INTELLIGENT GRID EVOLUTION

Mystic Wolves

School: West Port High School

Finn Nickerson, Tyson Breininger, Carlos Roa Diaz, Stella Rodriguez Rivera

Mentor: Arossa Adhikary

Teacher: Mrs. Bethea

T

OUR TEAM

Mystic Wolves			
Project Manager -	Quality Engineer -	Energy Analyst -	Design Architect -
• Stella Rodriguez Rivera	• Finn Nickerson	• Tyson Breininger	• Carlos Roa Diaz

Traditional Grids

One-Way Power Flow

Centralized Power Generation

Limited Monitoring

VS.

Smart Grids

Two-Way Power Flow

Decentralized Power Generation

Realtime Monitoring

From *HowStuffWorks*: "How Grid Energy Storage Works | HowStuffWorks"

From *Forbes*: "15 Ways Smart Grids Will Soon Transform The Energy Landscape"

S

MAPPING THE SYSTEM

Hospitals - 2

Fire Stations – 2

Senior Living Centers - 5

Cell Towers - 8

Schools (Shelters) - 7

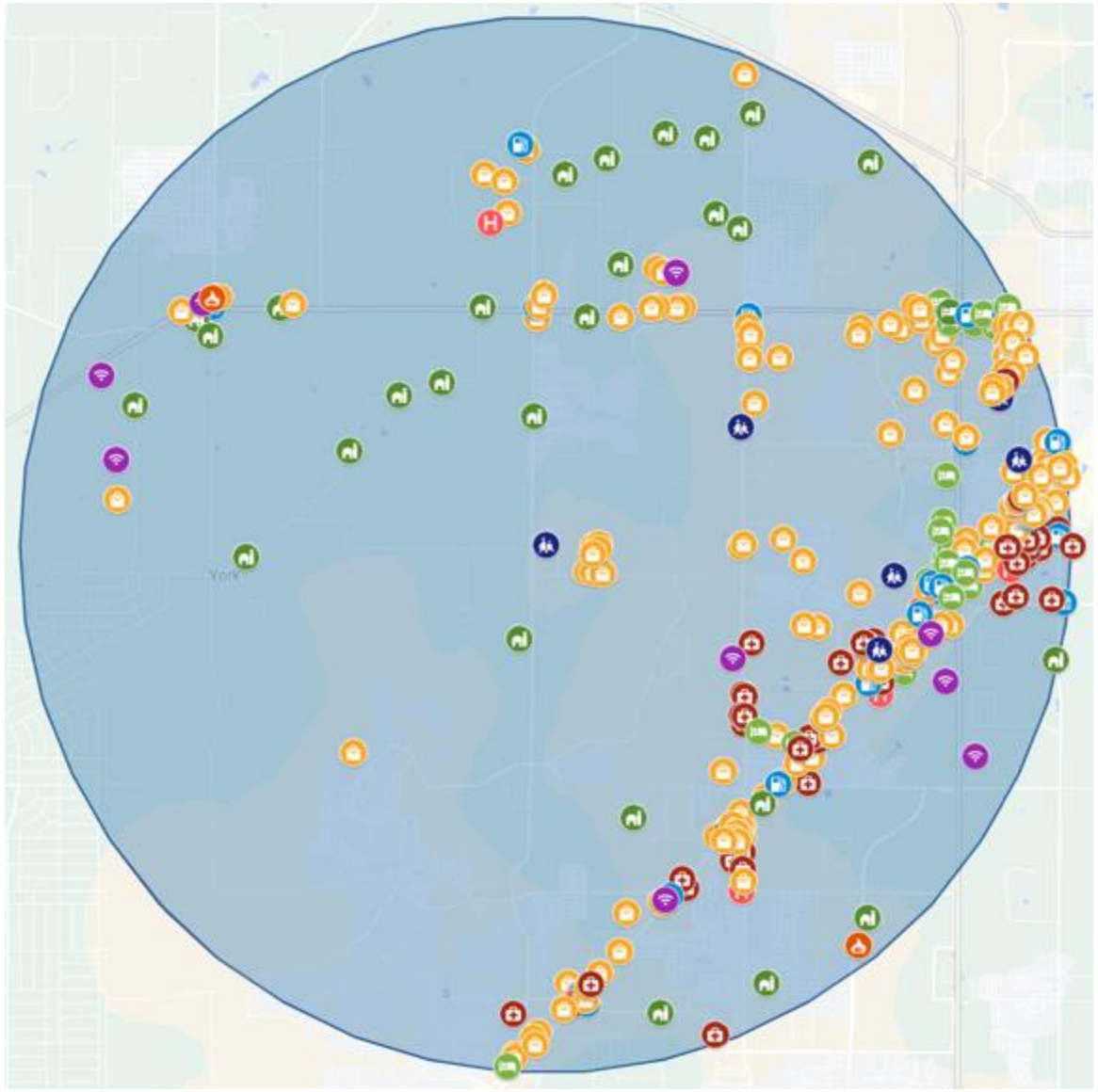
Hotels - 28

Gas Stations - 23

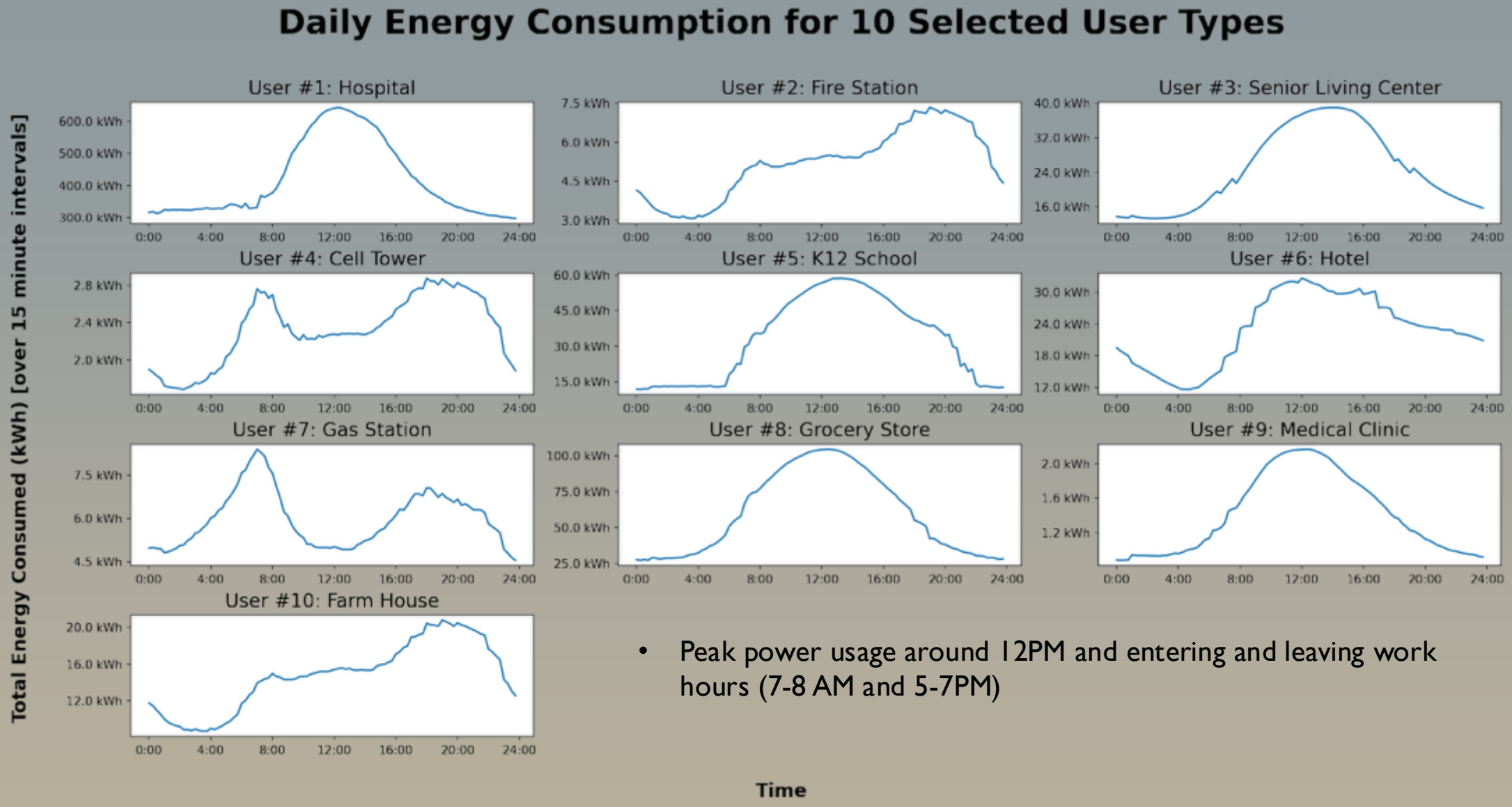
Stores - 215

Medical Offices - 26

Farms - 20



S &T



- Peak power usage around 12PM and entering and leaving work hours (7-8 AM and 5-7PM)

ENERGY CONSUMPTION LEVELS

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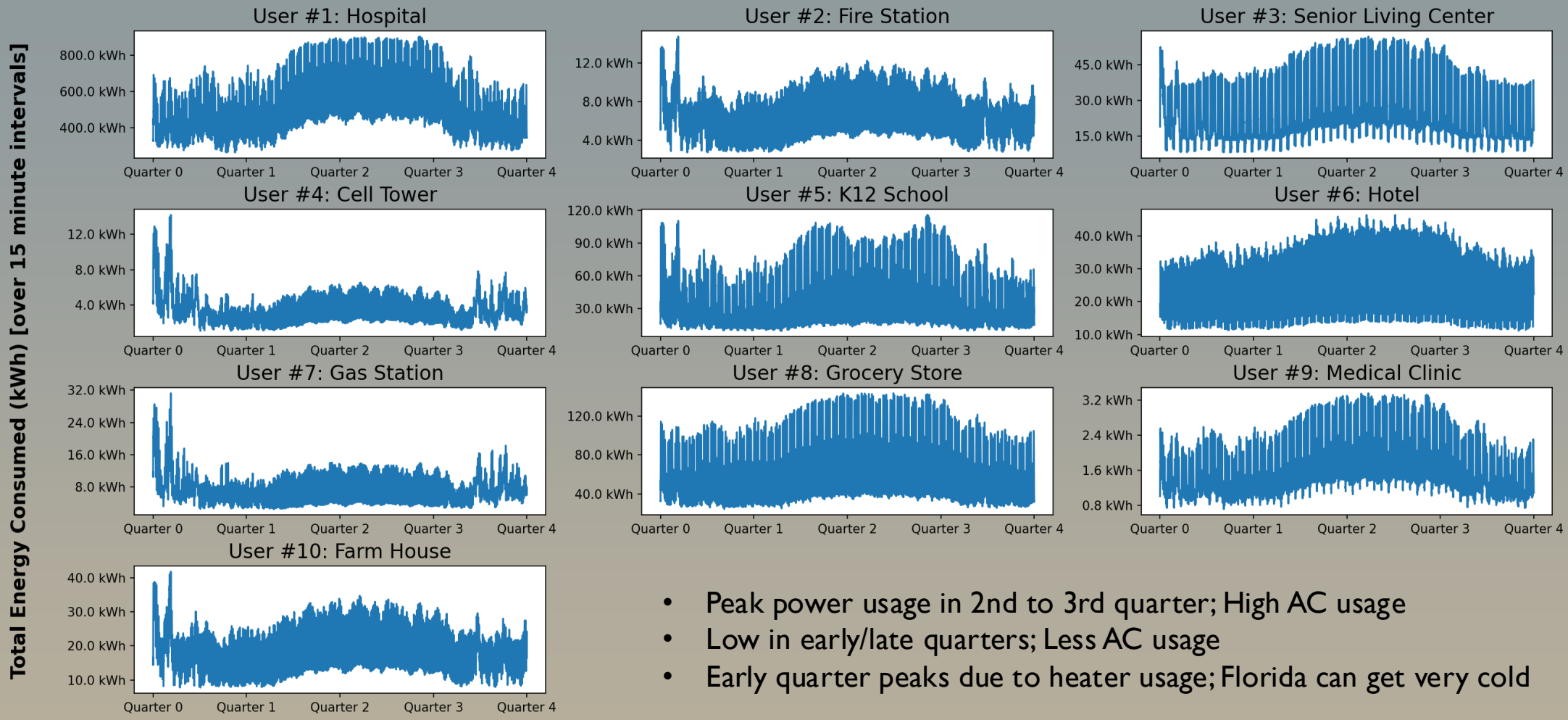
Yearly Energy Consumption for 10 Selected User Types



- Peak power usage in 2nd to 3rd quarter; High AC usage
- Low in early/late quarters; Less AC usage
- Early quarter peaks due to heater usage; Florida can get very cold

ENERGY CONSUMPTION LEVELS

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Power Prioritization

YOUR TASK IS TO DISTRIBUTE 100% OF THE AVAILABLE POWER (CELL C15) THROUGHOUT EACH QUARTER PHASE OF THE DAY

12:00 AM - 5:59 AM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand (kW) from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**8.30**	5174.2	2729.2	2445.0
User 2	**2.00**	1246.8	33.2	1213.6
User 3	**2.60**	1620.8	341.5	1279.4
User 4	**2.50**	1558.5	70.7	1487.8
User 5	**2.70**	1683.2	369.7	1313.4
User 6	**5.90**	3678.1	2184.0	1494.1
User 7	**3.00**	1870.2	661.6	1208.6
User 8	**65.00**	40521.1	38558.5	1962.6
User 9	**4.00**	2493.6	116.5	2377.1
User 10	**4.00**	2493.6	940.7	1552.9
	100.00	62340.15		

6:00 AM - 11:59 AM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**8.20**	5111.9	5103.1	8.7
User 2	**0.10**	62.3	43.1	19.2
User 3	**1.20**	748.1	740.5	7.6
User 4	**0.15**	93.5	88.4	5.1
User 5	**2.60**	1620.8	1574.3	46.5
User 6	**5.80**	3615.7	3591.3	24.4
User 7	**1.25**	779.3	771.9	7.3
User 8	**78.30**	48812.3	89293.7	-40481.3
User 9	**0.40**	249.4	224.6	24.8
User 10	**2.00**	1246.8	1220.3	26.5
	100.00	62340.15		

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User 7	**1.05**	654.6	630.3	24.3
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User 2	**1.20**	748.1	58.7	689.3
User 3	**2.00**	1246.8	541.2	705.6
User 4	**1.00**	623.4	92.0	531.4
User 5	**2.70**	1683.2	1150.5	532.7
User 6	**5.70**	3553.4	2820.8	732.5
User 7	**2.00**	1246.8	649.2	597.6
User 8	**76.20**	47503.2	47385.2	117.9
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User 7	**1.05**	654.6	630.3	24.3
User 8	**77.60**	48376.0	89855.9	-41479.9
User 9	**0.40**	249.4	225.3	24.1
User 10	**2.50**	1558.5	1546.3	12.2
	100.00	62340.15		

6:00 PM - 11:59 PM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**6.00**	3740.4	3096.5	643.9
User 2	**1.20**	748.1	58.7	689.3
User 3	**2.00**	1246.8	541.2	705.6
User 4	**1.00**	623.4	92.0	531.4
User 5	**2.70**	1683.2	1150.5	532.7
User 6	**5.70**	3553.4	2820.8	732.5
User 7	**2.00**	1246.8	649.2	597.6
User 8	**76.20**	47503.2	47385.2	117.9
User 9	**0.40**	249.4	143.6	105.7
User 10	**2.80**	1745.5	1663.0	82.6
	100.00	62340.15		

F

Power Prioritization

YOUR TASK IS TO DISTRIBUTE 100% OF THE AVAILABLE POWER (CELL C15) THROUGHOUT EACH QUARTER PHASE OF THE DAY

12:00 AM - 5:59 AM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand (kW) from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**8.30**	5174.2	2729.2	2445.0
User 2	**2.00**	1246.8	33.2	1213.6
User 3	**2.60**	1620.8	341.5	1279.4
User 4	**2.50**	1558.5	70.7	1487.8
User 5	**2.70**	1683.2	369.7	1313.4
User 6	**5.90**	3678.1	2184.0	1494.1
User 7	**3.00**	1870.2	661.6	1208.6
User 8	**65.00**	40521.1	38558.5	1962.6
User 9	**4.00**	2493.6	116.5	2377.1
User 10	**4.00**	2493.6	940.7	1552.9
	100.00	62340.15		

6:00 AM - 11:59 AM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**8.20**	5111.9	5103.1	8.7
User 2	**0.10**	62.3	43.1	19.2
User 3	**1.20**	748.1	740.5	7.6
User 4	**0.15**	93.5	88.4	5.1
User 5	**2.60**	1620.8	1574.3	46.5
User 6	**5.80**	3615.7	3591.3	24.4
User 7	**1.25**	779.3	771.9	7.3
User 8	**78.30**	48812.3	89293.7	-40481.3
User 9	**0.40**	249.4	224.6	24.8
User 10	**2.00**	1246.8	1220.3	26.5
	100.00	62340.15		

12:00 PM - 5:59 PM - Adjustment

User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**8.30**	5174.2	5149.8	24.4
User 2	**0.10**	62.3	54.6	7.7
User 3	**1.30**	810.4	781.2	29.2
User 4	**0.15**	93.5	88.6	4.9
User 5	**2.70**	1683.2	1644.6	38.6
User 6	**5.90**	3678.1	3657.8	20.2
User 7	**1.05**	654.6	630.3	24.3
User 8	**77.60**	48376.0	89855.9	-41479.9
User 9	**0.40**	249.4	225.3	24.1
User 10	**2.50**	1558.5	1546.3	12.2
	100.00	62340.15		

6:00 PM - 11:59 PM - Adjustment

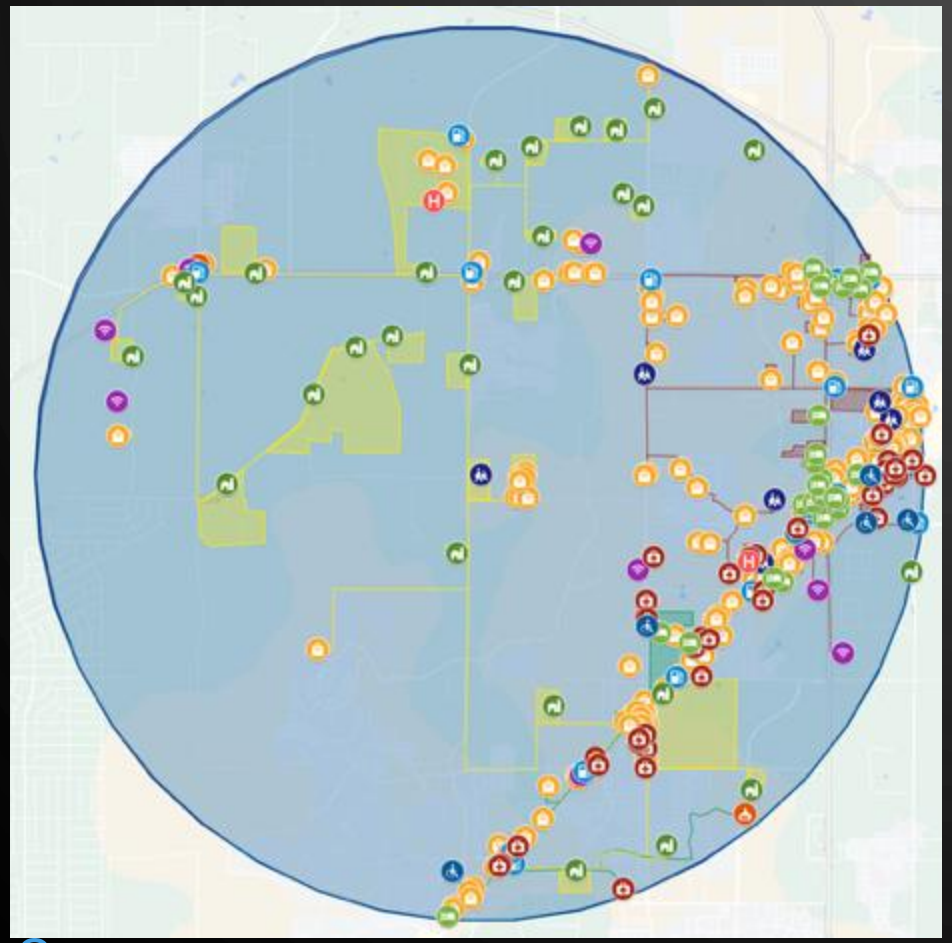
User	Disaster Power Distribution (% Max)	Distributed Power (kW	Normal Max Power Demand from 12A-6A	Power Allocation Difference (kW) from 12A-6A
User 1	**6.00**	3740.4	3096.5	643.9
User 2	**1.20**	748.1	58.7	689.3
User 3	**2.00**	1246.8	541.2	705.6
User 4	**1.00**	623.4	92.0	531.4
User 5	**2.70**	1683.2	1150.5	532.7
User 6	**5.70**	3553.4	2820.8	732.5
User 7	**2.00**	1246.8	649.2	597.6
User 8	**76.20**	47503.2	47385.2	117.9
User 9	**0.40**	249.4	143.6	105.7
User 10	**2.80**	1745.5	1663.0	82.6
	100.00	62340.15		

F

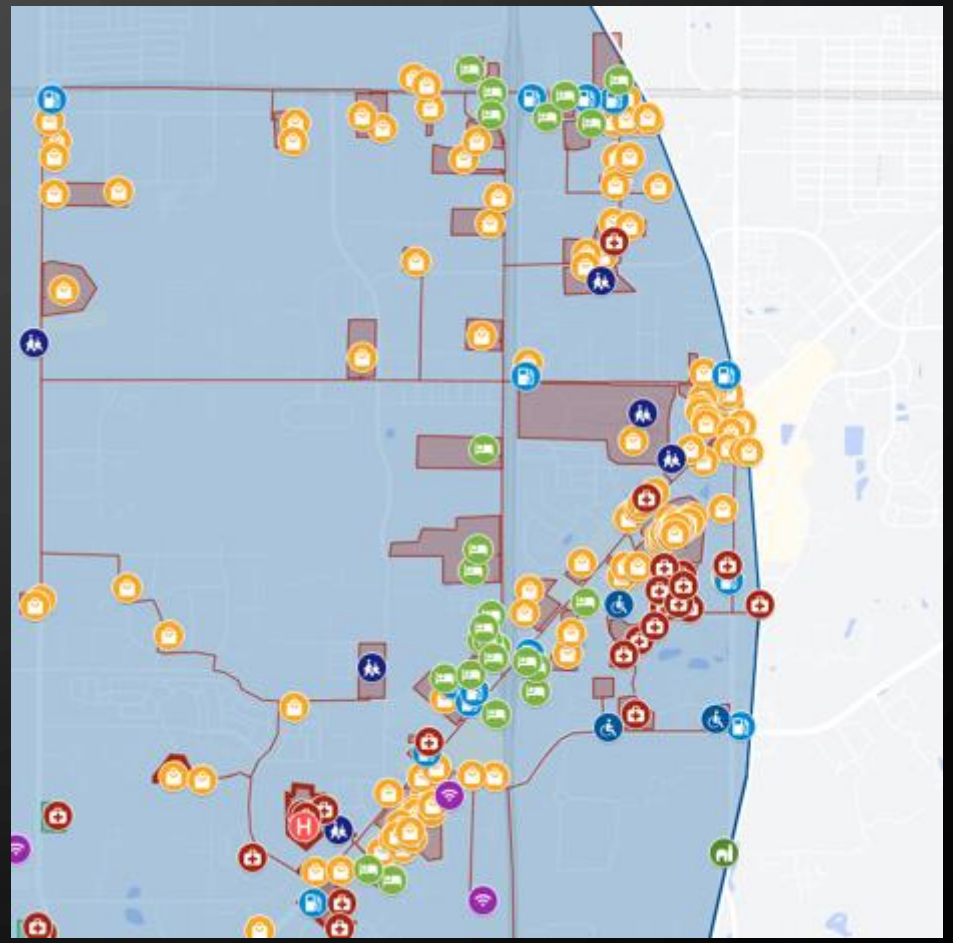
MAKING THE GRID SMART: THE IMPLICATIONS

Greater Efficiency:	• AI reduces energy waste, lowering costs and supporting environmental goals.
Stable Power Supply:	• AI minimizes outages and boosts grid resilience, benefiting essential services.
Better Renewable Integration:	• AI balances variable sources like solar and wind, supporting cleaner energy use. In turn, produces lower emissions.
The Risk of AI:	• AI system failures or cyberattacks could cause widespread blackouts. However, the use of decentralized power generation would result in a much less possibility of it, it would in turn affect the grid much less.
Potential Inequality:	• The amount of power that AI needs to run is a lot of power, in turn, would most definitely drive up energy costs. This can lead to a lot of problems and people without power, which defeats the goal of the smart grids. However, if it is done correct as it should be, this shouldn't be an issue.

GRID DESIGN

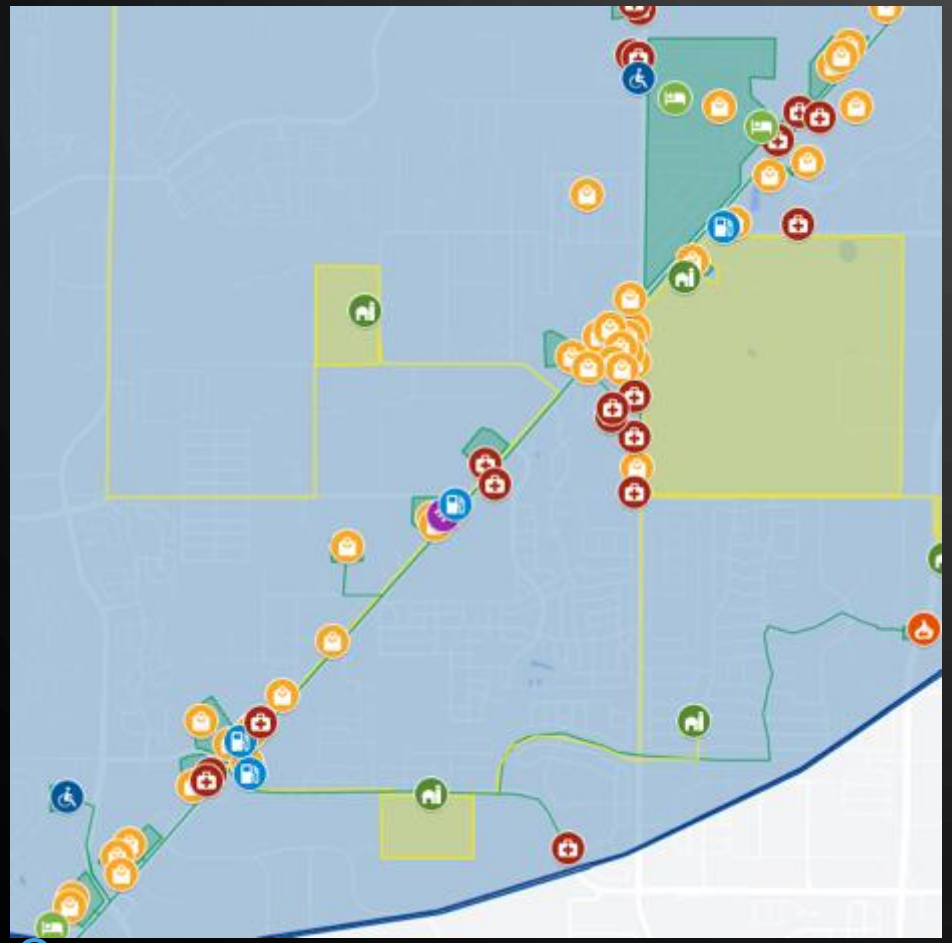


Microgrid (Whole)

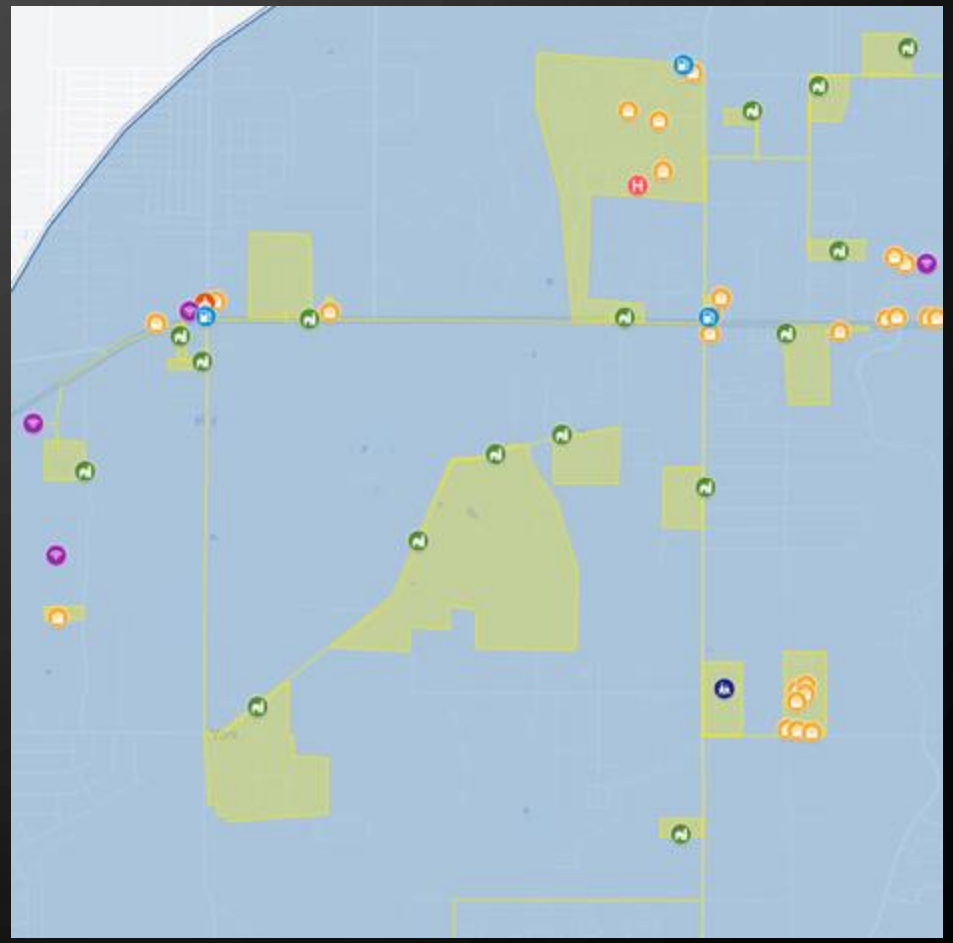


Microgrid 1

GRID DESIGN



Microgrid 2

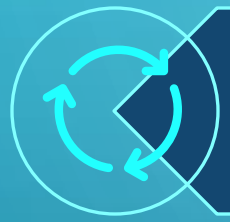


Microgrid 3

MAIN TAKEAWAYS

Design Considerations:

- Smart grids need to be designed with high-level priorities in mind, while also taking geographical factors into account

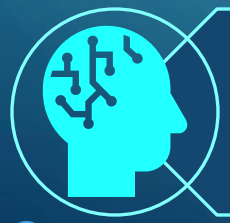


Efficiency:

- Smart grids are also extremely efficient, as they distribute power based on demand and priority so they will perfectly distribute power as needed and demanded.

Shorter Outages and Quick Recovery:

- Less extreme outages also occur as AI can identify these problems immediately, much faster than a person could.



AI's Incorporation:

- AI overall is a very new tool but will be and is starting to be an extremely useful tool. It's incorporations into grids hasn't happened yet fully, but will be very innovative when it does.

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