

AI DESIGN CHALLENGE

POWER GRID

True Legendary Turnips LLC

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POWER GRIDS

In regards to power grids, we refer to the traditional grid or the smart grid.





TRADITIONAL POWER GRIDS



A network of systems that transfer electricity from power plants to consumers

Some disadvantages:

- Inefficient with generation demands
- Mostly one-way communication



ABOUT SMART POWER GRIDS

Smart grids, unlike traditional grids, make use of digital systems to increase power efficiency, reliability, and security.

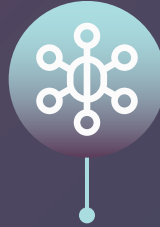


WHY SMART GRIDS?



BIDIRECTIONAL COMMUNICATION

Smart grids provide a two way communication between utility and customers



DECENTRALIZED POWER

Integrates consumer generators and renewable energy



LESS ENERGY COST

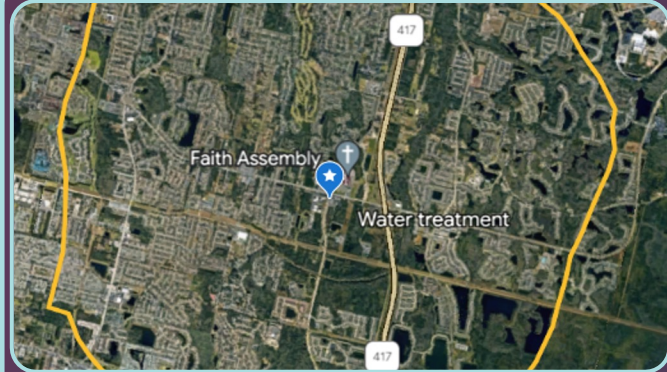
Energy cost is lower with increased efficiency and ease of management



01

MAPPING THE SYSTEM



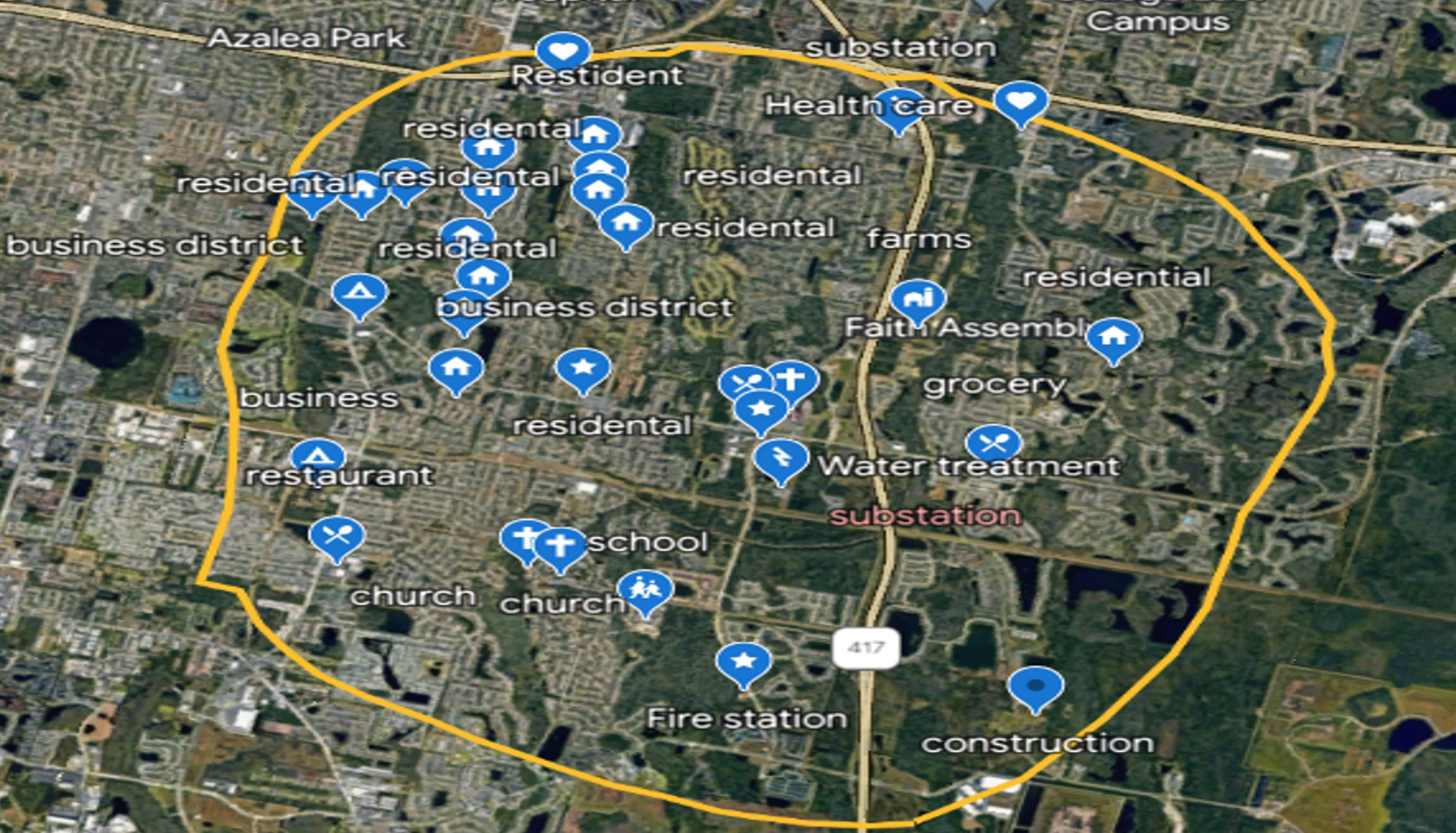


MAPPING THE SYSTEM

Mapping out the grid and marking key energy users like:

- Water Treatment Plants
- Hospitals
- Grocery Stores
- And more...

This will be important in creating microgrids.





CALCULATING POWER LOAD

02

AVERAGE POWER LOAD

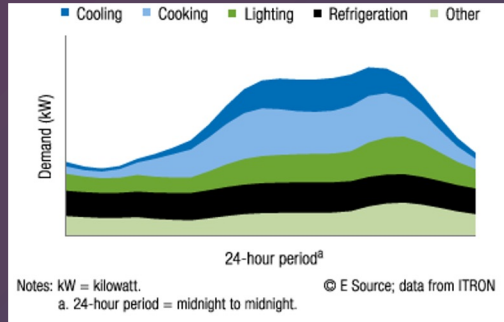
User Type	Power Load per Area (kW/ft ²)	Average Load Area (ft ²)	Total Power Load (kW or kWh/h)
Office	116.4 kBtu/ft ² 34.1 kWh/ft ² 0.00389 kW/ft²	63,000	245
Schools	127.5 kBtu/ft ² 37.4 kWh/ft ² 0.00427 kW/ft²	74,520	318.2
Hospitals	426.9 kBtu/ft ² 125.1 kWh/ft ² 0.01428 kW/ft²	326,000	4,655.5
Grocery Stores	444 kBtu/ft ² 130.1 kWh/ft ² 0.01485 kW/ft²	50,009	742.7
Single Family Houses	18.1 kBtu/ft ² 5.3 kWh/ft ² 0.0006 kW/ft²	2,014	1.2
Churches	58.4 kBtu/ft ² 17.12 kWh/ft ² 0.00195 kW/ft²	23,000	44.9

AVERAGE POWER LOAD

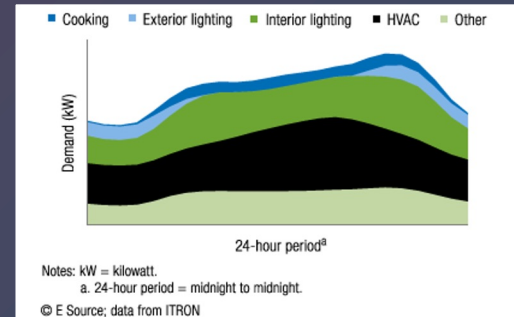
User Type	Power Load per Area (kW/ft ²)	Average Load Area (ft ²)	Total Power Load (kW or kWh/h)
Recreational Centers	112 kBtu/ft ² 32.8 kWh/ft ² 0.00374 kW/ft²	12,000	44.9
Restaurants	730.05 kBtu/ft ² 214 kWh/ft ² 0.02443 kW/ft²	4,250	103.8
Hotels	146.7 kBtu/ft ² 43 kWh/ft ² 0.00491 kW/ft²	78,000	382.9
Gas Stations	592.6 kBtu/ft ² 173.9 kWh/ft ² 0.01985 kW/ft²	3,200	63.5
Wastewater Treatment Facility	7.51 kBtu/ft ² 2.2 kWh/ft ² 0.00025 kW/ft²	250,000	62.5

DAILY POWER LOAD

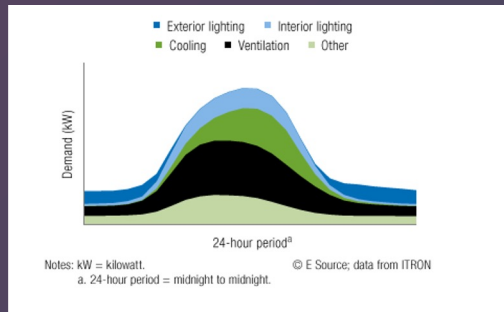
Restaurants



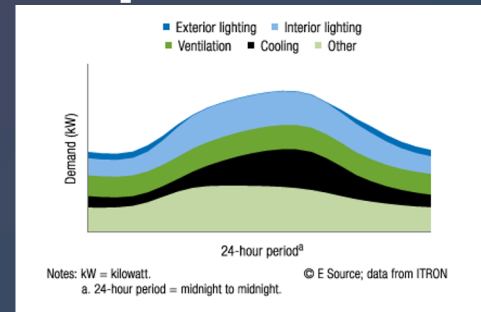
Hotels



Schools



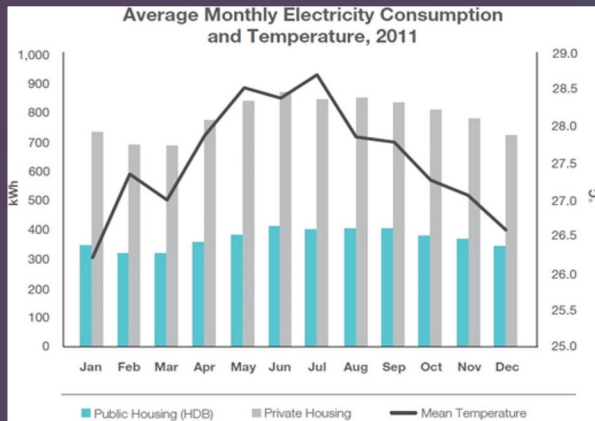
Hospitals



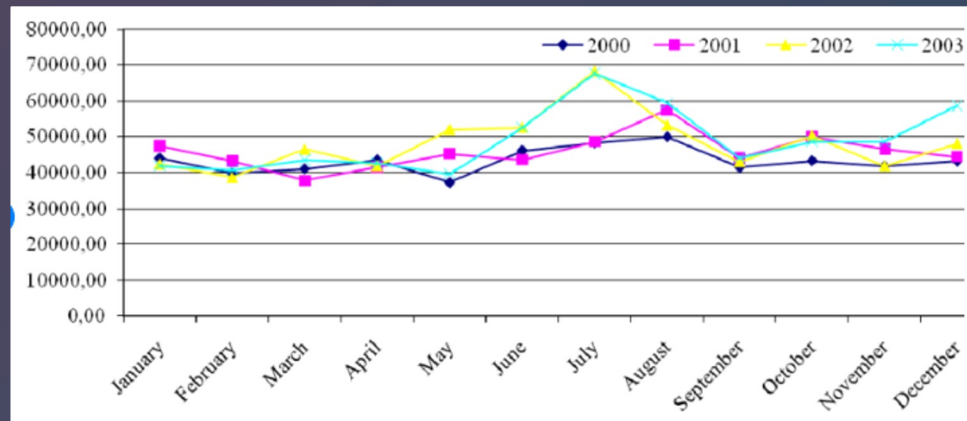
YEARLY POWER LOAD



Restaurants



Hotels





03

DETERMINING USER PRIORITY

USER PRIORITY

WATER TREATMENT **1**

2 **HOSPITAL**

GROCERY STORE **3**

4 **GAS STATION**

HOTEL **5**

6 **CHURCH**

SCHOOL **7**

8 **OFFICE**

REC. CENTER **9**

10 **HOUSEHOLDS**



MAKING THE DESIGN

04

OUR MICROGRID DESIGN

PRIORITY

Red - First

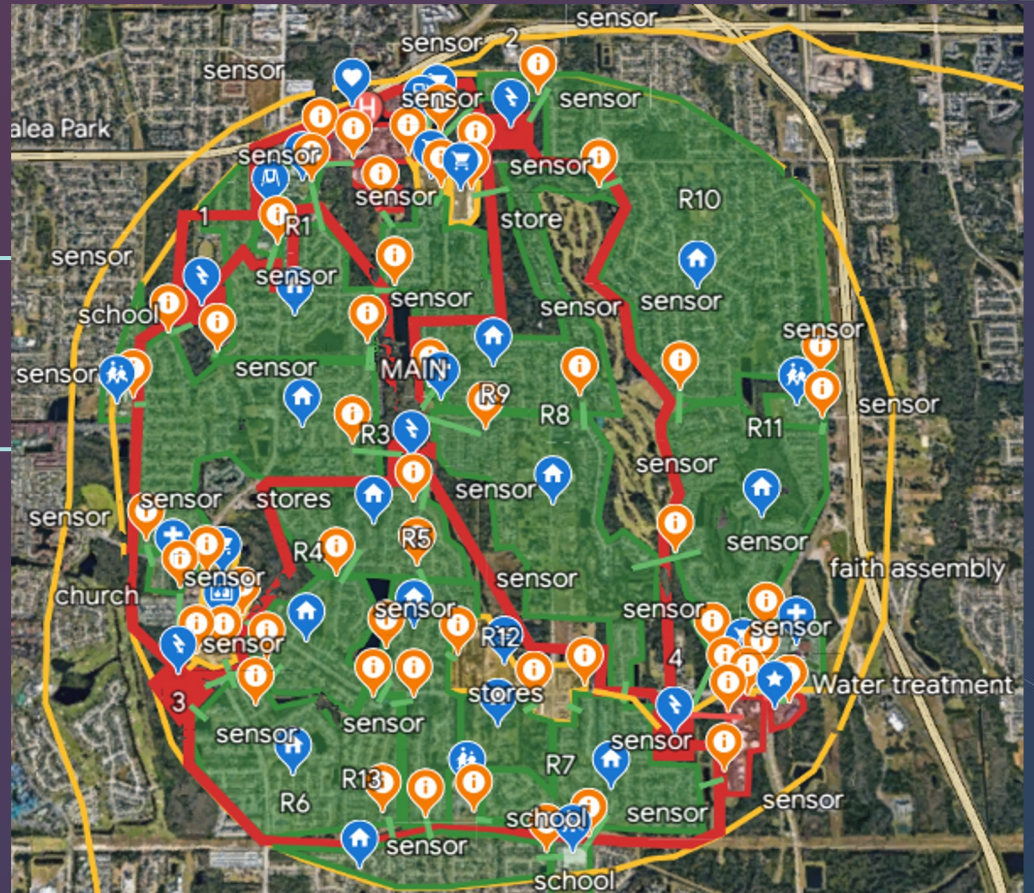
Yellow -

Second

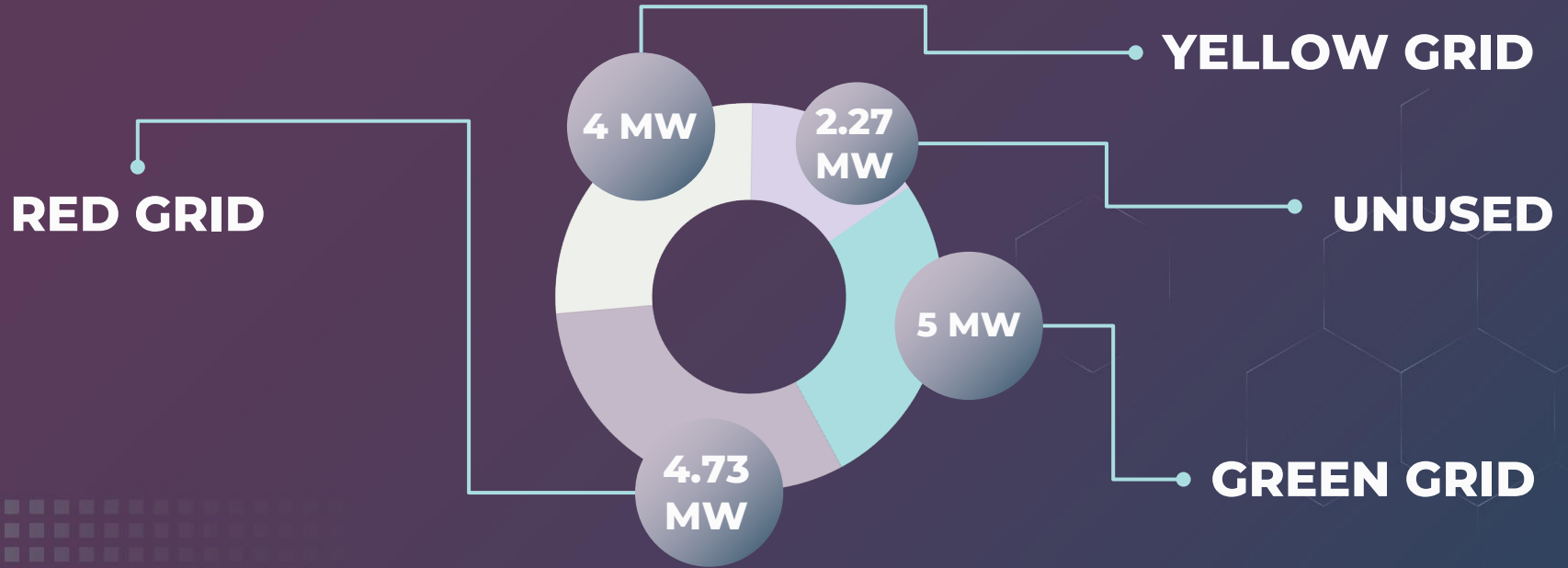
Green - Third

REDUNDANCY

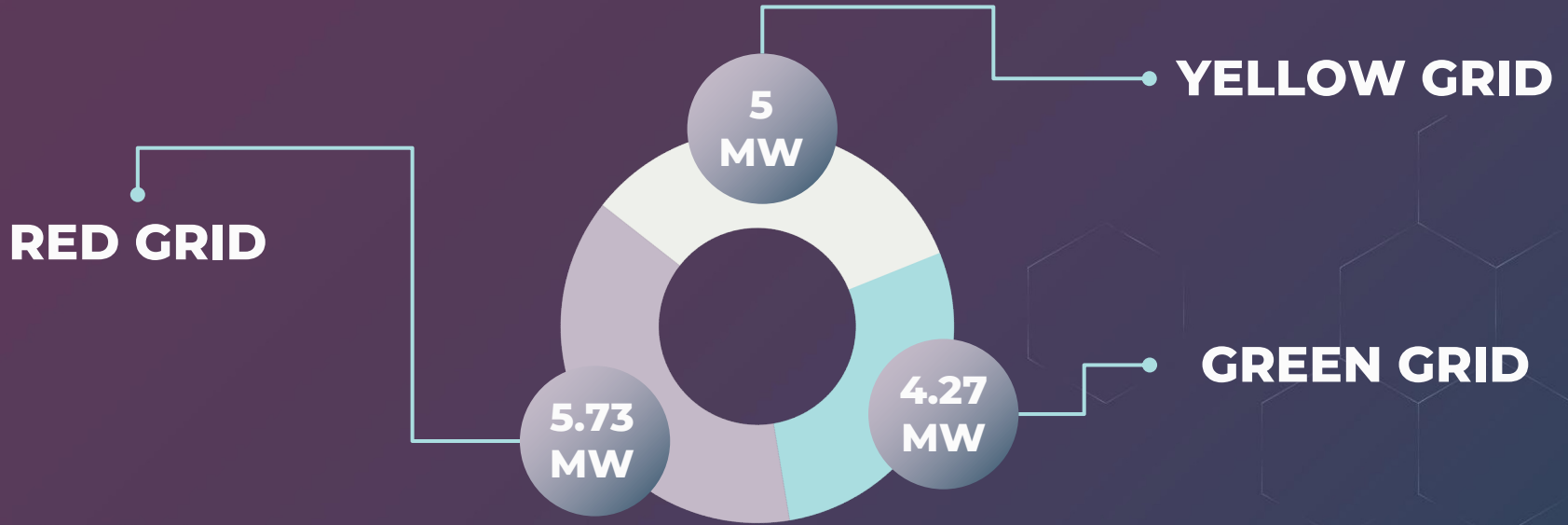
Interconnected grids with sensors to ensure reliability



POWER DISTRIBUTION



POWER DISTRIBUTION (HEAVY LOAD)



REFERENCED SOURCES

Information:

- **Slide 3-5:**
 - (<https://www.whatissmartenergy.org/how-the-smart-grid-keeps-your-power-on>)
 - (https://smartgrid.gov/the_smart_grid/smart_grid.html)
 - (<https://medium.com/sjei/smart-grids-updating-the-traditional-grid-7979bed47761>)
- **Slide 10-11:**
 - (<https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf>)

Images:

- **Slide 3:**
 - (<https://assets.taraenergy.com/wp-content/uploads/2021/12/power-grids-and-electrical-grids-photo-of-towers.jpg>)
- **Slide 4:**
 - (<https://www.power-technology.com/wp-content/uploads/sites/21/2021/08/Smart-Grid-in-Power-Technology-Trends.jpg>)
- **Slide 12:**
 - (https://api.bizenergyadvisor.com/sites/default/files/CEA-04_2F.gif)
 - (https://api.bizenergyadvisor.com/sites/default/files/CEA-04_2F_16)

REFERENCED SOURCES

Information:

- **Slide 10-11:**
 - (<http://energystar.gov/>)
 - (<https://www.fool.com/the-ascent/mortgages/articles/how-big-is-your-home-here-is-the-average-home-size-by-state/>)
- **Slide 15:**
 - (https://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/MA_101FINAL.pdf)
 - (<https://www.protoolreviews.com/how-power-restored-after-storm-order/>)

Images:

- **Slide 12:**
 - (<https://api.bizenergyadvisor.com/sites/default/files/2020-02/BEA-hotels-daily-load.gif>)
 - (https://api.bizenergyadvisor.com/sites/default/files/CEA-01_2E.gif)
- **Slide 13:**
 - (<https://www.researchgate.net/profile/Abhisek-Ukil/publication/268510365/figure/fig3/AS:614381247287298@1523491312743/Average-monthly-electricity-consumption-and-ambient-temperature.png>)

REFERENCED SOURCES

Images:

- Slide 13:
 - (<https://www.researchgate.net/profile/Natalia-Boemi/publication/230817809/figure/fig3/AS:393599096246274@1470852745353/Energy-consumption-of-a-medium-hotel-KWh.png>)



THANK YOU
ANY QUESTIONS?
