



Department Project Information

Department Name	MEES	Date Submitted	04/01/2025
Project Title	WIND TURBINE DESIGN (UNCC ME WIND4)	Planned Starting Semester	Fall 2025

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	1
Computer	1	Systems	
		Any	2

Total 7 students requested; minimum 3 ME/MET, minimum 1 EE, minimum 1 CE. The team will be required by the competition to build a new turbine +floating foundation every year. While they can reuse components from previous years, most of the designs have to be new. Along with the turbine design, there is also a project development component, that requires significant time input. This project requires a minimum of 7 students.

Project Overview:

The team will participate in the DOE Collegiate Wind Competition 2025-26. The project description given below is a general statement of the competition theme: design and testing of a wind turbine. The current team has built and partially tested a turbine according to this year's competition rules and requirements. While the next team may be able to build upon the work of the current team, the design requirements and final design may be different. The specifics will be known only in early Fall when DOE announces the rules and design requirements for 2025-26 competition.

This multidisciplinary project will be of interest to students from a variety of backgrounds such as mechanical, electrical, computer and civil engineering. The team will participate in the DOE collegiate wind competition (CWC) which is an opportunity for students to develop their abilities to identify, formulate and make decisions to solve real-world engineering problems independently. This unique hands-on experience involves students in i) designing the mechanical and electrical subsystems of a wind turbine according to design specifications, and ii) building the turbine prototype and components, and iii) testing the structural, electrical and electronic characteristics of



the subsystems, and iv) the experimental evaluation of the performance of the final turbine prototype and thus allows students to demonstrate proof-of concept for their designs and gives previously abstract concepts tangibility. The turbine must be designed, and mechanical loads analyzed, to withstand continuous winds of up to a specified wind speed. The electrical and control systems must be designed to maintain regulated output voltage to meet variable electrical load demands. Besides, the dimensions of a test-facility and the overall project cost will serve as a set of design constraints. The turbine prototype must be designed for testing inside a given wind-tunnel facility with specified dimensions while meeting the cost constraint. The project also requires community outreach throughout the project duration as well as preparing written documentation as part of the CWC.

Project Requirements:

All team members must be available to conduct field/laboratory testing on weekends and evenings and over school breaks, as well as travel to the competition in May. The team members will be required to take the laboratory safety tests to access the university machine shops, electrical labs etc. All students on the team are required to participate in on and off campus outreach and fundraising events.

Expected Deliverables/Results:

Deliverables include:

1. All senior design course deliverables
2. All competition deliverables as specified by DOE CWC
3. System block diagrams
4. System mechanical model, including stress analysis and static performance
5. System electrical load model and electrical diagrams
6. Turbine concept ideation sketches
7. System detailed drawings
8. System assembly drawings and procedure
9. System / subsystem testing plan
10. Financial plan
11. Outreach plan
12. System installation procedure and checklist
13. System operation procedure and checklist
14. Operable Hardware (turbine prototype and electrical subsystems assembly)

Disposition of Deliverables at the End of the Project:

The product can be displayed at the Senior Design Expo and then handed over to the mentor.

List here any specific skills, requirements, specific courses, club affiliation, knowledge needed or suggested (If none please state none):

Student should have an interest in one or more of the following:



- Aero/Fluid Dynamics
- Mechanical Design
- Electrical Circuit Design
- Power Electronics
- Power Systems
- Microcontrollers,
- Structural Analysis
- Instrumentation and Controls
- Dynamic Systems
- Wind Energy

Student should have the knowledge of or ability to learn one or more of the following software :

- CAD - Pro/e and/or Solidworks
- Circuit Design: Eagle or similar
- Power Electronics & Power System Analysis: MATLAB SIMULINK , PSSE, or similar
- CFD: ANSYS FLUENT/STAR CCM
- FEA: Abaqus or similar
- Programming: C/Java/Python , microcontroller programming
- Engineering analysis: Matlab/Mathcad
- Data Acquisition: Labview
- Microsoft Project, Microsoft Word, LaTeX