



## **Company Information**

<b>Company Name</b>	<i>Duke Energy</i>	<b>Date Submitted</b>	<i>11/15/2021</i>
<b>Project Title</b>	<i>Design of a Portable Hydration Monitor (DUKE_HYDRATION)</i>	<b>Planned Starting Semester</b>	<i>Spring 2022</i>

## **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.

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	1	Electrical	2
Computer	2	Systems	
Other ( )			


### **Company and Project Overview:**

Duke Energy is one of the largest electric power holding companies in the United States, providing electricity to 7.6 million retail customers in six states. Duke Energy has approximately 49,500 megawatts of electric generating capacity in six states in the Carolinas, the Midwest and Florida – and natural gas distribution services serving more than 1.6 million customers in Ohio, Kentucky, Tennessee, and the Carolinas.

### **Project Requirements:**

This project would create a prototype for a worker hydration monitor. Outside workers are vulnerable to dehydration when working outside during extreme hot weather or in high temperature areas of a power plant. The best way to prevent dehydration is to drink regularly. At Duke Energy we have a guidance document as shown below for water intake based on the ambient temperature. Currently, a person on the crew acts as a manual hydration monitor, watching the temperature and elapsed time and reminding crews to take breaks to stay hydrated. This proposal is for a portable device that measures ambient temperature and humidity and starts beeping loudly at preset conditions per the document below to alert

the crews to drink water and take breaks accordingly. The device could also warn crews when heat conditions are too dangerous to continue working even with proper hydration. The device could be magnetically mounted on the truck or a wearable and could have an electronic log, so we know the guidance has been followed for audit purposes. The log would also provide a record of the ambient conditions workers have experienced during the workday.



**Transmission Hydration Guidelines**

The table below gives general guidance on length of time between water breaks and a corresponding hydration target for each hour of work.

Temperature	Work Level	Maximum Minutes Worked Between Hydration Breaks	Hydration Target
< 80	Normal		8 – 12 oz / hour
80 – 85	Normal		8 – 16 oz / hour
86 – 90	Normal	50	12 – 20 oz / hour
91 – 95	Normal	45	16 – 24 oz / hour
≥ 96	Normal	40	24 – 32 oz / hour

> If you are performing heavy or excessive work you will need to increase your hydration level and take more frequent water breaks.  
 > People with a history of renal insufficiency or congestive heart failure need to be cautious of over hydrating.

**Roles & Responsibilities**

**Hydration Monitor Expectations**

1. Review the Hydration Guidelines during Pre Job Briefing for each job, establishing temperature threshold, maximum minutes between hydration breaks, and hydration target and document on the job briefing.
2. Observe water intake of self and others on the job for work being performed per the guidelines.
3. Monitor work/hydration break standard compliance, notifying crew when maximum duration between hydration breaks has expired.
4. Coach and intervene when break is required and hydration is not being met.
5. Discuss compliance with standard during post job brief and hydrate for the next job.

**Expected Deliverables/Results:**

- Refined list of requirements for a portable hydration monitor.
- Specifications and functional diagram.
- Design for electronics and enclosure to support functionality.
- Logging software for recording compliance with hydration requirements.



- Functional prototype of portable hydration monitor.

**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):**

- Electronics engineers to design microprocessor-based device to monitor ambient temperature, humidity, and elapsed time. Device should have display and control buttons.
- Mechanical engineers to design a wearable enclosure for the monitor. Different types of enclosures may be needed for other applications, such as magnetic attachment to vehicles.
- Computer engineers to build logging capability to monitor compliance. Potentially use Bluetooth connection to cell phone application.