UNC CHARLOTTE
*The* WILLIAM STATES LEE COLLEGE *of* ENGINEERING

# UNC Charlotte – Lee College of Engineering Senior Design Program

## Senior Design Project Description

| | | | |
|---|---|---|---|
| **Company Name** | *EPRI* | **Date Submitted** | *11/15/2019* |
| **Project Title** | *Wind Turbine Design Project – Phase 2* **(EPRI_WIND2)** | **Planned Starting Semester** | *Spring 2020* |

**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 | 4 | Electrical | 1 |
| Computer | 1 | Systems | |
| Other (multi-disciplinary or systems ) | | | |

**Company and Project Overview:**

The Electric Power Research Institute (EPRI) conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for the public interest, we focus on electricity generation, delivery, and use in collaboration with the electricity sector, its stakeholders and others to enhance the quality of life by making electric power safe, reliable, affordable, and environmentally responsible.

EPRI has collaborated with the electricity sector and its stakeholders since 1972 and our membership has grown to represent approximately 90% of the electric utility revenue generated in the United States and extends to participation in more than 35 countries. The worldwide membership that supports our work comprises more than 1,000 organizations. While most members are electric utilities, others are businesses, government agencies, regulators and public or private entities engaged in some aspect of the generation, delivery, or use of electricity.

Through their advisory roles in EPRI, its research sectors and programs, EPRI members help inform the development of EPRI's annual research portfolio, identify critical and emerging electricity industry issues, and support the application and technology transfer of EPRI's research and development.

EPRI has teamed with UNCC to support a senior design project focused on wind energy

production.

**Project Requirements:**

- Research, design, build, and test an operational wind turbine according to a rule-set determined by industry needs, such as requirements set by the U.S. department of energy (DOE) collegiate wind turbine competition. This inaugural wind-turbine design project will be reviewed by wind turbine experts at EPRI and by UNCC professors and peers.
- Example rules are posted here: https://www.energy.gov/sites/prod/files/2019/01/f58/CWC%202019%20Rules%20and%20Requirements%20Manual_20190104_0.pdf
- https://www.energy.gov/eere/collegiatewindcompetition/articles/us-department-energy-releases-request-proposal-collegiate
    - Rules may be simplified if necessary – but course could include design, reporting, cost-benefit analysis of 2-3 major design choices, and final testing and measurements of power production and efficiency of an operational wind turbine.
- This project will be a Phase 2 follow-on to the EPRI_WIND project that started in Fall 2019.
- EPRI_WIND and EPRI_WIND2 are preparation projects to set the stage for UNC Charlotte to enter and compete in the US DOE 2022 Wind Competition. The timeline for the 2022 Competition is:
    - September 2020 – Request for Proposal for 2022 competition open
    - December 2020 – Competition application "Request for Proposal" submitted
    - March 2021 – 12 collegiate teams selected for competition
    - April 2021 – 2022 Rules released
    - April-June – 2022 Competition
- Because of the multi-year nature of the competition, we will have successive EPRI sponsored Senior Design teams which will work toward the competition schedule. EPRI_WIND is the starter project, Fall 2019 to May 2020. EPRI_WIND2 will run from Spring 2020 to Fall 2020. The Fall 2020 semester team will prepare the RFP submittal for the 2022 competition. That RFP effort will span from Sept 2020 to Dec 2020. EPRI_WIND3 will start Jan 2021 and run through December 2021. That team will be making the competition product based on their work which has built off of EPRI_WIND 1 and 2. EPRI_WIND4 will start in Spring 2022 and actual deliver and be present for the competition that is planned for May/June 2022. Their Fall semester will be to deliver the RFP for the next competition cycle.

**Expected Deliverables/Results:**

- Rule-set will be solidified during the first week of course-work, but deliverables will likely include
    - Design report with goals and analytical design results
        - efficiency, electrical output, mechanical loads
    - Functional 'small' wind turbine designed and built by students
    - Test plans, physical testing, and test reports validating whether goals met
        - efficiency, electrical output, mechanical loads
        - wind tunnel testing ("free jet" or otherwise)
- RFP Submittal to the Department of Energy that results in UNC Charlotte being selected as

1 of 12 participants for the 2022 competition.

**Disposition of Deliverables at the End of the Project:**

Delivered to EPRI after the conclusion of the Expo.

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

- Interest in renewable energy
- ME students desired to have taken, or be taking MEGR 3090 Fundamentals of Wind Energy Systems
- Design group will need to be resourceful to best utilize opportunities and interactions with cross-functional departments, labs, professors, and students from different educational backgrounds. A wind turbine system is designed utilizing, but not limited to, the following engineering disciplines:
    - Aerodynamics
        - Rotary-wing focus, “blade element momentum” analysis, wind-tunnel testing
    - Mechanics
        - Materials
        - Dynamics
    - Electrical
    - Controls / Computer