

Barry-Wehmiller  
Design Group

# INDUSTRIAL POWER

Planning for Today & Tomorrow



NORTHWEST  
CONSTRUCTION  
CONSUMER  
COUNCIL

NWCCC  
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Director

# Introduction

- Joined Design Group in February 2016
- Licensed electrical engineer in 11 states (excluding Washington)
- Previous employments: Upstream Oil & Gas, defense contractor
- US Army veteran

# DELIVERING THE FUTURE OF MANUFACTURING + TECHNOLOGY

We are the **only** professional services firm born from a manufacturing technology company to become an **independent** and fully **integrated** consulting, design, systems integration, and construction management firm for **food**, **beverage**, **industrial**, and **science & technology** clients shaping our 21<sup>st</sup>-century economy.

**45+**  
Offices  
Nationwide

**1600+**  
Professionals

**\$600m**  
Revenue



**#60** Top 100 Design-Build Firms , **#90** Top 500 Design Firms, **#2** in Food & Beverage, **#3** in Semiconductor, **#10** in Industrial Process, **#12** in Chemical Plants, **#13** in Oil & Gas



PLATINUM  
**System Integrator**  
A ROCKWELL AUTOMATION PARTNER





# AGENDA

Introduction

Overview

Energy Reduction Options

Decarbonization of Building Systems

Energy Efficiency Building Codes

Standby Power Options

Challenges, Planning, & Utility Coordination

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# OVERVIEW



# Large Power Facilities

- Primary Metering: receive power at Medium or High Voltage
- Redundant utility feeds
- Significant standby power systems
- Redundant power distribution systems
- HRG or LRG transformer secondaries
- On-site WWT, bulk gas yards, energy storage, steam or water turbines
- Networked power monitoring systems, some with energy management



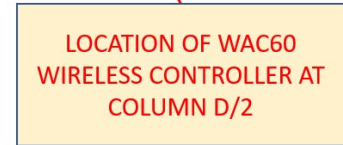
# Energy Reduction Options

# Lighting Control Systems

- As simple as single line-voltage devices
- As complex as networked building controls
- Automatic lighting controls are mandated by most energy codes
- Reduction in electrical energy usage may only be 0.01% or less
- Incentives and rebates may be available from your utility, municipality, or national EE organizations
- Wireless controls are improving and expanding



- Project Scope:
  - Battery-powered Occupancy Sensors
  - Amber LEDs for photosensitive work
  - Single POE Wireless controller for entire space
  - Ethernet connection to existing network control panel
  - Detailed Design and Construction Administration services



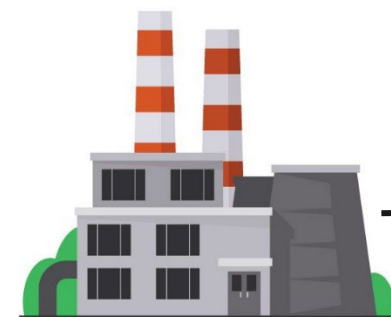
## Client Profile:

## Advanced Tech market facility



# Photovoltaic (PV) Arrays

- Large PV systems make more sense, better \$/W cost
- Without the grants/incentives, PV installation becomes costly.
- Requirements to consider:
  - Geographic
  - Space. Roof or Ground mounted
  - Structural. Existing or new roof. Most racking system are weighted.
  - Architectural. Roofing material, life on existing roof, and warranty timeline.
  - Shading over PV panels.
  - Electrical connection to the distribution panels.
  - Selection of PV system, grid-tie, grid-tie with battery back up
  - Communication and monitoring systems.
  - Maintenance of the system



# Energy Management Systems

- What are they for?
- Critical for facilities with distributed energy resources
- Identify and correct actual and potential problems: nonconformities, corrective and preventive action.
- May be used for EV charging stations, each one could be rated up to 10kW.
  - If you have 20-30 charging stations, demand gets heavy and requires a larger service
  - EMS can keep that demand to within a set amperage.
  - Some are built directly into the EV station and can self regulate if you have two cars charging at once.
- Consultants must design for the worst case, unless controls are included to reduce demand.

# Decarbonization of Building Systems

# What's happening?

- Electricity currently represents ~11% of total industrial energy consumption
- What is “decarbonization”?
- How do you transition away?
- Drivers: Some are building code changes, others are efficiency credits (LEED, Net Zero)

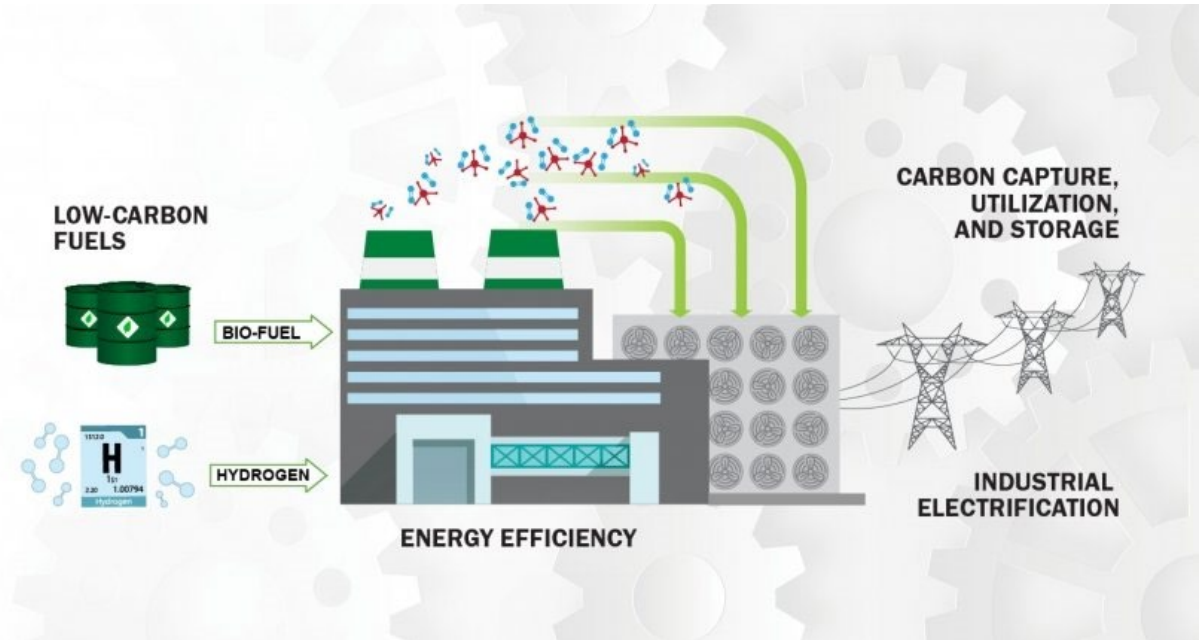
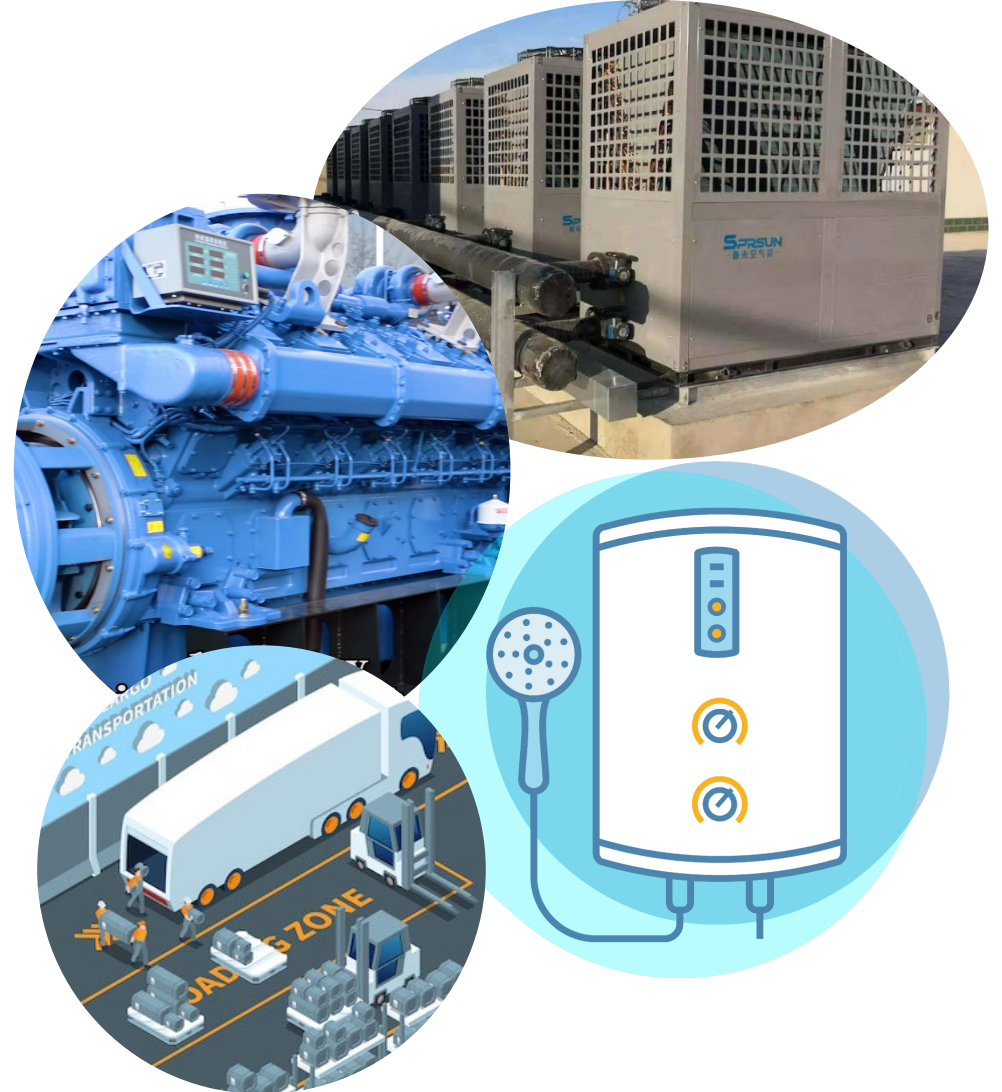


Image courtesy of Energy.gov



# Common Industrial Equipment

- Diesel Generators
- Heat pumps in HVAC
- Water Heaters
- Air Handling equipment using electric heat
- Fleet vehicles will transition to EV
- What are other states doing?



# Refrigerants

- Low GWP refrigerant is a form of refrigerant that has a low global warming potential (GWP)
- R-410A for chillers and other equipment will be replaced with alternatives that have “low” flammability characteristics
- Flammable refrigerants required safety standards be updated to allow for their use in equipment and buildings: leak detection & mitigation.
- Energy required for air conditioning is likely to triple by 2050

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# Energy Efficiency Building Codes

# International Energy Conservation Code (IECC)

- Most recent release is 2021
  - Montana adopted 2021.
  - Washington State Energy Code based on 2018.
  - Idaho adopted 2018.
- Massachusetts amendment to C402.3 requires a solar ready zone for commercial roofs

Table C401.4.1 EVSE Installed, EV-Ready Space and EV-Capable Space Requirements for New Commercial Buildings

<u>Total Number of Parking Spaces</u>	<u>Minimum number of Spaces with EVSE Installed<sup>a</sup>.</u>	<u>Minimum Number of EV-Ready Spaces</u>	<u>Minimum Number of EV-Capable Spaces</u>
1	1	1	-
2 – 10	1	2	-
11 – 15	1	2	1
16 – 19	1	2	2
21 – 25	2	3	2
26+	5% of total parking spaces	10% of total parking spaces	10% of total parking spaces

(a). Spaces that terminate with a Level 2 EVSE are considered EV-Ready Spaces and count towards the minimum number of EV-Ready Spaces.

- Where parking is provided, new construction shall provide Electrical Vehicle Supply Equipment (EVSE) installed spaces and facilitate future installation and use of EV-Capable Spaces.

# ASHRAE 90.1

- Most recent release was 2022 though not many states have adopted it
  - Oregon based on 2019
- Electric motors for fire pumps have a minimum efficiency
- New buildings require energy monitoring, recording, and reporting

## 10.4.6 Whole-Building Energy Monitoring

Measurement devices shall be installed at the *building* site to monitor the *energy* use of each new *building*.

### 10.4.6.1 Monitoring

Measurement devices shall be installed to monitor the *building* use of the following types of *energy* supplied by a utility, *energy* provider, or plant that is not within the *building*:

- Natural gas
- Fuel* oil
- Propane
- Steam
- Chilled water
- Hot water

### 10.4.6.2 Recording and Reporting

The *energy* use of each *building* on the *building* site shall be recorded at a minimum of every 60 minutes and reported at least hourly, daily, monthly, and annually. The *system* shall be capable of maintaining all data collected for a minimum of 36 months and creating user reports showing at least hourly, daily, monthly, and annual *energy* consumption and *demand*.

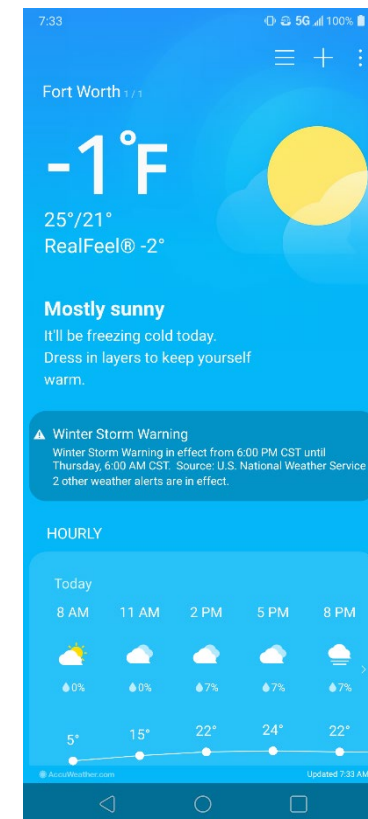
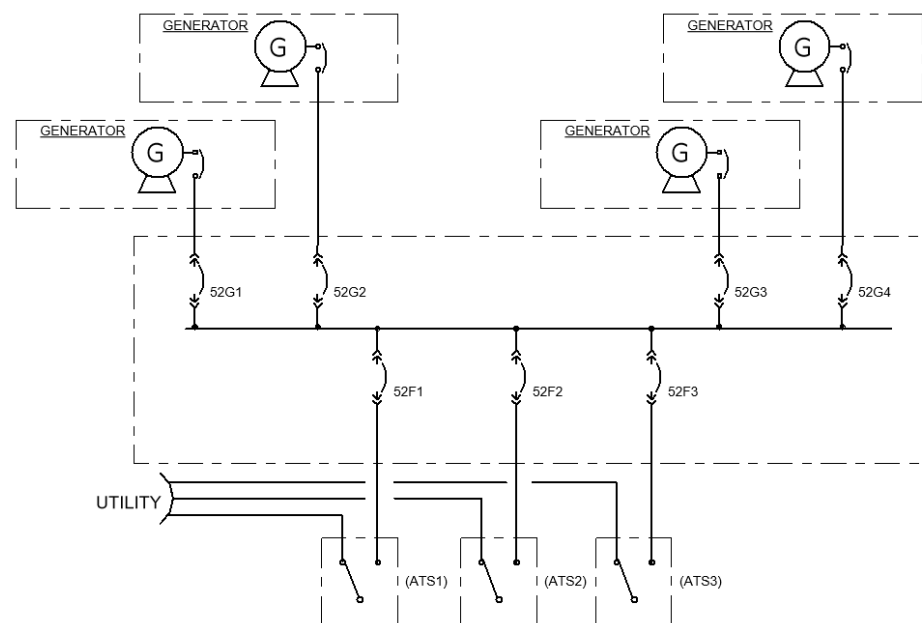
One good Exemption:  
buildings less than 25,000 ft<sup>2</sup>



# Standby Power Options

# Natural Gas (NG) Generators

- Designed to run more than your emergency standby generators
- Lower NO<sub>x</sub>, CO<sub>2</sub>, and sulfur oxide emissions
- Opportunities for Combined Heat and Power (CHP)
- Trade-offs



# Advancements in Generators

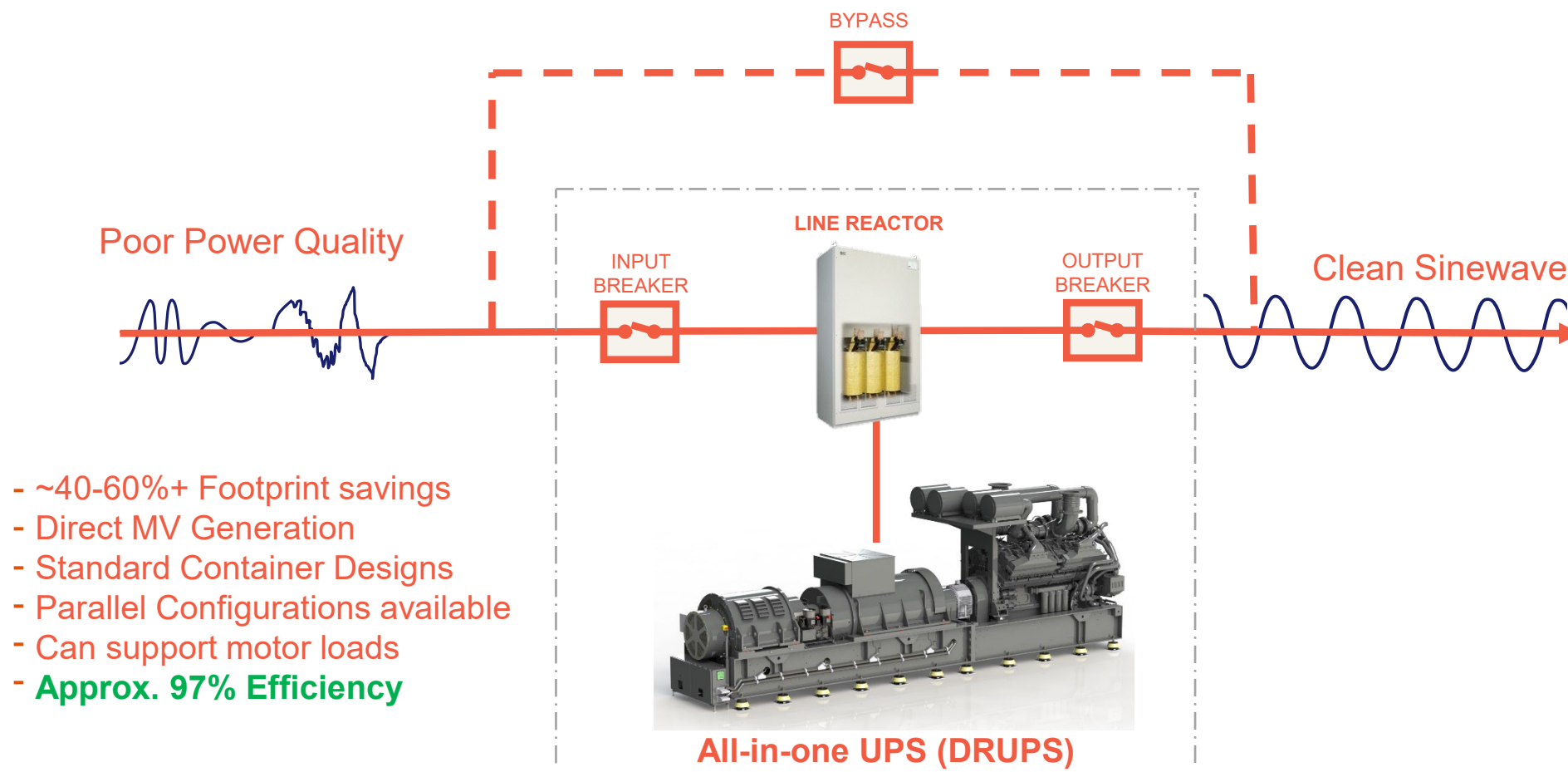
- Hydrotreated Vegetable Oil (HVO)
  - Renewable diesel
  - Very low carbon content
  - Approved for use in many major manufacturers existing and new diesel gensets: Cummins, Caterpillar
  - Potential for slight reduction in full power \*
  - Not prone to bacterial growth of other biodiesels
  - Slightly lower energy density than diesel equates to slightly higher fuel consumption

\*Courtesy of Caterpillar testing in 2021

# Dynamic Rotary Uninterruptable Power Supply (DRUPS)

- One package includes UPS and a backup generator
- Kinetic energy storage (flywheel) coupled to a spinning synchronous alternator
- Eliminates switching between the UPS and generator in traditional critical power architecture
- 1MVA – 3.6MVA module sizes
- Capable of Tier IV emission treatment to reduce carbon footprint
- No batteries
- One of many options for big systems, to include capacitor bank
- Trade-offs

# DRUPS CONFIGURATION



\*Diagram and information courtesy of HITEC Power Protection.

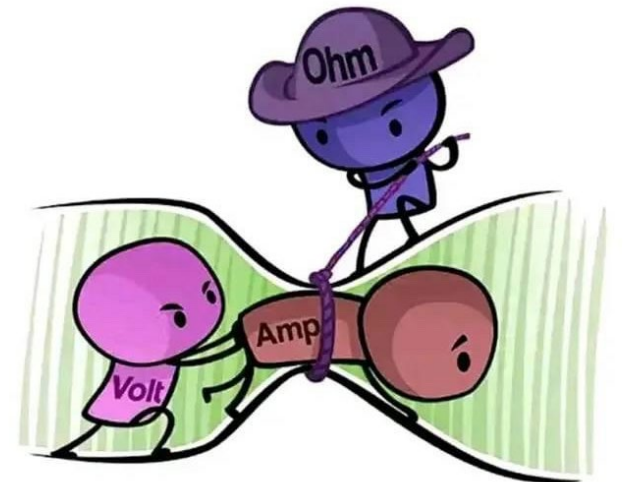


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# Challenges, Planning, & Utility Coordination

# Challenges to Energy Efficiency Improvements

- More VFDs & switching power supplies means more Harmonics
- Improved efficiency in transformers reduces impedance and increases available fault current
- Network security & intrusion
- More maintenance, more spare materials



# Planning & Coordination

- Talk to your utility
- Power quality should be monitored with space planning for improvement
- Near term, distribution equipment lead times are still long
  - Packaged solutions can save on lead times
- Expand the use of Medium Voltage, plan for substation yard expansion
- No such thing as too much metering, just control the access
- Coordinate your Process Control System and your BAS

According to McKinsey & Company research, electricity demand in the US could triple by 2050.

# Project Example

## Total design for expansion and reliability enhancement of the complete campus electrical distribution system

- Project Scope:
  - System Evaluation and Recommendation Report
  - Preliminary Design
  - Final Design
  - 115KV to 13.2 KV Substation
  - 13.2KV Distribution network
  - 480V Transformers with Generator/UPS Backup
  - Neutral Grounding resistors
  - Construction Administration



### Client Profile:

Largest microchip manufacturer

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Questions?