A Plan to Power Our Communities

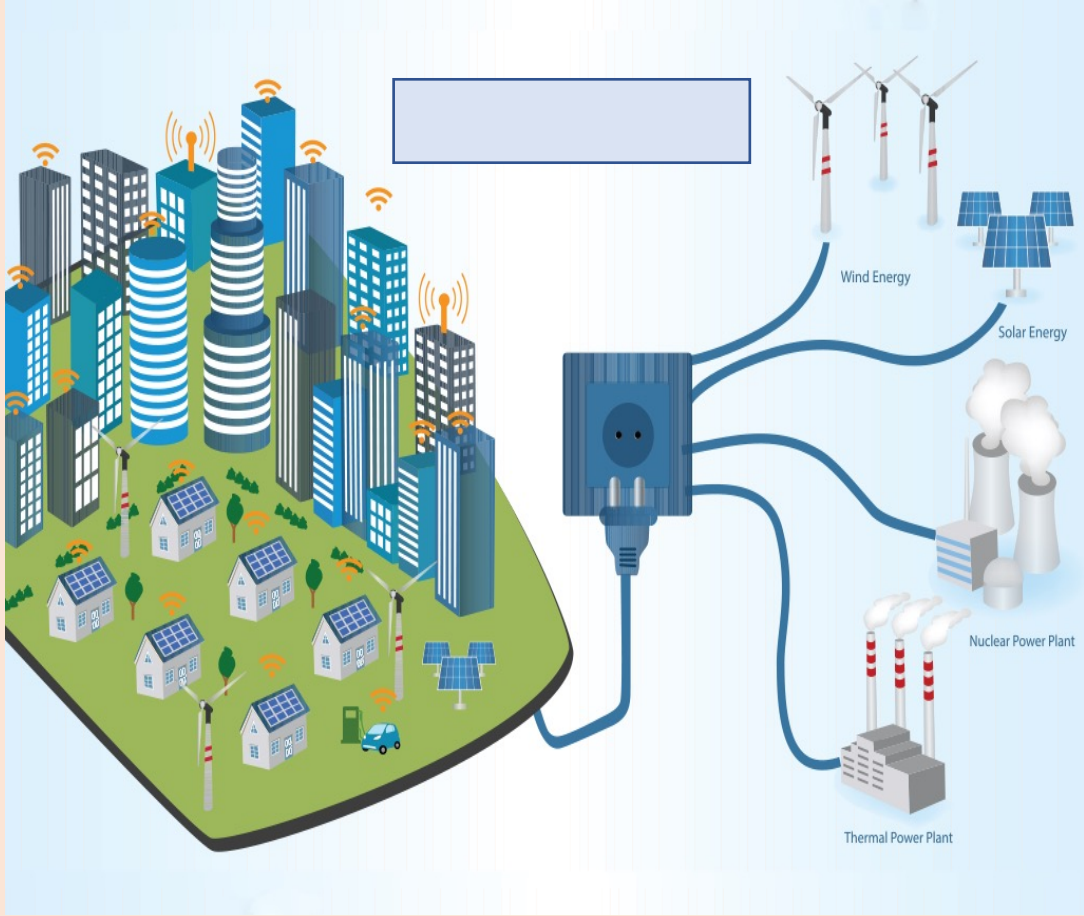
Boone 1

Lindsay Byrd, Evelyn Hunt, Havalyn Hale, Christian

Mentor: Areesha Razi

Background Information

Smart and microgrids are needed to help efficiently transfer power and reduce the carbon footprint of power. Smart grids help monitor and manage the transportation of electricity from all sources to meet the needs of users. Smart grids are different than our current forms of power transportation because the conventional grid gives one way of electricity, and only certain communication is possible. However, a smart grid gives a two-way flow of electricity and is more efficient.



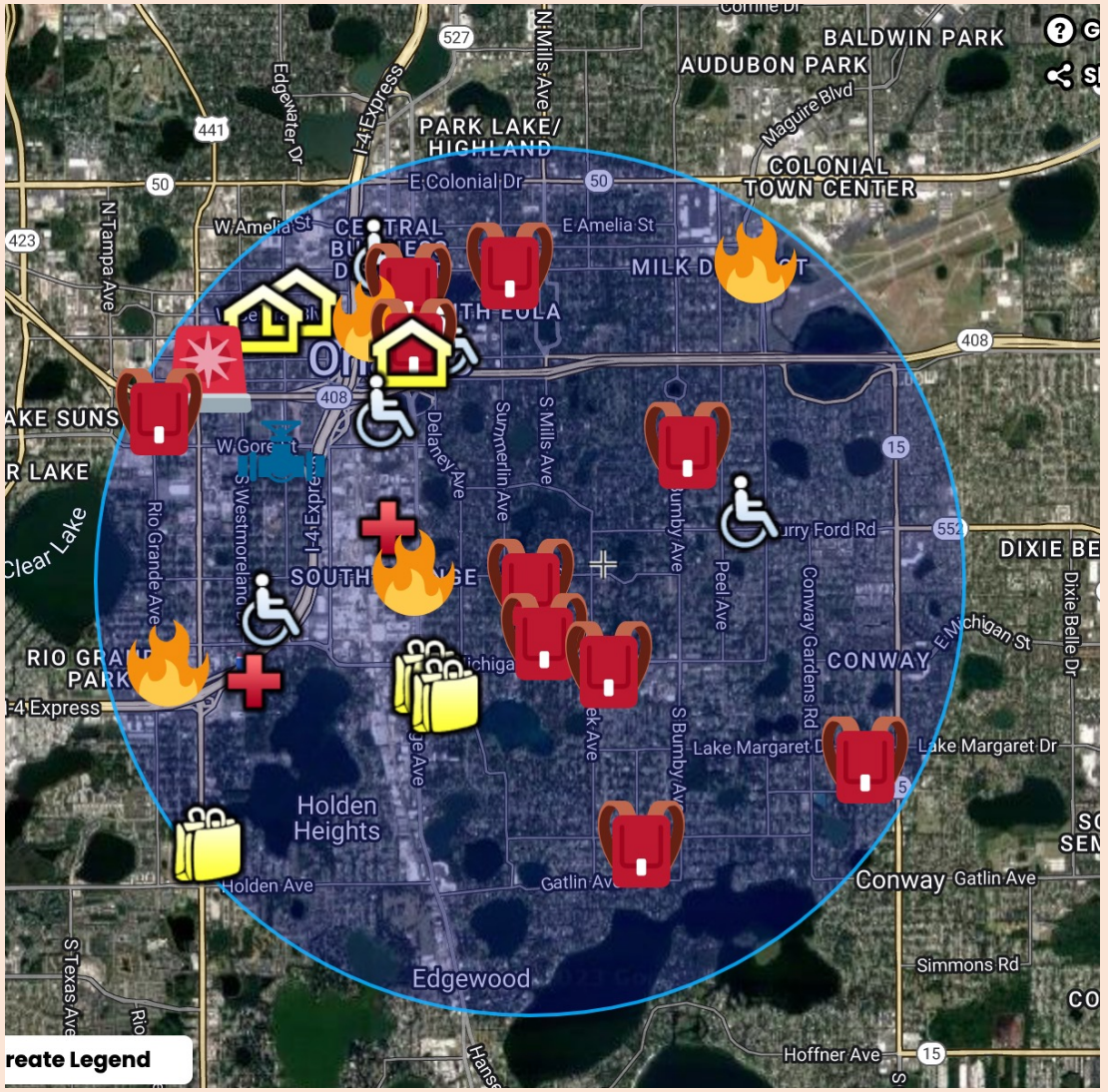
Our Design Process

1 We researched and discussed user types that we felt needed power primarily during natural disasters. In our research, we searched for places that had high amounts of people relying on them, and/or could help restore areas back to normal. Our original list consisted of the following;

1.Schools
2.Hospitals and Emergency Rooms
3.Grocery Stores
4.Senior Living Center
5.Shelters
6.Power Plants
7.Fire Departments
8.Police Departments
9.911 Call Centers
10.Water Utility

Our Design Process

2 We mapped the locations of places from our list in a two-mile radius of our school.



Our Design Process

3

We then took our list of high-need places and determined the amount of power they used per the area and other necessary factors. We then observed how the power cycles of the area change throughout the day, and year. Some of our data below.

User Type	Power Load per Area (kBtu/ ft²)	Power Load per Area (kWh/ft²)	Power Load per Area (kWyr/ ft²)	Average Load Area (ft²)	Total Power Load (kWyr)
911 Call Center	116.4	34.11	0.00389	63,000	245
Senior Center	213.2	62.485	0.00713	57,744	412
Grocery Store	444.0	130.13	0.01485	50,009	743

User Type	Daily Cycle Notes	Yearly Cycle Notes
Schools	peaks during the day	peaks every 10 months per year
Hospitals/ ER	peaks during the afternoon time	Peaks every 2-3 weeks
Grocery Stores	peaks during the day	peaks ever Monday-Friday

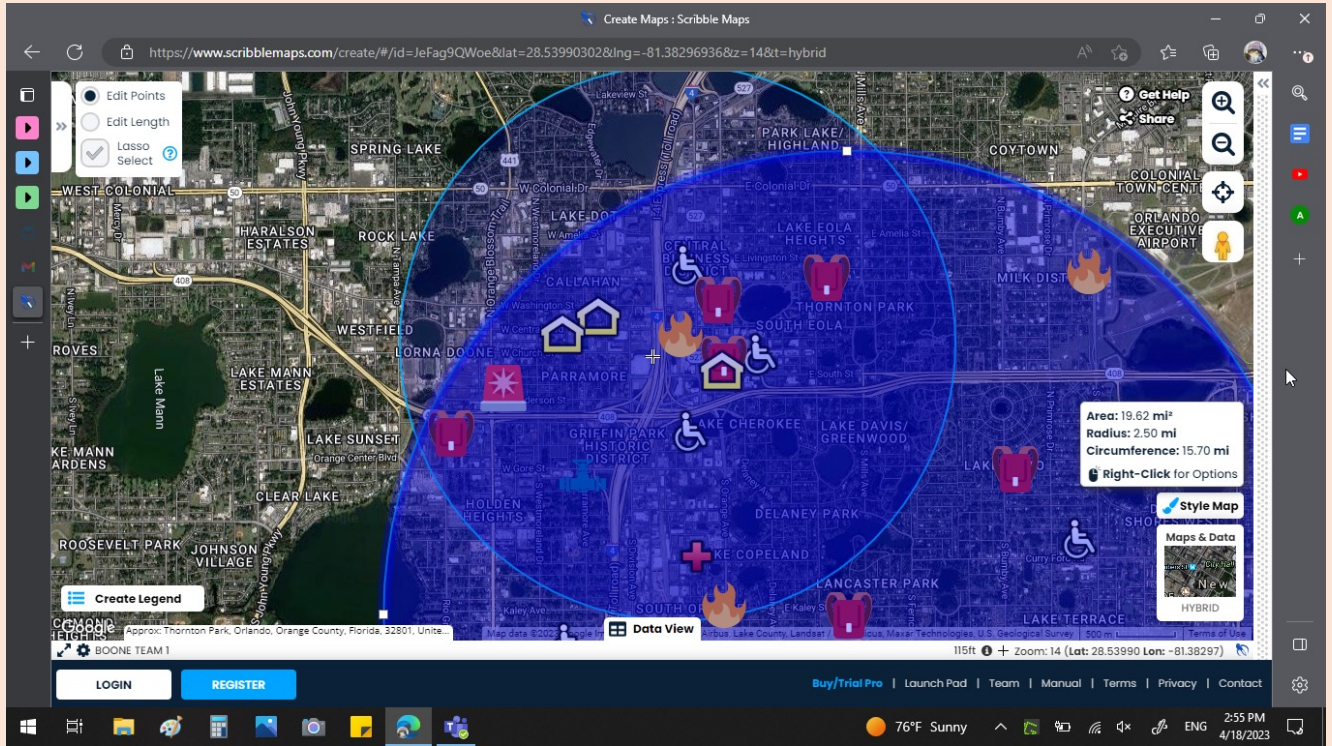
Our Design Process

4 We then discussed with our team which user types we felt were more important and listed them in order of need.

1. Power Plants
2.Hospitals and Emergency Rooms
3. Shelters
4. Fire Departments
5. Police Departments
6. 911 Call Center
7.Grocery Stores
8.Schools
9.Water Utility
10.Senior living Centers

Our Design Process

5 We then created a microgrid using a 1.5 mile radius around the larger populated area. We created two different designs and determined which would be most effective for our proposal. Our microgrid allowed for us to easily create our final design.



The Design

Grid Level	User Type	How much power is supplied? (kW)	When is the power supplied or cycled?
3	Power Plants	382	Consistently
3	Hospitals	789	Peaks during the afternoon consistently
3	Shelters	648	Peaks during natural disasters
1	Grocery Stores	743	Peaks during the afternoon consistently
2	Schools	235	Peaks every 10 months per year
1	Water Utility	593	Consistent
1	Senior Living Center	412	Peaks during the day consistent
2	Fire Departments	263.34	Peaks during the day consistently
2	Police Departments	263.34	Peaks during the day consistently
1	911 Call Centers	245	Consistent

Our design splits up the amount of power that is needed by priority with the amount of power supplied and when. Our grid levels are determined by what priority the group of user types needs. This design is efficient and can easily help the areas in our radius.

Why our design?

Our design does the following;

- efficiently reaches the main needs of our local population
- amount of power is based on load and area
- times & cycles are given from peaks throughout natural disasters
- well researched
- uses the least amount of power

References

- U.S. Energy Use Intensity by Property Type – Energy Star
- Energystar.gov – Energy Star
- Energy Sustainability of Food Stores and Supermarkets – Energies Journal
- Business Energy Advisor – Tennessee Valley Authority

Thank you!!
Any questions?