

## **Specifications**

### **02-5: Energy Supply**

#### **Problem statement**

TCNJ is committed to providing a reliable but cost-efficient energy supply to the TCNJ campus. There is currently no application that lets users access and visualize the use and costs of locally produced and grid energy with environmental considerations for the entire TCNJ campus. Users would benefit from a single module that provides visualizations and tables concerning the costs and environmental impacts of the various energy supply methods. This would allow for the campus to create a well-informed decision for a future plan to reduce emissions at a fair price.

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

Our objective is to develop a module that allows for a user to simultaneously minimize both energy consumption costs and environmental impact with the current TCNJ data.

#### **Desired end product, and the part you will develop for this class**

We would like to create a webpage application that provides visualizations of the costs associated with power supply for the TCNJ campus, which specifically will allow a user to come to an informed conclusion about how economical and environmentally friendly different energy sources are. Another feature of the module would be the ability to predict future costs and energy expenditure. The end product would compare the cost of creating energy on campus in comparison to taking energy from the grid. Additionally, the module will weigh the environmental impacts thereof. We hope to create a comprehensive database using PostgreSQL to store the existing energy supply data, provide projections on future energy usage and costs, all within an efficient, secure, and informative user interface.

#### **Importance and need for the module, and how it addresses the problem**

By aggregating and displaying data, this module will allow a user to come to an informed decision regarding the most cost-effective and environmentally friendly way to supply the TCNJ campus with power. We plan to provide visual representations in the form of graphs and charts to help the user understand trends in their data. We believe that an intuitive user interface is crucial to achieving our goal of informing our users. With the expansion of TCNJ power sources to solar panels and wind turbines, the college requires a comprehensive database to store and visualize the data in real-time.

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

To complete our task, we will need information from many sources. Namely, data on the unit cost of power when produced locally vs. taken from the grid. Important sets of data include the carbon emissions of each energy supply method, price, and energy expenditure in kWh, all in

relationship to time. Some research on our part would include obtaining available data on energy supply from solar power and wind turbines in a similar-sized institution. This would allow us to create a better model for TCNJ power supply and cost calculations.

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

A similar system to our proposed project is that of Energy star. Their portfolio manager application displays data on energy consumption and efficiency per building. Our module will display campus-wide data on the costs of energy supply. We plan to include both locally produced power and energy from the grid, as well as the environmental consequences of producing versus outsourcing energy supply. The advantage of our module is that all the data will be stored together, the user will be able to compare energy consumption from different suppliers for the entire campus.

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

This module will be useful in visualizing data from the past and current day, as well as providing projections into the future. A possible modification can be to create multiple projection plans and compare them using live data. This means that a user could view historical trends in power supply in former years. It can also be used to build various plans for years in the future. As TCNJ expands, the module can be used to support data for different energy sources. As more and more data is collected, future projections will become more accurate.

**Performance – specify how and to what extent you will address this.**

We hope to create an efficient application and database that can manage all the data gathered by TCNJ for energy expenditures and create visualizations based on the data. By using Python and PostgreSQL we believe that it would be possible to create a module of this size. For security purposes, we will implement access control to allow only authorized users to access the database and sensitive information. There will be a home page

**Security – specify how and to what extent you will provide security features.**

Before creating the full-scale database, we hope to learn more about database security in class and implement these practices in our project. We will use GitHub and its repositories to store the data and source code. We can improve the security of our modules by following certain best practices, such as [those outlined by IBM](#). Specifically, we will make sure that all software we use is patched and up to date, implement a password-secure administrator profile, and record database logins and uses. Registering for an administrator account will be limited to staff and faculty who present a pressing need to alter or configure certain parts of the database itself; normal users themselves will not be permitted to alter the database.

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

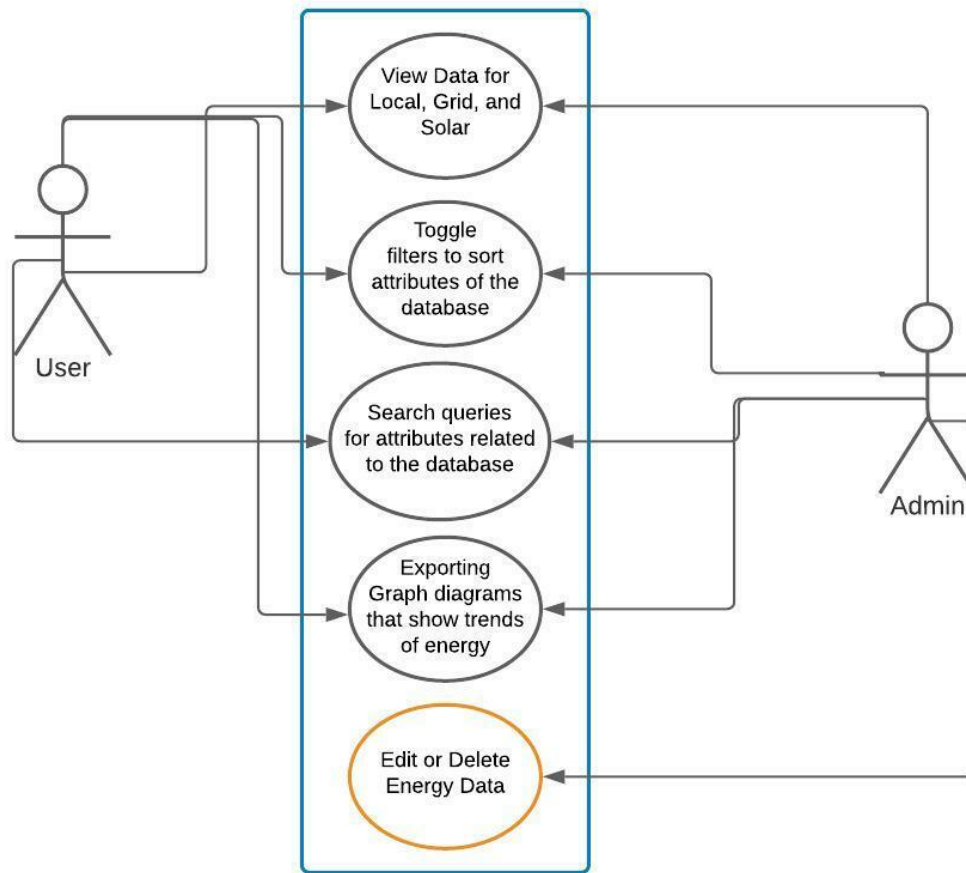
We will need to learn how to use Python to create a secure connection to PostgreSQL, as well as learn how to use PostgreSQL in order to efficiently store our data. As students, we will learn the basics of how to use these tools in class and then will look for reference material on the execution of specific tasks that we may not be familiar with doing. Each member in our group has different experience levels with tasks that we will be responsible for, but this allows for us to learn as a group while having an “expert” on various topics.

**Backup and recovery – specify how and to what extent you will implement this. and which queries you will implement.**

GitHub offers easy recovery and version control solutions, and seems to be the best resource to achieve this goal. Github not only can serve as a repository for our source code, but also as a way to store our starting data sets, and information crucial to our project. However, this requires our team to properly use branches and commits to ensure that we keep our final production code segregated from our in-progress code and materials.

The ability to backup our database itself is critical, and as such we plan to back it up consistently. Specifically, since the database will likely see minimal (if any) use outside of working hours, we plan to back up our database late at night or in the early morning. There are a number of services which provide the ability to back up a SQL database, such as [Microsoft SQL Server](#). Since our database is relatively small, we plan to back up the entire database, as well as log files, as opposed to a partial backup. As we move forward, we will refer to Microsoft’s [guidelines](#) as the details of our project become more granular.

**Diagrammatic Representation**



## Quad Chart

<p><b><u>Need:</u></b> TCNJ, as well as other customers in the market, are looking for a cost-effective, yet environmentally conscious way to balance energy supply costs.</p>	<p><b><u>Approach:</u></b> Create a web-based module that allows for easy visualization of the costs of various supplies of power for TCNJ's campus.</p>
<p><b><u>Balance:</u></b> Balance in energy cost and environmental sustainability Benefits for future use of buildings and energy sources</p>	<p><b><u>Competition:</u></b> No direct competition; energy star provides a somewhat similar service on a per building basis.</p>