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## NRGY 242.50: Solar, Thermal and Wind Systems

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# Missoula College

THE UNIVERSITY OF MONTANA

## NRG 242 SOLAR AND WIND SYSTEMS

**Course Number:** NRG 242  
**Course Title:** Solar Thermal and Wind Systems  
**Meeting Times:** TR 8:10-9:30  
**Instructor:** Bradley Layton  
**Contact:** bradley.layton@umontana.edu  
**Credits:** 3

### COURSE DESCRIPTION

NRG 242 Solar and Wind Systems is an introduction to the fundamentals of solar thermal and wind energy for the design and installation of solar thermal and wind systems. The material covered will prepare students for a career in renewable energy or for installing a renewable energy system on their own home.

### COURSE OBJECTIVES

Upon completion of this course, the student will be able to:

1. Develop a working knowledge of the solar constant ( $1000 \text{ W/m}^2$ )
2. Apply the laws of thermodynamics to solar thermal and/or wind systems
3. Describe factors that affect solar and wind output
4. Evaluate solar resources on a site-specific basis
5. Evaluate wind resources on a site-specific basis
6. Perform a thermal load analysis
7. Perform an electrical load analysis
8. Describe, specify, and site equipment appropriately
9. Estimate energy output and cost
10. Use the tools of the plumbing and electrical trades using safe working practices
11. Identify at least six local installers of solar thermal or wind systems
12. Participate in a Passivhaus build, OR
13. Design, build, and test a solar thermal system, OR
14. Design, build, and test a wind system
  - a. Design includes drawing both a plan view and a detailed mechanical view of the system
  - b. Build includes acquiring materials, and constructing system
  - c. Test includes data collection of system for at least one week
15. Present data from project

### PREREQUISITES

NRG 101, M121, M122 (co-req) Students must be able to download and open Word and PDF files and do online research. A prior knowledge of the basics of electricity is recommended but not mandatory.

### AUDITING

This course may be audited for no credit.

REQUIRED TOOLS

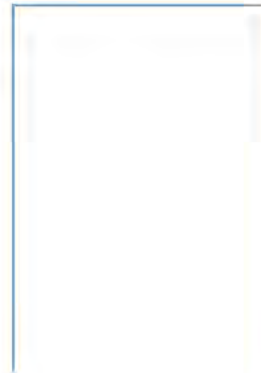
A **digital multi meter** for measuring AC or DC voltage, continuity, resistance, and 10 amps of AC or DC current. Inexpensive meters (\$25.00) are available from Radio Shack, auto parts stores, or [online](#).

A [Kill-A-Watt meter](#) for measuring power usage.

REQUIRED TEXTS

**Planning & Installing Solar Thermal Systems: A guide for Installers, Architects and Engineers** 2<sup>nd</sup> Edition. Earthscan London, Washington, DC. Deutsche Gesellschaft für Sonnenenergie. ISBN 978-1-84407-760-1

**Wind Power Workshop: Building Your Own Wind Turbine** Piggott  
ISBN 978-1-902175-62-1



**Wind Turbine Technology** Jha ISBN 978-1-4398-1506-9

RECOMMENDED TEXTS

[Home Power Magazine](#) digital subscription \$9.95 highly recommended. A hard copy is available in the Missoula College library.

ASSESSMENT:

|                           |     |
|---------------------------|-----|
| assignments/participation | 30% |
| Exams and quizzes         | 40% |
| Class project             | 30% |

GRADE SCALE:

|                  |
|------------------|
| A = 90-100       |
| B = 80-89        |
| C = 70-79        |
| D = 60-69        |
| F = 59 and below |

ASSIGNMENTS AND PARTICIPATION:

Students are required to login at least twice per week to check announcements and to update assignments. Generally, assignments require researching a topic from the textbook or the Internet, posting information to the discussion board, and participating in discussions on multiple topics. Participation in the weekly forums is required and includes responding to at least one fellow student posting to receive full credit. **Late work is typically not accepted.**

ONLINE LECTURE MATERIAL, QUIZES AND EXAMS:

Each week students will be required to read the lecture material and supplemental online reading and take the corresponding quiz or exam prior to the following class meeting. Expect 3-4 hours for reading lecture material and completing quiz or exam each week plus 3-4 hours for doing research and completing assignments each week. **Late work is typically not accepted.**

CLASS PROJECT:

The class projects this year will be building intensive and will require each student to design and build either a solar thermal or a wind turbine system followed by a report. Example projects include (1) participating on a solar thermal or a wind turbine build of an existing passive house, (2) designing, building, and testing a solar thermal system (3) designing, building, and testing a wind turbine.

DROP/ADD POLICY

The Drop/Add Policy may be found at the in the [Provost's website](#).

ACADEMIC HONESTY POLICY

*All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.*

*All students must be familiar with the [Student Conduct Code](#).*

ACCOMMODATIONS

To request an [accommodation](#), please contact the Course Instructor. For more information, visit accommodation [website](#) or call 406.243.2243 (Voice/Text).

COMMUNICATION

Communication is vital to your success in this course. Contact information is provided in this Syllabus. As the Course Instructor, I try to answer all calls and e-mails promptly. Communicating with the Course Instructor is the Student's responsibility especially with regard to meeting deadlines. In general, late assignments are not accepted and exams cannot be made up. If an unforeseen event happens, please contact the Course Instructor immediately, and PRIOR to a deadline, to make alternative arrangements for meeting your class responsibilities.

ONLINE SUPPORT

Online support may be obtained via [courseware-support@umontana.edu](mailto:courseware-support@umontana.edu) or x4999

EMAIL POLICY AT UM

According to University [email policy](#), an "employee must use *only* UMM assigned student email accounts for all email exchanges with students, since such communication typically involves private student information." For more information on setting up and using your GrizMail account, visit the [UMontana Information Technology Website](#).

OUTLINE:

- Week 1 Project planning, Solar Resource/Wind Resource
- Week 2 Theory Part I
- Week 3 Design Review
- Week 4 Theory Part II
- Week 5 Preliminary Building
- Week 6 Theory Part III
- Week 7 Continue Building
- Week 8 Theory Part IV
- Week 9 Continue Building
- Week 10 Theory Part V
- Week 11 Review of Local Economy
- Week 12 Review of Local and Regional Subsidies
- Week 13 Projects Complete / Thanksgiving Holiday
- Week 14 Theory Part VI
- Week 15 In-class design reports

Topics in Detail:

- Week 1 Solar Resource/Wind resource  
Project selection
- Week 2 Theory Part I  
Jha  
Propose system
- Week 3 Design Review  
Begin sourcing materials  
NABCEP  
National Electrical Code  
ANSI-IREC discussion

Week 4 Theory Part II

Jha

Storage options for projects

Week 5 Preliminary building

Tools

Safety

Share build plans

Revise theoretical output predictions

Week 6 Theory Part III

Jha

Week 7 Continue Building

Preliminary Data?

Week 8 Theory Part IV

Jha

Week 9 Continue Building

Midterm on theory

Week 10 Theory Part V

Jha

Week 11 Review of local Economy

Economics of your project and larger projects

Week 12 Review of local and regional subsidies

Week 13 Projects complete / Thanksgiving Holiday

Data acquisition review

Week 14 Theory Part VI

In class discussion of theory vs. data presented

Week 15 Reports due/final exam review