Reinventing The Power Grid

Grid Gators
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Introduction

- As communities change, **traditional** power grids are **no longer as effective** as they used to be.
- Our team set out to **reimagine** how a smart grid can be implemented, and how it will function alongside the help of **AI**.
- We used a **data-driven** approach to make the grid more **resilient** and **adaptable.**

How can we Improve Traditional Grids?

Distribution, efficiency, and adaptability.

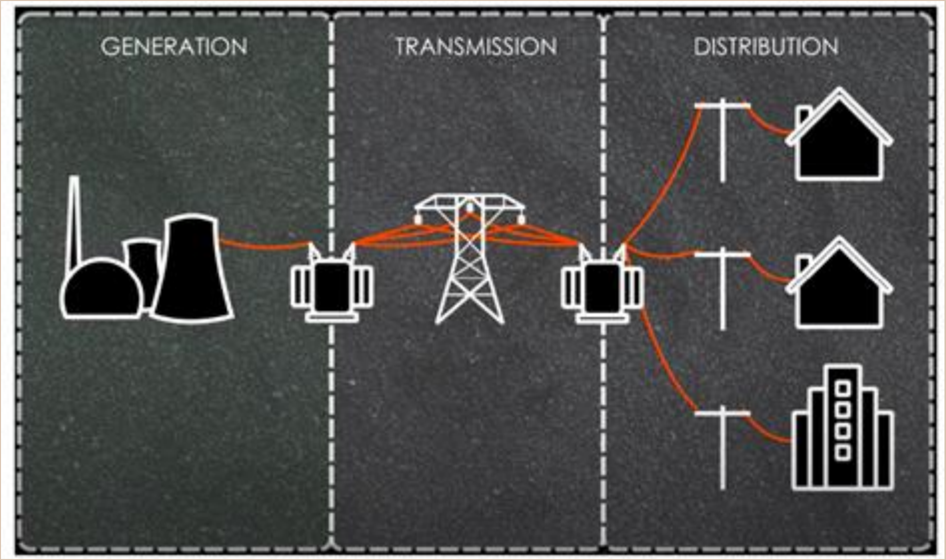


Fig. [1] Power Distribution Process.

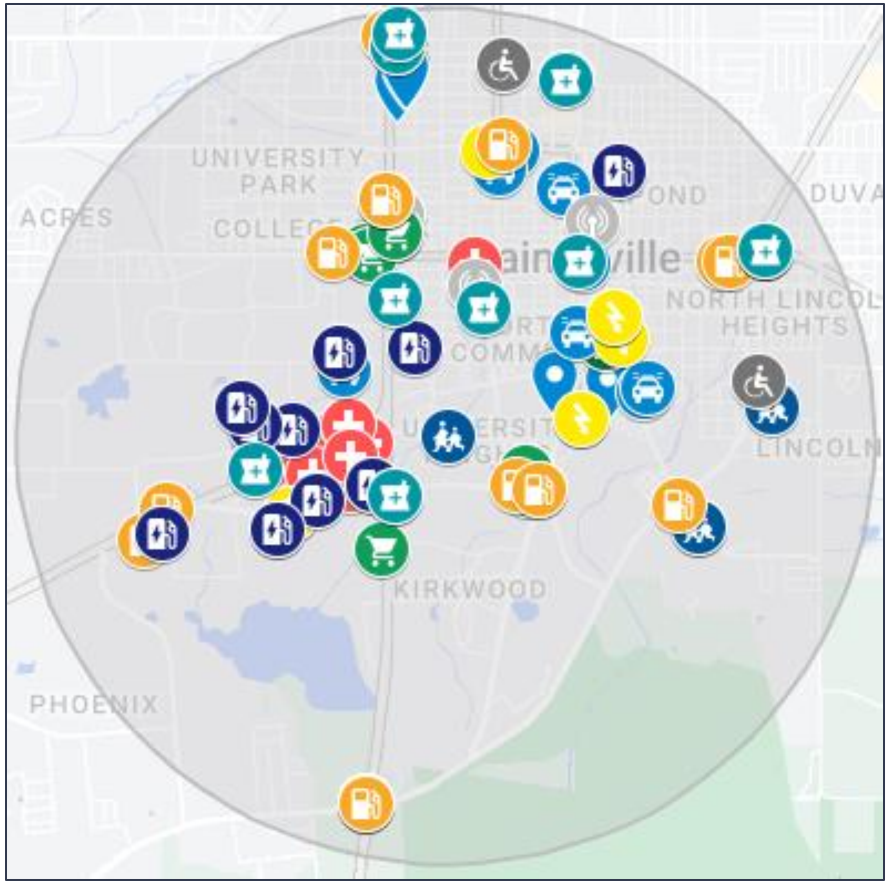
- A power grid is a **network** of **interconnected services** that deliver electricity from **producers** to **consumers**. The three main parts are: generation, transmission, and distribution.

- We aimed to make a **resilient**, **efficient** and **adaptive** grid. By **integrating AI**, decisions can be made **quickly** and backed by **data**.

Describing the Community

- We decided to focus on **prioritizing different** user types based on how essential they were towards public health, safety, and **power restoration** during an emergency.

- When designing our grid, our goal was to get power to the most amount of people as **quickly as possible**. This made us push more priority to getting power to places with **high population density**.



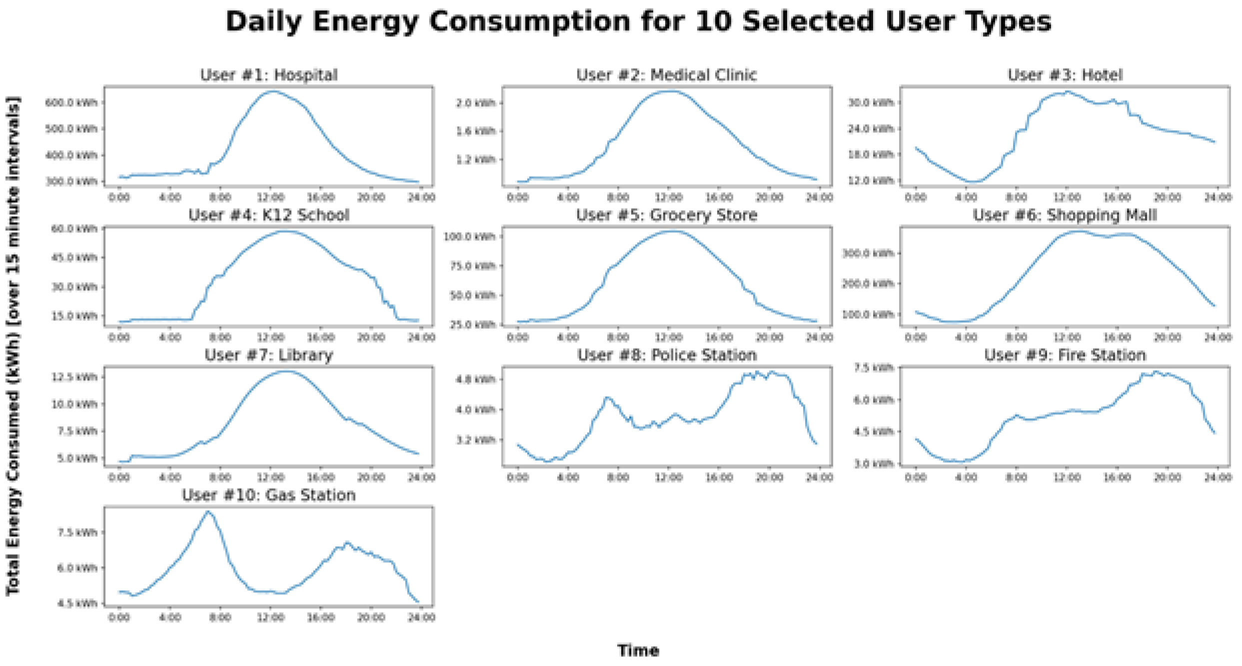
1. Power Plants
2. Hospitals, Medical Centers
3. Emergency Response
4. Water Treatment Plants
5. Communication
6. Pharmacies
7. Gas Stations
8. Shelters/Community Centers
9. Transportation
10. Banks and ATMs

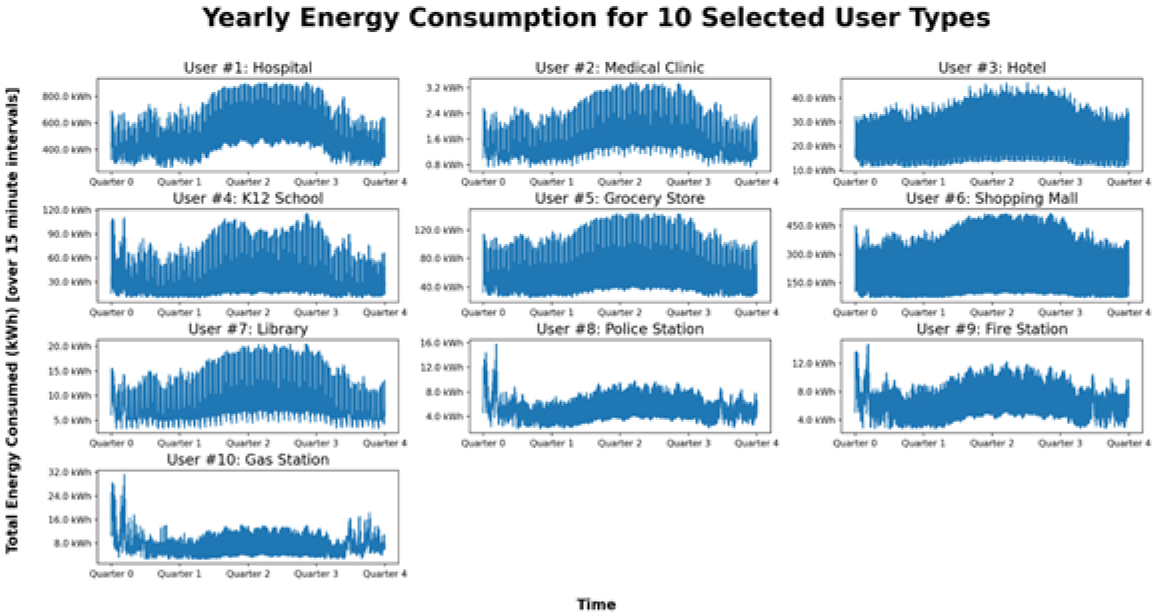
Power Needs in our Community

- Essential services such as **emergency services** require **uninterrupted** power, making them a top priority.

- **High-priority** user types were in **similar areas**, while **residential** and shopping users were **spread out**.

- These differences made us change how we designed the microgrids to keep all user types with some power, as **location matters**.





Utilizing AI to Optimize Power Distribution

- Our AI processes power consumption data across **different user types** to detect patterns, **predict peak demands**, and **prioritize** critical services. This helps us make informed decisions during outages.

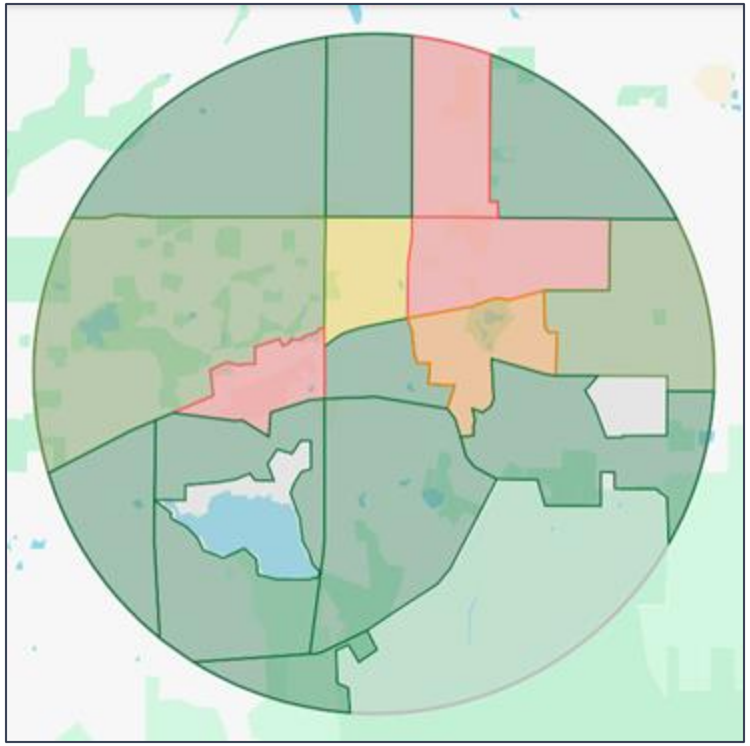
- In power restoration, there were **tradeoffs**. Such as **prioritizing emergency services** over non-essential residential areas during outages.

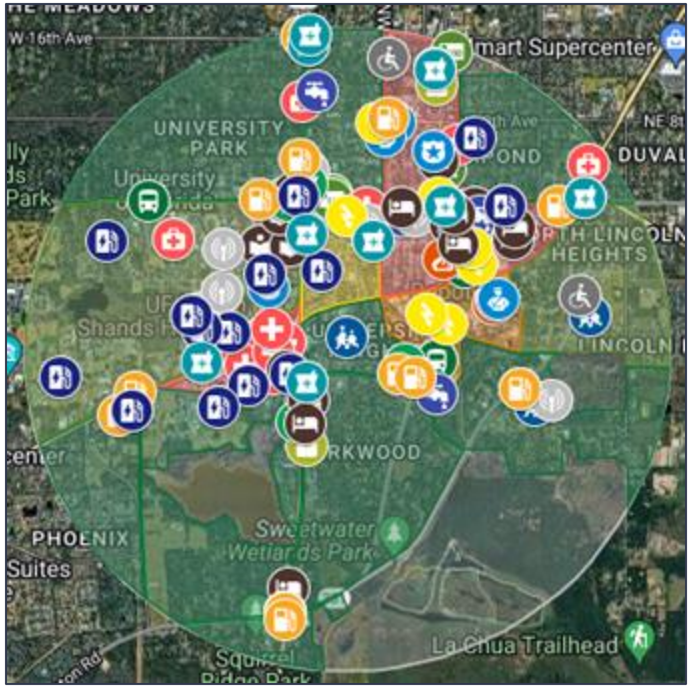
- Power restoration **isn't immediate**, AI considers the impacts and restores essential services first and then residential.

12:00 PM - 5:59 PM - Adjustment			
User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A
User 1	**80.0**	30952.2	51498.4
User 2	**2.0**	773.8	34.7
User 3	**3.5**	1354.2	1959.6
User 4	**1.0**	386.9	939.8
User 5	**9.2**	3559.5	5851.1
User 6	**2.6**	1005.9	2978.8
User 7	**0.2**	77.4	364.6
User 8	**0.5**	193.5	150.4
User 9	**0.5**	193.5	54.6
User 10	**0.5**	193.5	520.7
	100.00	38690.29	

Developing Microgrids for our Community

- When designing our microgrids, we considered the **prioritization** and **power consumption** of each user type.
- We considered about how each user could **help each other** across the microgrid.
- The systems of smaller microgrids inside our main smart-grid allows for more **targeted power restoration**.
- These smaller grids ensure that the main grid is **decentralized**, micro-grids to get power **without relying** on the whole grid.





Main Takeaways

- **Our team** had to redesign the electrical grid into a smart-grid that is **resilient to severe weather,** and can **adaptively provide** power.
- **By utilizing** a **decentralized system** with **AI**-**driven** decision making, this grid is able to **adapt** to user demands and weather conditions incredibly quickly.
- **In the future**, problems such as higher **population density**, **climate change**, and **increasing dependence** on **technology** will pose problems to current electrical grids.
- **To improve** our microgrid system, we would improve the **AI's accuracy** with more training, resulting in it being able to **adjust** to **unpredictable** weather and changing problems in our community.

Sources and References

- [1] H. Ahmed, “Improvements in Grid Connectivity to Bring Renewables to Where the Supply Is,” PSCI, Jul. 11, 2022.
  - https://psci.princeton.edu/tips/2022/7/11/improvements-in-grid-connectivity-to-bring-renewables-to-where-the-supply-is
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- [3] N. Dhanesha, “The futuristic plan to fix America’s power grid,” Vox, Dec. 02, 2021.
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Thank you!
Questions?