduction to Renewable Energy*	3	3-0
20-809-269	Energy and Society	3	3-0
10-481-110	Energy Management	3	2-2
20-806-290	Renewable Energy for International Development** OR	3	3-0
10-140-112	Renewable Energy for the Developing World**	(3)	(3-0)
Total		at least 6 credits*	

<i>Choose at least 2 credits from among these Intermediate courses:</i>			
10-482-101	Intro to Wind Energy Technology	3	1-4
10-484-120	Introduction to Biofuels*	2	2-0
10-482-138	Introduction to Photovoltaic Technology	2	2-0
10-484-160	Introduction to Biomass Energy*	3	3-0
Total		at least 2 credits*	

<i>Choose additional credits from the following courses to reach a total of 12 credits:</i>			
10-414-100	DC/AC Circuits for Industry OR	3	0.5-5
32-414-316	DC/AC Circuits	3	4-2
10-482-103	Photovoltaic Systems and National Electric Code	1	1-0
10-482-135	Advanced Photovoltaic Elective	1-3	1-3-0
10-482-137	Photovoltaic Site Assessment	1	1-0
10-482-140	Grid Connected Photovoltaic System Design	1	1-0
10-482-141	Grid Connected Photovoltaic Systems Installation Lab	1	0-2
10-482-142	Off Grid Photovoltaic System Design	1	1-0
10-482-143	Off Grid Photovoltaic Systems Installation Lab	1	0.5-0.5
10-482-149	Photovoltaic Technical Sales	1	1-0
10-482-102	Wind Systems Technician 1	3	1-4
10-482-152	Wind Systems Repair/Maintenance	2	2-0
10-482-153	Wind Turbine Installation***	1	1-0
10-482-154	Advanced Wind Electives	1-3	1-3-0
10-482-156	Wind Turbine Design Instruction	3	1.5-1.5
10-484-121	Introduction to Ethanol Fuel	1	1-0
10-484-130	Introduction to Biodiesel Fuel***	1	1-0
10-484-161	Anaerobic Digester Technology***	1	1-0
Total		up to 4 credits	

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

*Online delivery available

**Hybrid delivery: online for 8 weeks and study abroad for 2 weeks

***Three-day short-course delivery

10-482-101 Intro to Wind Energy Technology 3 credits
This course prepares the learner to assess the global energy picture; analyze the causes of wind and wind flow properties; explore small, medium, and large wind turbine designs; assess the environmental effects of wind turbines; perform business and site assessments for a wind turbine project, plan your wind turbine project, evaluate operation and maintenance of the turbine system, and analyze the future of wind energy.

10-482-102 Wind Systems Technician 1 1 credit
This course allows participants to develop essential skills and attitudes for employment to wind industry. Topics include: safety, electrical hazard, confined space, climbing practices, tool use, calibration, documentation and routine maintenance operations. Prerequisite: 10-482-101.

10-482-103 Photovoltaic Systems and the National Electric Code 1 credit
Students will learn to apply the NEC rules to photovoltaic systems. Topics will include conductor sizing, overcurrent protection, grounding, maximum voltage and current calculations and other applicable rules. Students will be able to apply this knowledge to one or more photovoltaic systems.



Program Courses (continued)

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.

10-482-137 Photovoltaic Site Assessment 1 credit
Students will learn how to conduct an assessment of a location for a photovoltaic system. They will learn the qualities of an ideal location, structural concerns, the tools to use, proper documentation techniques, load analysis, energy production estimation, and concerns with existing electrical service. Students will also complete a photovoltaic site assessment as part of the course.

10-482-138 Introduction to Photovoltaic Technology 2 credits
Students will learn the basic concepts of photovoltaic systems, including how photovoltaic cells produce electricity, components and types of photovoltaic systems, the process of installing a photovoltaic system and whether and where to install a photovoltaic system. Students will also analyze utility bills, energy production, cost and incentives available for photovoltaic systems.

10-482-140 Grid Connected Photovoltaic System Design 1 credit
Students will learn the principles of photovoltaic system design for photovoltaic systems connected to the utility grid. Each student will prepare a model design. Prerequisites: 10-414-100 and 32-414-316.

10-482-141 Grid Connected Photovoltaic Systems Installation Lab 1 credit
Students will install one or more fully operational grid connected photovoltaic systems. Prerequisites: 10-414-100 and 32-414-316.

10-482-142 Off Grid Photovoltaic System Design 1 credit
Students in this course will learn the principles of photovoltaic system design for off grid photovoltaic systems. Each student will prepare a model design. Prerequisites: 10-414-100 and 32-414-316.

10-482-143 Off Grid Photovoltaic Systems Installation Lab 1 credit
Students will install one or more fully operational off grid photovoltaic systems.

10-482-149 Photovoltaic Technical Sales 1 credit
Students will learn the tools and information needed to perform in a sales position for photovoltaic contractors. Students will prepare a sales document as part of the course. Prerequisites: 10-414-100, 32-414-316, and 10-482-138.

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.

10-482-156 Wind Turbine Design and Construction 3 credits
Develop knowledge and skills in basic electricity, wood working, metal working, resin casting, and a variety of other skills. Attendees will complete at least one 7" and one 10" diameter wind turbine and have the opportunity to build a wind machine of their own. Based upon the Homebrew Wind Power text and design, and inspired by the work of Hugh Piggott. Each turbine will be fabricated from "scratch" and tested upon class completion. An option to purchase a completed turbine may occur in each class.

10-484-120 Introduction to Biofuels 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.

10-484-121 Introduction to Ethanol Fuel 1 credit
Provides 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.

10-484-130 Introduction to Biodiesel Fuel 1 credit
Provides 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 3 credits
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.

20-806-290 Renewable Energy for International Development 3 credits
Renewable Energy for the Developing World provides an examination of energy and economics in developing countries with special consideration given to renewable energy sources. The course combines 8-weeks of online instruction with 10 days of travel and study abroad in Costa Rica. Students will learn to specify, design, and install renewable energy systems for the developing world. Students will install operational renewable energy systems in the field with current renewable energy equipment.

20-806-291 Introduction to Renewable Energy 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.

20-809-269 Energy and Safety 3 credits
The American experience is better understood within the context of the history of energy consumption and production. Our nation's future is inextricably connected to our resolution of the challenges we face with respect to energy. Analyses and solutions require an interdisciplinary approach. The course "Energy and Society" considers the technical, economic, political, environmental, ethical and social contexts of the topic of energy.

32-414-316 DC/AC Circuits 3 credits
Introduces the practical DC/AC concepts including electrical quantities and components and measurement instruments for AC and DC circuits used in commercial, industrial, and sustainable energy fields. 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.

Career Potential:

- Wind Turbine Engineer or Technician
- Photovoltaic Engineer or Technician
- Anaerobic Digester Engineer or Technician
- Biofuel Refinery Engineer or Technician
- Biomass Resource Engineer or Technician
- Building Systems Engineer or Technician
- Power and Utility Engineer or Technician
- Energy Policy Specialist
- Energy Manger/Analyst
- Energy Broker/Marketer

More detailed and updated information on this program may be available at: madisoncollege.edu. 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.

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