THE WILLIAM STATES LEE COLLEGE OF ENGINEERING

Company Information

Company Name	*Westinghouse Electric Company*	**Date Submitted**	*11/23/2021*
Project Title	*Design of a Working Prototype of a Cold Energy Storage System* **(WEST_COLD)**	**Planned Starting Semester**	*Spring 2022*

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	5	Electrical	
Computer		Systems	
Other ( )			

Company and Project Overview:

Nuclear power splits atoms to create energy; yet, when it comes to shaping a carbon-free future, Westinghouse is committed to harnessing an even more potent source of power: The strength of human ingenuity. Our company has a 130-year history of innovation that began when our founder, George Westinghouse, commercialized the alternating current and forever changed the way electricity was distributed. Our legacy continues in the nuclear era, which originated when we built the world's first commercial pressurized water reactor in Shippingport, Pennsylvania. More than 60 years later, 430 nuclear reactors operate around the world using Westinghouse technology.

While we are proud of our past, its real value lies in providing a guide for our future. As the world strives to address the challenges of a changing climate, we are constantly rethinking the way we deliver nuclear energy. From the efficient and economical AP1000® nuclear plant to the new eVinci™ micro-reactor for remote energy applications, we are leading the way with the

development of new nuclear technologies that will enable us to share the benefits of this reliable, clean, safe and economical source of energy for generations to come.

When Westinghouse powered up the world's first pressurized water reactor (PWR) at Shippingport in 1957, not even the most forward-thinking nuclear engineer could have conceived the technology that drives our cutting-edge AP1000® PWR system or even our game-changing eVinci™ micro-reactor. Today, it's equally difficult to imagine what nuclear technology will look like 50 or 60 years from now. Yet, one truth is sure to remain constant: Westinghouse will be there. Today, we supply our cutting-edge technology to nearly half the commercial nuclear power plants in operation today – and that's just the beginning. We're also providing complete development, licensing, engineering, project management, component manufacturing and start-up support for new plants in Korea, China and the United States, and facilities built on our technology are on drawing boards in the U.K., throughout Europe and in other parts of the world.

Project Overview:

The project is to validate the conceptual design of cold side energy storage system, which is one of the mechanical systems to support the design of Westinghouse Long Duration Energy Storage technology.

Project Requirements:

The conceptual design of Cold Side Energy Storage System has been completed by Westinghouse. The conceptual design documentation (e.g. drawings, system description, design conditions, performance requirements & etc.) will be provided as the starting point for the UNCC engineering senior design project team to plan and further develop into detailed design. Super critical CO_2 will be used as the heat transfer media, utilize the heat pump application and phase change of water, to further develop the details of this system, including but not limited to piping and equipment sizing, thermal hydraulic modeling of heat transfer (three-dimensional temperature profile and transient), computational analysis. The Phase/Semester 1 of this project is expected to complete the detailed design of this system; and the Phase/Semester 2 will develop the prototype of the completed design and testing to be performed to collect performance data, and validate the results from the thermal hydraulic modeling completed in the Phase/Semester 1. Various design conditions and performance requirements will be provided and included in the Design Specification to be provided to the design team to start. After the prototype testing is completed; scale up analysis may be needed to meet the design conditions and performance requirements.

Expected Deliverables/Results:

- Detailed Design Report, including the detailed system hydraulic fluid analysis, thermal hydraulic (CFD) modeling, drawings and technical requirements

- Final Technical Report, including the testing data and results.
- Proof of concept prototype designed built and tested.
- Others, as noted in the Design Specification

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

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

- Thermodynamics
- Heat Transfer Application
- Fluid Dynamics
- Thermal Hydraulic Modelling/Computational fluid dynamics (CFD) for the 3D simulation tool of fluid flows and heat transfer (ANSYS is the preferred tool)
- Equipment Sizing (MathCAD is the preferred tool for calculations)
- Students choosing this project must understand and agree that any intellectual property developed will be owned exclusively by Westinghouse and they will need to sign the company's Non-Disclosure agreement.