

Northeast Wisconsin Technical College

Land Acknowledgement Statement

The region served by NWTC **occupies the ancestral home** of the Menominee Nation, who have **persisted here** in Northeast Wisconsin from **before recorded history** to the present day. The College's Green Bay campus exists **upon lands ceded from the Menominee Tribe to the Oneida Nation**. We acknowledge this land we stand upon today as sacred, historical, and significant to the Menominee and Oneida Nations as are the **lands of all First Nations People**.

See more detail at <https://tinyurl.com/244wh3xf>



Photovoltaics – Design & Site

Catalog # 10-482-132 & Class # 22830

3/23/23 - 5/16/23

Class Syllabus

INSTRUCTOR INFORMATION

Instructor: John Hippensteel, PE
Office: Green Bay, EE 101 G & Lab EE 116
Telephone: Office: 920-498-7103, Cell: 920-559-3337
Email: John.Hippensteel@nwtc.edu
Office Hours: By Appointment on
Mondays 8:30 to 11 am
Wednesdays 8:30 to 11 am
And as mutually agreed upon, in person, email, phone or remote/WebEx

CLASS INFORMATION:

Course Description: 10-482-132 PHOTOVOLTAICS-DESIGN & SITE ...learn steps to performing a site audit prior to installation of a PV system. Focus on defining the solar window, system site placement, system sizing and design, load analysis and energy efficiency concepts. (Corequisite: 10-482-126, Intro to Solar)

Credits: 3

Class Schedule:

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
	8:30AM - 12:15PM		8:30 AM - 12:15 PM			

(this may vary based on field trips)

Class Delivery Mode: This class meets in an 8 week format in person, unless Covid 19 requires it to meet online.

Class Meeting Location: Green Bay Campus, EE 116 (and other sites as yet to be determined)

Pre-requisites: (Co requisite: 10-482-126, Intro to Solar)

Textbook: Photovoltaic Systems, 3rd Edition, by Jim Dunlop, PE

Supplies: Calculator, digital camera, tape measure, compass, angle finder, safety glasses, work gloves & work clothes. (to be discussed in class)

Course Competencies: You have the opportunity to learn the following skills in this course:

COMPETENCIES

1. Describe the elements of a photovoltaic system design.
 - A. Identify the basic types of PV systems
 - B. Describe the hardware components of a PV system
 - C. Explain the best application and limitations of each system type.
 - D. Identify photovoltaic mounting types.
 - E. Describe the basics of photovoltaic system design.
 - F. Perform basic line drawing.
 - G. Describe installation techniques.
 - H. Explain the basics of system costs and economics
2. Describe the basics of roof design.
 - A. Describe basic residential roof design.
 - B. Describe roof load issues.
 - C. Explain basic PV system roof mounting options.
 - D. Describe basic commercial roof design.
3. Perform a site inspection for a solar site analysis.
 - A. Use site assessment tools.
 - B. Determine solar resource.
 - C. Conduct a building energy load analysis.
 - D. Identify PV array placement options.
 - E. Determine suitable locations for installing inverters and other balance of system components.
 - F. Provide installer and equipment vendor information.
4. Estimate an appropriate photovoltaic system for a site and communicate the results to a site owner.
 - A. Recommend a PV system type based on results of a site inspection.
 - B. Write a PV site assessment report.
 - C. Calculate a general cost estimate of the PV system based on the PV system type and size.
 - D. Estimate the size of a PV system based on the customers energy requirement and physical information for the site.
5. Utilize photovoltaic system analysis software
 - A. Use internet-based performance calculators
 - B. Calculate a general cost estimate
6. Explain relevant codes, standards and certification
 - A. Describe basic building code issues relevant to photovoltaic installations.
 - B. Describe the basic interconnection regulations.
 - C. Investigate PV installer training and certification requirements.

7. Apply various photovoltaic mounting and racking systems.
 - A. Describe typical PV racking and installation for shingle roof applications.
 - B. Describe typical PV racking and installation for standing seam and corrugated steel roof applications.
 - C. Describe pole mount PV systems racking, mast and foundations requirements.
 - D. Describe various ground mount PV system racking and foundations requirements.
 - E. Describe single and dual axis PV system racking, mast and foundations requirements.
 - F. Describe various ground mount PV system racking and foundations requirements.
8. Explain the economic and financial considerations for Photovoltaic systems.
 - A. Estimate PV system component and installation costs.
 - B. Define and calculate Simple Payback.
 - C. Define and calculate Return on Investment for various PV systems.
 - D. Define and calculate Internal Rate of Return for various PV systems.
 - E. Define and calculate Net Present Value for various PV systems.
 - F. Define and calculate Profitability Index for various PV systems.
 - G. Define and calculate Cumulative Cash Flow for various PV systems.
 - H. Incorporate incentives such as grants and tax credits into your financial calculations.
9. Design a photovoltaic system by correctly integrating system components
 - A. Calculate voltage and current for PV modules for various design & temperature applications.
 - B. Determine correct string configurations for PV modules and inverters for design conditions.
 - C. Match various PV arrays to various inverters.
 - D. Select appropriate inverters for specific utility inter-tie voltage requirements.
 - E. Properly apply micro inverters to specific PV modules and utility inter-tie requirements.
10. Prepare and understand permitting and utility intertie forms and requirements to photovoltaic systems
 - A. Summarize local permitting requirements for PV systems.
 - B. Obtain and complete permitting applications and discuss with the local AHJ.
 - C. Summarize the utility inter-tie requirements for PV systems.
 - D. Obtain & complete the correct utility inter-tie applications and agreement for a PV system.
 - E. Explain the permitting process to a client.
 - F. Explain the utility inter-tie requirements and application process to a client.

Employability Skills: In addition to specific job-related training, NWTC has identified transferrable employability skills reaching beyond the context of a specific course. They are skills that employers desire, and skills that lead to success in all aspects of life.

NWTC's TRANSFERABLE EMPLOYABILITY SKILLS
1. Communicate Effectively
2. Work Cooperatively and Professionally
3. Think Critically and Creatively
4. Solve Problems Effectively
5. Value Individual Differences and Abilities
6. Demonstrate Personal Accountability
7. Demonstrate Community and Global Accountability

NWTC ALL-COLLEGE POLICIES

These policies are in effect for all classes at NWTC.

Please refer to the [NWTC Student Handbook](#) for a full explanation of all NWTC student-related policies, definitions, and related consequences. To raise your awareness and understanding of the expectations of higher learning, we invite you to specifically review the policies outlined below:

Rights & Responsibilities:

- [Student Code of Conduct](#)
- [Academic Integrity \(includes Plagiarism, cheating and collusion\)](#)
- [Affirmative Action/Equal Opportunity Statement](#)
- [Assessments](#)
- [Copyright Notice](#)
- [NWTC Alcohol, Tobacco and Drug Free Campus](#)
- Title IX as it relates to:
 - [Pregnancy](#)
 - [Sexual Misconduct](#)
- [Tobacco/Nicotine Use– All Campuses](#)
- [Refund Policy](#)
- [Withdrawal from a Class or Program](#)
- [Student Academic Grievance](#)
- [Accommodation for Religious Beliefs](#)
- [Web Privacy Policy](#)

Student's Right to Know:

- [Alcohol and Drug Abuse Prevention](#)
- **Discrimination and Harassment Prevention:** NWTC is committed to embracing the worth of every individual and promoting a respectful environment. Discrimination and harassment of protected categories in its employment and educational programs is prohibited. For questions or concerns, contact the Director of Diversity & Inclusion/Title IX Coordinator @ mohammed.bey@nwtc.edu or by phone @ (920) 498-6826.
- **Disability Act Statement:** NWTC complies with all provisions of the Americans with Disabilities Act and makes reasonable accommodations upon request. Please contact Disability Services for more information regarding the support services available to you, call 920-498-6904.
- **Campus Closure Day(s) Procedure:** In the event a campus closure is necessary, there are two emergency closure dates built into the end of each 8-week session. Instructors will provide detailed information within 24 hours of the college cancellation.

Student Academic Calendar:

Visit [Academic Calendar page](#) for important College dates you should add to your personal calendar.

Instructor Responsibilities:

As a NWTC instructor, I am expected to:

- Maintain a professional, safe learning environment while adhering to the policies of the college.
- Provide open and frequent communication with students regarding their progress in this class.
- Reply to communications within 48 business hours.
- Grade assignments and post scores in Blackboard regularly.
- Provide feedback to guide learners toward improvement of their coursework.
- Post information about assignments in Blackboard Class Materials and Grade Center.
- (In the event of a college level cancellation) Communicate with students within 24-hours a detailed plan regarding expectations for responding to the cancellation.

Student Responsibilities:

As a NWTC student, you are expected to:

- Follow the policies of the College as outlined by the Student Handbook (noted above in Rights & Responsibilities section) and of the Instructor as outlined in the course syllabus.
- Monitor and use your NWTC Student Email account. Email is the official mode of communication at NWTC.
- Make an honest attempt to use correct English grammar and punctuation in all written communications.
- Utilize Starfish to monitor your course success, to communicate with instructors, and to connect with college services.
- Follow the due dates established in the Course Calendar (found at the end of this document) and posted in the electronic calendar in Blackboard.
- Keep your contact information up to date in [RAVE](#) to ensure that you receive prompt notification in the event of a college closure.
- Communicate questions, comments or concerns to your instructor via email, voicemail, or in-person.

Student Services:

NWTC cares about your Physical and Emotional well-being, Resources and Support services are available for a variety of student needs. Visit the following link to explore:

<https://www.nwtc.edu/students>

It can be challenging to do your best in class if you have trouble meeting your basic needs like a safe and stable place to sleep or getting enough food to eat. If you have difficulty with these things, contact Student Support Services located on the Green Bay campus in SC133, call 498-6258, or email supportservices@nwtc.edu. Though located in Green Bay, support services are available district wide. For more information, please visit [Support Services page](#)

Academic Coaching at NWTC:

Academic Coaching is available for most courses at NWTC. Check us out at www.nwtc.edu/academiccoaching for more information.

CLASS SPECIFIC & DEPARTMENT POLICIES

In addition to the college policies referenced above, the following department & instructor policies also apply.

Appropriate Use of Technology:

The use of Social Media, cell phones, and other electronic devices are encouraged, and expected for specific class topics and class research only. Students are expected to respect others' views and display common courtesy when posting their views to online discussions, as well as in classroom discussions. It is important that everyone understands how to use online course tools and etiquette in a way where ALL students feel safe and supported.

Campus Closure Day(s) Procedure:

In the event of a campus closure, NWTC and or instructors will provide detailed information regarding expectations for students, should the need arise.

Class Cancellation: Class cancellations will be posted as early as possible at:

<http://www.nwtc.edu/Lists/CancelClasses/WebView.aspx>

Syllabus Changes:

Instructors retain the right to make changes based on the timeline of the class, feedback from learners and/or logistical issues. Students will be informed as soon as a change is made. A current copy of the course syllabus will be maintained by the division office

Attendance and Participation:

You will receive a Participation Grade for each class period. In a face-to-face class, we learn from each other in an interactive, real-time format, and we need to make the most of this opportunity.

Active participation includes:

- Attending class,
- Arriving on time,
- Being prepared to participate in class activities by completing the assignment(s),
- Focusing on the lesson during class time,
- Making a positive contribution to the lesson by paying attention and participating in discussions,
- Treating each person and opinion with respect, and
- Using electronic devices for classroom purposes only.

Submitting Assignments: (Be sure to save a copy of every assignment before you submit it so that you don't lose any work.)

Each assignment in the Class Materials has a link at the bottom that allows you to submit your work through Blackboard. The file name of the document that you submit should include the ASSIGNMENT NAME & NUMBER and YOUR FULL NAME. For example:

Barb Johnson LP 10 Wind Energy.pptx.

The body of your submittals should include The COURSE NAME, ASSIGNMENT NAME & NUMBER, YOUR FULL NAME, and DATE. For example:

Intro to Solar
LP 1A Energy Overview, PV Systems & Solar Radiation
Barb Johnson
10/26/20

You can submit your work in .doc, .docx, .xls, .xlsx, .pdf, .rtf, .ppt, .pptx or other MS Office formats ONLY. (Open Office & other format documents must be saved and submitted in MS Office or .pdf formats ONLY.

Grading Policy:

You can earn up to full credit for an assignment by submitting it in Blackboard by the assigned due date. Expect one letter grade deduction for every day of late submittal. For special situations make-up work is allowed with approval from instructor. Extra credit projects may be available.

Grading Scale:

Percentage	Grade
91-100	A
81-90	B
71-80	C*
51-70	D
0-50	F

* C is the minimum passing grade for this class for Solar Energy program students.

Safety Policy: Safety is paramount and you will be expected to dress and act suitably for the situation, especially during any lab work and or field trips.

**Course Calendar:
Due Dates & Competency Map
Photovoltaics – Design & Site 10-482-132
Spring 2, 2023, Class #22830**

WK	LP	Topic/Competency	Due Dates	Possible Points	COMPETENCIES ASSESSED	EMPLOYABILITY SKILLS ASSESSED
1	LP 1A Syllabus	Syllabus email Plan for Success Class Participation	Th 3/23	0 10 5	1-10	1-7
1	LP 1A	Getting Started with Design & Site Class Participation	T 3/28	10 5	1,3	1-7
1	LP 1B	Site Assessments Class Participation	Th 3/30	10 5	1,3,4,5	1-7
2	LP 2A	Solar Pathfinder Use Class Participation	T 4/4	10 5	3,5	1-7
2	LP 2B	Estimating PV Array Performance Class Participation	Th 4/6	10 5	3,5	1-7
3	LP 3A	PV Site Assessment Class Participation	T 4/11	10 5	1,2,3,4,5	1-7
3	LP 3B	PV Mounting Options Class Participation	Th 4/13	10 5	1,2,7	
4	LP 4A	PV Cells, Modules & Arrays Class Participation	T 4/18	10 5	1,4,9	1-7
4	LP 4B	PV Inverters Class Participation	Th 4/20	10 5	1,4,9	1-7
5	LP 5A	String & Branch Circuit Sizing Class Participation	T 4/25	10 5	1,9	1-7
5	LP 5B	System Design, Equipment Selection & Specifications Class Participation	Th 4/27	10 5	1,2,4,7,9	1-7
6	LP 6A	Utility Interconnection Applications Class Participation	T 5/2	10 5	10	
6	LP 6B	Permitting & Inspection Class Participation	Th 5/4	10 5	10	1-7
7	LP 7A	Available Solar Incentives Class Participation	T 5/9	10 5	8	1-7
7	LP 7B	Solar Economics Class Participation	Th 5/11	10 5	8	1-7
8	LP 8A	Term Project 1 Site Assessment	T 5/16	100	1 - 10	1-7
8	LP 8B	Term Project 2 Site Assessment & System Design	T 5/16	200	1 - 10	1-7
			TOTAL	525 points possible		

NOTES: All Assignments are due before the start of class on the Due Dates shown above, except for Class Participation Notes which are due the day of class.

Special Events: You will have the opportunity to attend the following optional conferences and events during this semester. (Attending these events is a great learning opportunity, but attendance is not required.) NOTE: Other field trips may be available and will be posted in the Announcements section of Blackboard.

Thursday, January 26 th 2023	RENEW Renewable Energy Summit, Monona Terrace, Madison, WI https://www.renewwisconsin.org/renewable-energy-summit/
Stevens Point: Tuesday, March 14, 2023 Green Bay: Wednesday, March 15, 2023 Milwaukee: Tuesday, March 21, 2023	WE Energies/WPS Energy Forum 2023
June 23-25, 2023	(32nd) Midwest Renewable Energy & Sustainability Fair (Custer, WI) (3 day event full of educational sessions and equipment demos) https://www.theenergyfair.org/
Ongoing	Focus on Energy – Events and Training (state wide) https://focusonenergy.com/about/events
Thursday, January 26 th 2023	RENEW Renewable Energy Summit, Monona Terrace, Madison, WI https://www.renewwisconsin.org/renewable-energy-summit/

Energy and Conservation Club (#405)

is a great way to get involved with many school projects in this subject area.

<https://www.nwtc.edu/student-experience/student-involvement/clubs-and-organizations/energy-conservation-club>

Advisors: Jenny Brinker & John Hippensteel

Jenny.Brinker@NWTC.EDU & John.Hippensteel@NWTC.edu

Student Agreement: After you have read the syllabus, please send me an e-mail with the following statement: *I confirm that I have read the course syllabus and agree to the class policies, procedures, due dates, and all the other information communicated in the syllabus.*

For Reference: Addendum for Fall 2020

NWTC COVID-19 Safety Statement:

Given the widespread transmission of COVID-19, Northeast Wisconsin Technical College (NWTC) is committed to providing a high-quality and safe student educational experience while ensuring the safety of our students and our workforce in alignment with the CDC published guidelines.

- Physical distancing is required. Stay at least 6 feet apart and do not gather in groups.
- A face covering/mask that covers both the mouth and nose is required to be worn by all students when on campus except when eating or drinking. Wearing a face covering helps protect others in case you are infected but don't have symptoms.
- When Face coverings are removed, they should be removed without touching eyes, mouth, and nose.
- Wash hands each time mask is touched or adjusted, put on or removed.
- Cloth face coverings should be washed daily, ideally using a washing machine.

Students not following these guidelines will be asked by faculty and staff to do so. Failure to comply will result in a request for the student to leave the campus and may result in disciplinary action for violation of the NWTC Student Code of Conduct.

Team Attendance Policy: (Add the bolded statement to the current Attendance Policy on the syllabi.)

Exception:

If you are feeling ill:

- Do not come to class.
- Communicate with your instructor right away and continue to communicate throughout your illness. If you do test positive for COVID-19, please report this to your instructor right away.
- Due dates will be extended, and reasonable and appropriate exceptions will be made when timely communication occurs.
- Please know that your instructor will work with you to continue making progress in your class if you are feeling ill.
- Returning to the Classroom/Lab:
 - If you were diagnosed with COVID-19:
 - A student may return to the classroom/lab based on the CDC guidelines for discontinuing isolation or upon health care providers authorization to return to work.
 - Return to work is generally at least seven (7) to ten (10) days from the start of symptoms and at least 72 hours fever free (<100.4) without the use of fever reducing medication.
 - If you had Other Illnesses:
 - Free from symptoms and at least 72 hours fever free (<100.4) without the use of fever reducing medication.

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- **Disability Act Statement:** NWTC complies with all provisions of the Americans with Disabilities Act and makes reasonable accommodations upon request. Please contact Disability Services for more information regarding the support services available to you, call 920-498-6904.
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