Energy Demand and Building Comparison

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Problem Statement

- With the effects of global warming becoming increasingly apparent, it is of the utmost importance for TCNJ to monitor its energy use.
  - Additionally, Companies and colleges around the world are striving to lessen their carbon footprint and become carbon neutral.
- Additionally, it is important to meet these environmental goals in an economically feasible way.
- 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**. Therefore, our objectives are:
  - To make this important energy demand data easily accessible to the Energy Management Team at TCNJ and others who might find it useful.
  - We also want to use the energy demand data to help evaluate and estimate the cost of building energy demand.
- This application will be a useful tool for monitoring the data and making and making the right decisions for both the environmental and economic sides of this problem
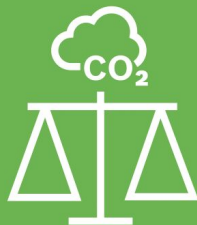
Description of the Desired End Product

- The application will be able to present data about building energy demand and cost in both graphical and tabular forms depending on the user's request.
- It should also make use of energy demand data from other colleges as a useful comparison tool.
  - For example, it could provide a visual comparison of the energy demand of the STEM building at TCNJ and Rowan.
  - Realistically, it might not be feasible to obtain this data from other colleges so we could provide other useful information, such as how to lower TCNJ carbon footprint and eventually reach carbon neutrality.
- We hope that this tool helps TCNJ identify important patterns, such as a relationship between building age and energy cost.

Importance of the Module

- According to NOAA scientists, New Jersey temperatures have gone up by 3 degrees Fahrenheit over the past century.
- 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 at TCNJ.
- Also, by addressing cost, this application will help TCNJ tackle this environmental problem in the most economically efficient way.
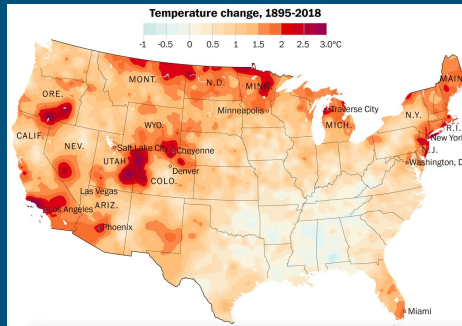
Research Plan

- The TCNJ energy demand data appears to already be on Canvas.
- To obtain the additional data that we talked about, such as other northeastern colleges' energy demand, we will need to either make use of public data or reach out to the colleges themselves.
  - Some colleges that we might reach out to include **Sacred Heart (6417 students)**, **Fairfield (4354 students), and Marist (5682 students)**.
  - To learn more about how to reach carbon neutrality we will likely use governmental resources.
- If cost is not provided in the dataset, we will need to use publicly available data about the cost of different fuel sources (natural gas, coal, clean energy, etc.) in New Jersey.

Property Name	Portfolio Manager ID	Year Built	Property Type - Self Selected	Construction Status	Gross Floor Area	Occupancy (%)	Number of Buildings	How Many Buildings?	Parent Property ID
The College of New Jersey	3864873	1855	College/University	Existing	2830421	100	More Than One	47	3864873
Bliss Allen Brewster House	6151485	1855	Residence Hall/Dormitory	Existing	34144	100	One	1	3864873
Armstrong Hall	6151485	1961	College/University	Existing	71847	100	One	1	3864873
Art & IMM	6151480	2010	College/University	Existing	70283	100	One	1	3864873
ABE	6151492	1968	College/University	Existing	32299	100	One	1	3864873
Biology Building	6151495	2001	College/University	Existing	77393	100	One	1	3864873
Bliss Hall	6151517	1935	College/University	Existing	33913	100	One	1	3864873
Brower Student Center	6151511	2016	College/University	Existing	106480	100	One	1	3864873
School of Business	6151515	1999	College/University	Existing	46005	100	One	1	3864873
Centennial Hall	6151517	1974	Residence Hall/Dormitory	Existing	48944	100	One	1	3864873
Cromwell Hall	6151497	1967	Residence Hall/Dormitory	Existing	53947	100	One	1	3864873
Decker Hall	6151499	1963	Residence Hall/Dormitory	Existing	103816	100	One	1	3864873
Education Building	6151500	2012	College/University	Existing	79923	100	One	1	3864873
Eickhoff Hall	6151504	1992	College/University	Existing	147100	100	One	1	3864873
Forcina Hall	6151507	1968	College/University	Existing	77392	100	One	1	3864873
Green Hall	6151508	1931	College/University	Existing	71808	100	One	1	3864873
Hausdoerffer Hall	6151510	2009	Residence Hall/Dormitory	Existing	70000	100	One	1	3864873
Kendall Hall	6151511	1932	College/University	Existing	69000	100	One	1	3864873
Maintenance Building	6151513	1970	College/University	Existing	21049	100	One	1	3864873

Similar Systems/Approaches That Exist

- 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.
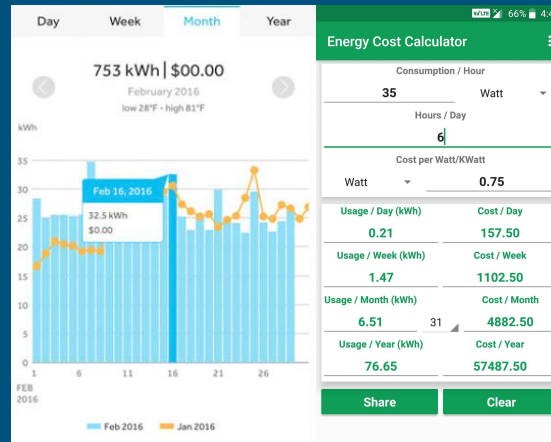
Other Applications

- 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, our tool could be useful to companies that track their energy usage.
  - We are hoping that it could be useful in monitoring energy usage, monitoring energy cost, making comparisons, and reducing the carbon footprint.

Concepts/Technologies Needed

- 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.

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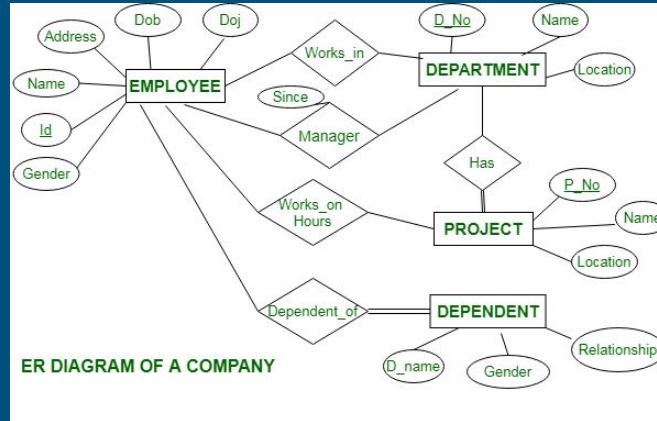
Diagrammatic Representation
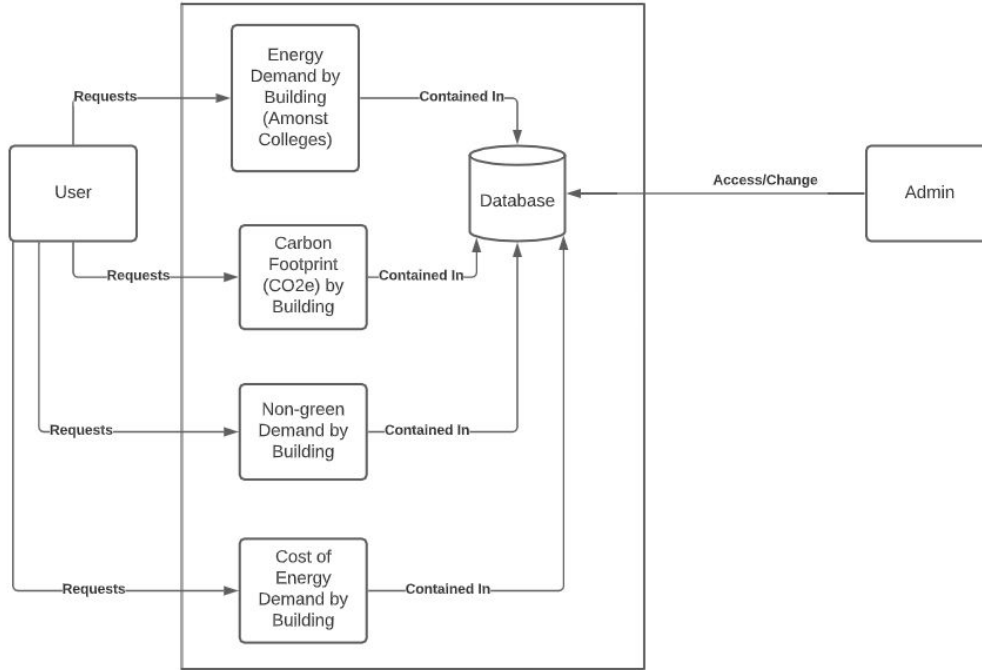
- Users will be able to make queries about each of the pieces of data they are linked to
- This data will be stored in our database which we will explain in more depth in the next iteration
- Admins can access and change all data in the database

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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.

2/6/22