## AUSTIN LEE

**SCHOOL:** University of Wisconsin - Platteville
**MAJOR:** Mechanical Engineering

# GRINNELL COLLEGE

GRINNELL

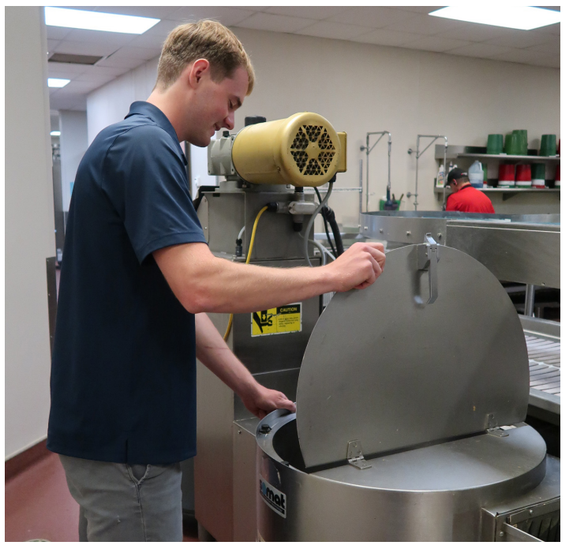
### COMPANY PROFILE:

**Grinnell College is a liberal arts college located in Grinnell, Iowa, and hosts around 1,750 students and employs roughly 550 employees. The college offers 28 major degree programs with 17 concentrations. Common fields of study include social sciences, biology, and computer sciences. The main campus includes 120 acres and 63 buildings, 20 of which are residence halls. Grinnell College actively practices sustainability through LEED certified building construction, rainwater collection, and renewable energy usage.**

### PROJECT BACKGROUND

Grinnell College's dining service is proactive about collecting food waste from various sources such as kitchen preparations and post-consumer leftovers. The intern focused on exploring options to more efficiently collect data and document sources of food waste to guide future waste reduction projects. Disposal alternatives were also investigated to mitigate odor production.

The college's energy consumption fluctuates throughout the day resulting in high peak demand charges. The intern was tasked with finding opportunities to reduce the peak demand such as load shifting, efficiency updates, and dynamic building controls.



### INCENTIVES TO CHANGE

The college created a sustainability plan in 2018 that outlined steps to move towards carbon neutrality by 2040. Recent projects such as adding a solar field and geothermal installations have made progress towards their goal.

Grinnell prioritizes landfill diversion through recycling and composting. Increasing allergy-free alternatives and more dining options have gradually increased food waste production. For this reason, continuing to meet their landfill diversion goals necessitates source reduction and an update to the current food waste collection system.

Recent billing structure changes have also incentivized Grinnell to reduce their peak demand for energy. Opportunities that reduce peak use have the appeal of both decreasing peak demand charges as well as overall energy consumption.

### RESULTS

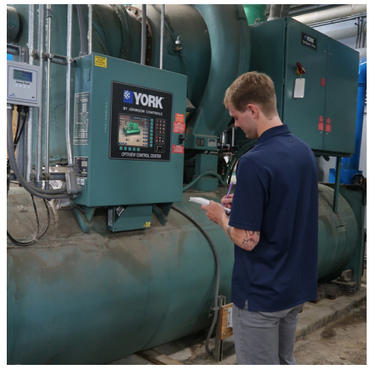
**Food Waste Characterization Study**

Food waste characterization studies are used to better understand the food waste production on campus and guide future waste reduction projects. However, the quantity of food waste data being collected was limiting waste reduction projects. Investing time into designing and conducting a thorough food waste characterization study will provide the information needed to evaluate source reduction opportunities.

Two types of food waste studies were designed to measure the waste produced across Grinnell's campus and document the contributing sources. The first food waste study considers all food waste streams across the campus to identify major contributors. This introduces measurements from sources that have not been tracked before. The second study evaluates specific meals and is designed to be implemented regularly for continual improvement on campus. This allows the dining services to assess preparation processes, meal options, and student behavior. Data collection forms for each of the food waste studies were created by the intern. A dining manager will need to organize data collection and train employees on how to use the forms for successful implementation.

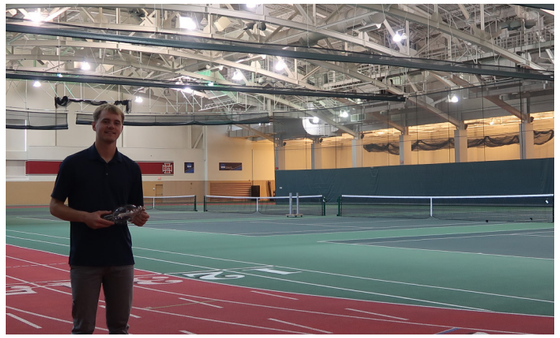
**Sanitary Sewer Disposal**

The campus currently collects food waste in a compacting container for weekly transportation to an industrial composter. Immediate disposal is an approach to eliminate odor production from food waste. A kitchen sink disposal system could be an effective alternative to reduce the volume of food waste and minimize transportation. Utilizing the sanitary sewer to transport food waste to the wastewater treatment plant combines the convenience of immediate disposal with the stewardship of aerobic digestion at the plant. This system streamlines the kitchen's process to increase reliability, reduce the labor involved for employees, and reduce operating expenses. Grinnell College will need to obtain an updated quote from a contractor for the installation of the sink disposal and plumbing.




**Update Lighting to LED**

LED updates are a straightforward way to increase the efficiency of building lighting. Three large gym spaces currently utilize high bay, metal halide HID lamps. These spaces are open for various hours throughout the week, and the lights remain on during open hours. LEDs provide the value of reduced electrical consumption and greater control to quickly modulate brightness. This update was previously recommended by another intern; however, the technology was unproven at the time. LEDs have since become a staple in building lighting and have set the efficiency standard. A quote has been received from a contractor and installation is ready to begin upon approval.



**Building Temperature Setback**

The high-variable chiller load was determined to be a key contributor to the peak demand set point. Grinnell College's solar energy production aligns with the total energy consumption on campus; therefore, the daily peak often occurs sometime between 5:00 p.m. and 8:00 p.m. A building temperature control plan was developed to incorporate setbacks during this three-hour period to counter the peak demand. It strikes a balance between source reduction while maintaining comfort for the people on campus. Once the temperature ranges are approved, building control technicians on campus can adjust the temperature settings.

### ENVIRONMENTAL AND ECONOMIC SAVINGS TABLE

| PROJECT | ANNUAL COST SAVINGS | ANNUAL ENVIRONMENTAL RESULTS | STATUS |
|---|---|---|---|
| FOOD WASTE CHARACTERIZATION STUDY | $6 PER $1 INVESTMENT | Reduced Food Waste and Operating Costs | RECOMMENDED |
| SANITARY SEWER DISPOSAL | $13,150 | Reduced Operating Costs | RECOMMENDED |
| UPDATE LIGHTING TO LED | $21,248 | 194,106 kWh<br>506 kW | RECOMMENDED |
| BUILDING TEMPERATURE SETBACK | $8,655 | 17,616 kWh<br>388 kW | RECOMMENDED |