

**CSC 315-01**  
**3/10/22**  
**Mid-Semester Project Report**

Group Number: 01-4

Group/Project Name: cab-project-01-4

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## **Elaboration: Project Proposal and Specifications**

### **Problem Statement:**

With the effects of global warming becoming increasingly apparent, it is of the utmost importance for TCNJ to monitor its energy use. Companies and colleges around the world are striving to lessen their carbon footprint and become carbon neutral in the near future. Additionally, it is important to meet these environmental goals in an economically feasible way. To aid in this endeavor, our group wants to create an interactive software application for the TCNJ Energy Management Team that makes use of the energy demand data by building.

### **Objective of the Module:**

At Paul Romano's presentation, he stated that TCNJ wants to be carbon neutral by 2040. Keeping this goal in mind, the overall objective of the project is to make the energy demand and energy cost data easily accessible to the Energy Management Team at TCNJ and others who might find it useful. This application will be a useful tool for monitoring the data and making the right decisions for both the environmental and economic sides of this problem.

### **Description of the desired end product, and the part you will develop for this class:**

To start, the user will enter a meter, a year, and a month. Then, the application will display the cost, energy demand, and CO<sub>2</sub>e for the given input data. Along with that, the application will display line graphs that plot the cost, energy demand, and CO<sub>2</sub>e over the given year. Next to or under the line graphs, the application will display averages: average cost, average energy demand, and average CO<sub>2</sub>e for the input year. If time allows, we will add a feature that allows a user to compare two or more years. These features will help the TCNJ Energy Management Team identify trends in cost, demand, and carbon footprint.

### **Description of the importance and need for the module, and how it addresses the problem:**

According to NOAA scientists, New Jersey temperatures have gone up by 3 degrees Fahrenheit over the past century. Also, over the past decade, we have seen record-setting storm seasons in NJ. The data has made it clear that the effects of climate change are in motion. Therefore, it is important to create a tool that can be used by energy experts to reduce the carbon footprint of TCNJ. With our tool, TCNJ can monitor its energy demand and use that data to come up with a strategic environmental plan. Going along with that, the tool will also address cost, thus allowing TCNJ to tackle this problem in the most economically efficient way.

### **Plan for how you will research the problem domain and obtain the data needed:**

The TCNJ energy demand data appears to already be on Canvas. Also, to convert Kwh and therms to CO<sub>2</sub>e will we use formulas from reputable sources such as [epa.gov](http://epa.gov) and [eia.gov](http://eia.gov).

**Other similar systems/approaches that exist, and how your module is different or will add to the existing system:**

Reliant and Energy Star have energy usage tools for commercial buildings and residences that make comparisons to common averages. Additionally, there are also many applications where the user enters in their energy usage and it outputs the cost of the by day/month/year. While we might be incorporating some of their UI designs and their data for comparison purposes into our own implementation, ours is unique because it's specifically for colleges like TCNJ.

**Possible other applications of the system (how it could be modified and reused):**

If our application is useful to the TCNJ Energy Management Team we could reach out to other colleges to see if they could benefit from the tool. Additionally, if companies track their energy usage they might be able to make use of it as well. We are hoping that it could be useful in monitoring energy demand, monitoring energy cost, identifying patterns, and reducing carbon footprint.

**Performance:**

As we learn more about proper database schema design, the CSC 315 portion of the team will come up with efficient access paths. Also, since we are not dealing with huge amounts of data, performance should not be a serious problem. We also plan to keep the user interface rather clean and simple so that no unnecessary UI features slow down the application.

**Security:**

Since the project will be on GitHub we do not have to deal with security for now. However, if we want to make the application publicly available we will use database security knowledge from CSC 315. As we create our application we will keep in mind techniques, such as defense in-depth, and make sure only approved admin accounts can change things in the database. We will use an already existing login system with encryption of login credentials to ensure the security of admin accounts.

**Backup and Recovery:**

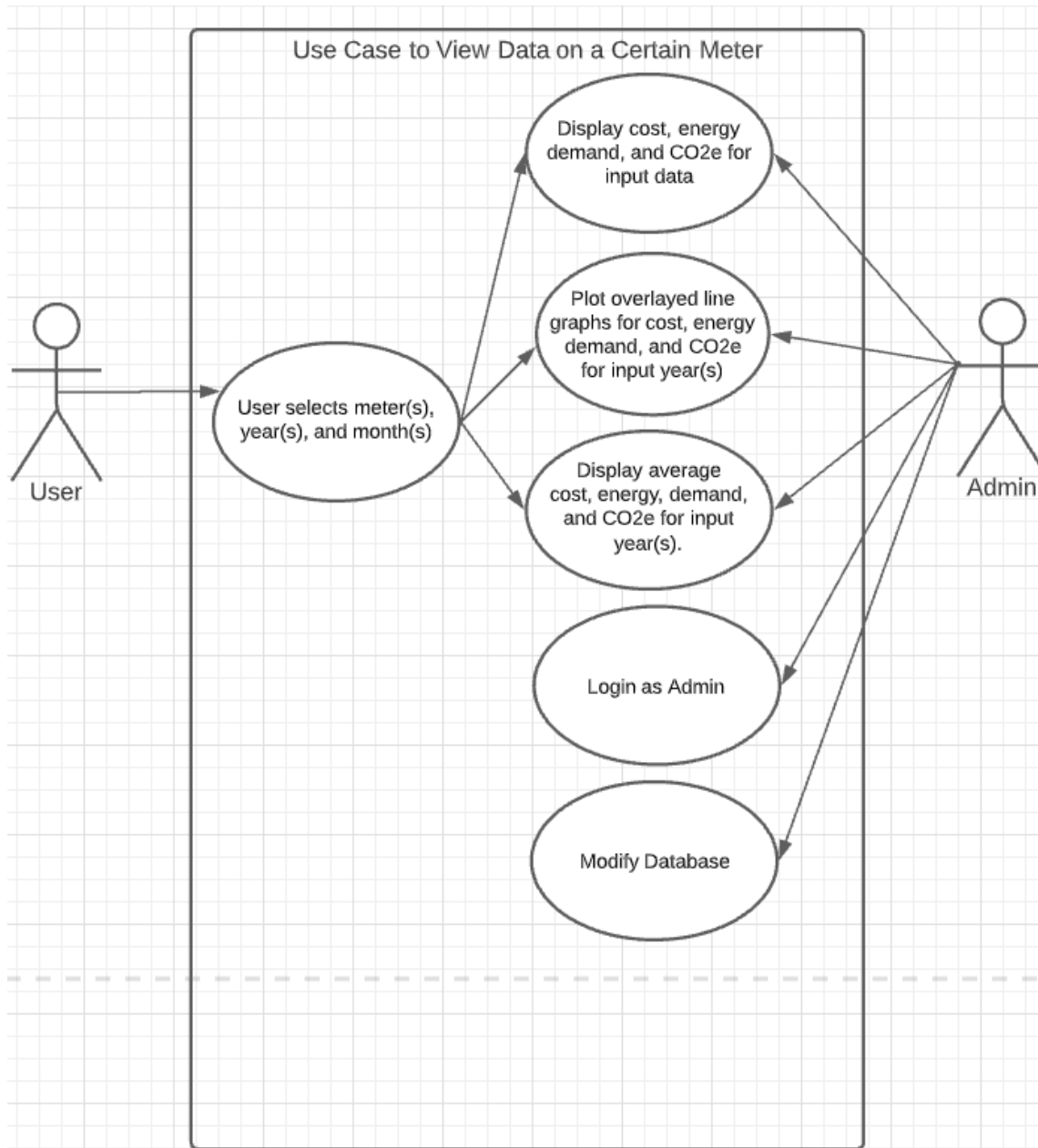
Github has features in which we can revert our project to previous versions if something were to go wrong. Since we have multiple computer science members who are experienced with GitHub, the project should be safe if we need to recover it. However, if we want to make the application publicly available we will use database backup and recovery knowledge from CSC 315.

**Technologies and database concepts the group will need to learn, and a plan for learning these:**

We will need to learn more about proper relational database design. As of now, we have a basic understanding of entities, attributes, and the relationships amongst entities. But we will need to learn more about how to make efficient access paths and how to limit the number of NULL

entries. As we learn more about databases we will be able to choose a technology that seems right for our project, whether it be Postgres, MySQL, etc.

### Use Case:



UI:

<b>TCNJ Energy Demand Application</b>  Select Meter: <input type="text"/>  Select Year: <input type="text"/>  Select Month: <input type="text"/>	<div>Cost Energy Demand CO2e</div> <div>Cost line graph</div> <div>Energy Demand line graph</div> <div>CO2e line graph</div> <div>Average Yearly Cost Average Yearly Energy Demand Average Yearly CO2e</div>
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Quad Chart:



## Energy Demand

Section 1 Group 4

### Need

With the effects of climate change becoming more prominent, TCNJ and most other universities are striving to lessen their carbon footprint and become carbon neutral in the near future. We believe there is a need to track energy consumption in specific parts of our campus and make this data easily available to the people who can use it to the school's benefit.

### Approach

Our group wants to create an interactive software application for the TCNJ energy Management Team that makes use of the energy demand data. The application will be able to present data about building energy demand in both graphical and tabular forms depending on the user's request.

### Benefit

If our tool is useful, we could aid our university and possibly other universities in their goal to reach a carbon neutral status by showing useful information to the respective energy management teams, which they could react accordingly to.

### Competition

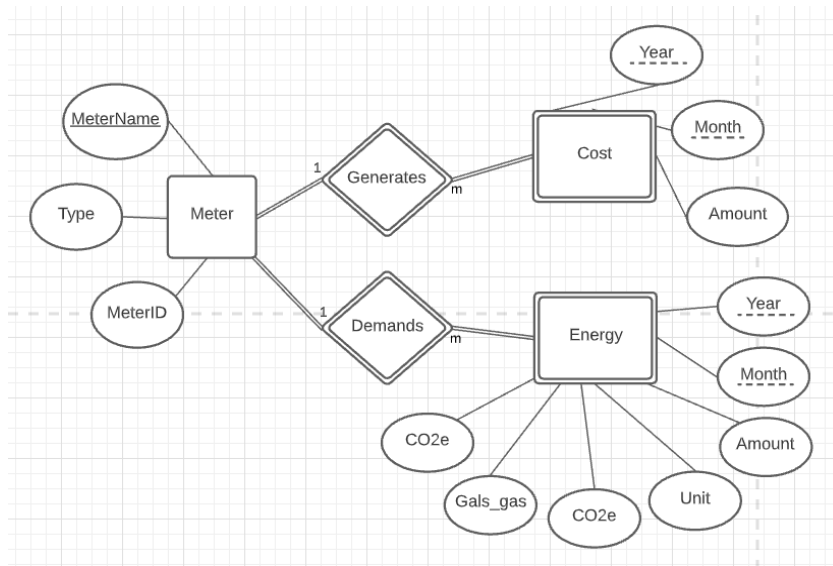
Reliant has an energy usage tool for residencies that makes comparisons to averages. There are also many applications where the user enters in their energy usage, and it outputs the cost of the by day/month/year. While we might be incorporating some of these ideas into our own implementation, ours is unique because it's specifically for colleges and should be able to provide feedback on how to reach carbon neutrality.

## Proposal Pitch Presentation:

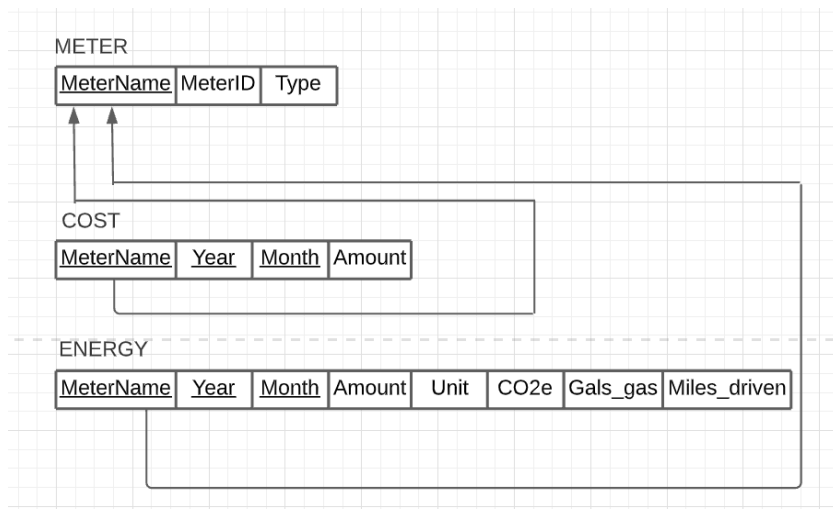
[https://docs.google.com/presentation/d/1lUeX46Y4lFBfLoqhOVffujV3\\_ZCzWnesArtRYRmXl38/edit?usp=sharing](https://docs.google.com/presentation/d/1lUeX46Y4lFBfLoqhOVffujV3_ZCzWnesArtRYRmXl38/edit?usp=sharing)

## Elaboration: Design

### ER Diagram:



### Relational Schema:



**Mid-Semester Project Presentation:**

[https://docs.google.com/presentation/d/1-F0cJVGnpRk\\_lIBd-DKJfc10P-KeFcqZ\\_3qqUZtptx4/edit?usp=sharing](https://docs.google.com/presentation/d/1-F0cJVGnpRk_lIBd-DKJfc10P-KeFcqZ_3qqUZtptx4/edit?usp=sharing)