



# Don't Be Left in the Dark: The Microgrid Solution

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# Cushing Terrell

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MECHANICAL ENGINEERING  
PLANNING  
REFRIGERATION ENGINEERING  
STRUCTURAL ENGINEERING  
VISUALIZATION

## By the Numbers

450+

professionals

1B+

annual construction volume

84

years in business

100+

green-certified projects since 2005

13

office locations

1

client-driven mission

# Agenda

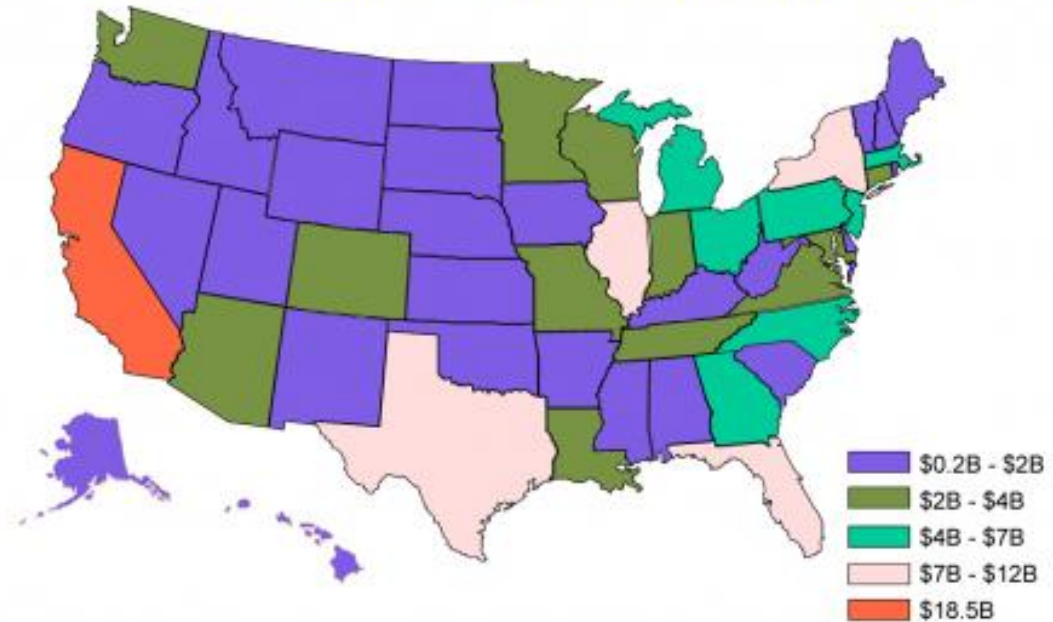
- Market Drivers Pushing Microgrids
- Microgrid Integration
- Microgrid Example Projects

# Market Drivers Pushing Microgrids

- Economics
- Sustainability
- Grid Resilience
  - Extreme weather events:  
70% of ERCOT customers  
lost power during the 2021  
winter event

## Annual Business Losses from Grid Problems

*Primen Study: \$150B annually for power outages and quality issues*





# Microgrid Integration

## Pre-qualification:

- Energy Efficiency Upgrade
  - Energy modeling
  - Building envelope
  - Lighting systems
  - HVAC systems

## Feasibility Study:

- Define project goals
  - Grid resilience
  - Economics
  - Sustainability
  - Modes of operation
- Develop microgrid model
  - Load profile
  - Utility rates (energy rates, demand rates, time of use rates)
  - DER power dispatch
  - Optimize system size and economics



# Microgrid Integration

## Utility Company Requirements:

- Net metering
- Behind the meter generation
- Master-metering and sub-metering
- Interconnection requirements
- Grid parallel non-export
- IEEE 1547 and 1741
- Anti-islanding
- Direct transfer trip

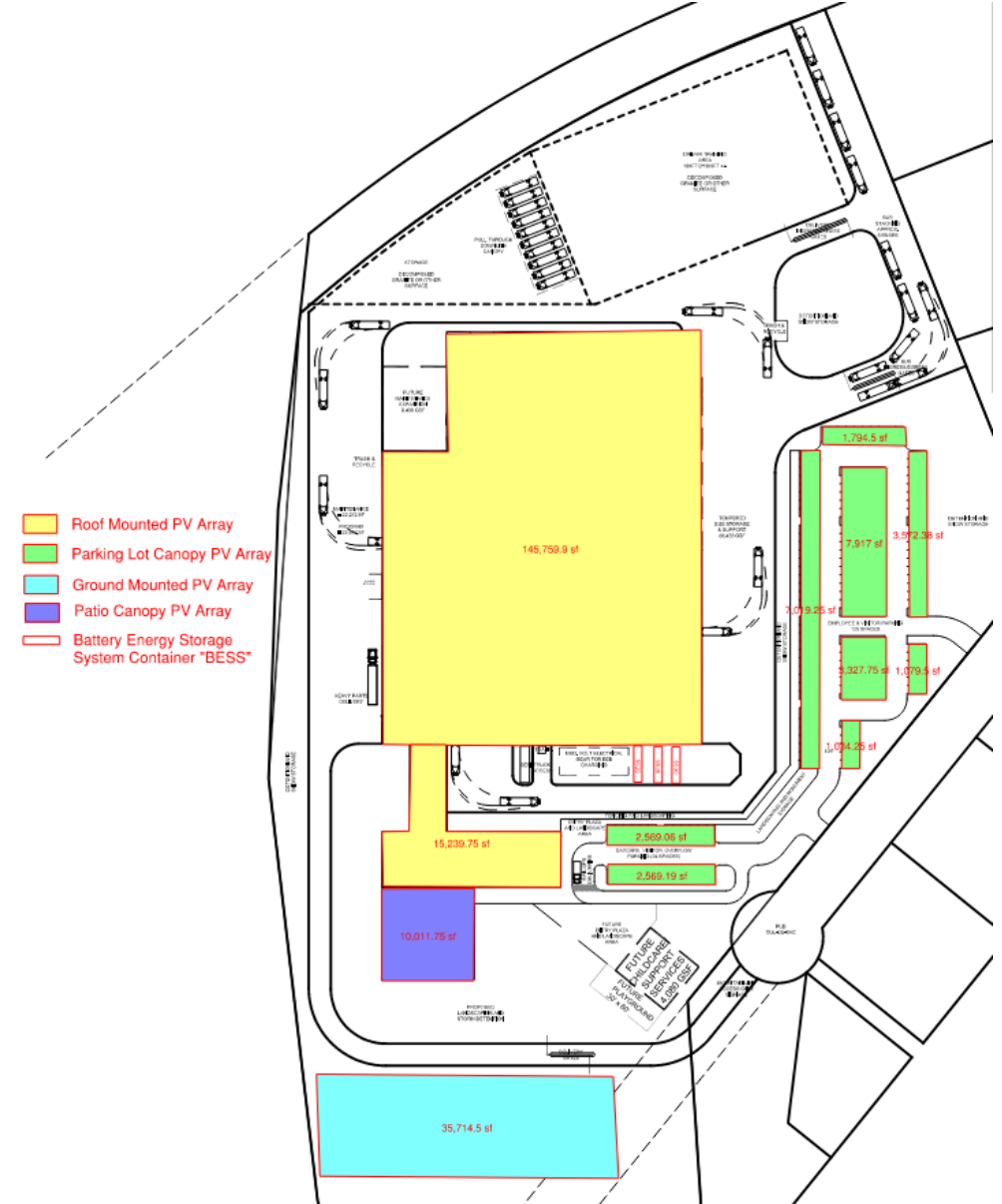
## Space Planning:

- Rooftop solar PV
- Parking lot solar PV
- Battery storage
- Power generation equipment
- Electrical switchgear



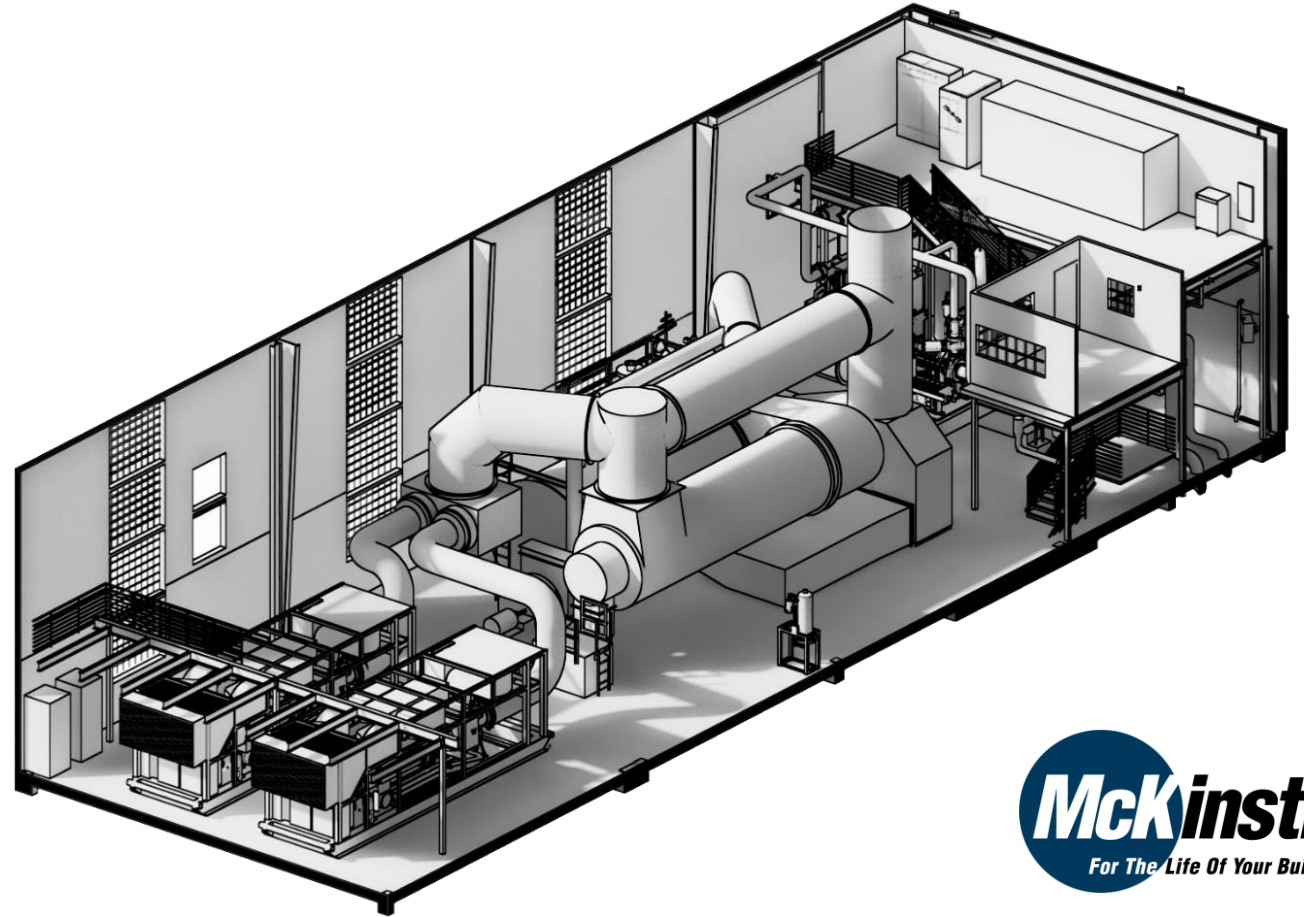
# Project: Mountain Line Bus

- 100% Electric Facility
- 127k SF Operations Center
- 86 Electric Vehicles (busses, paratransit vans, service/support vehicles)
- 4MW EV Charging Load
- 4.4MW Total Load
- 1MW Solar PV
- Battery Energy Storage System
- Utility Line Upgrade



# Project: University of Montana CHP Plant

- Combined heat and power plant
- 2016 DEQ Feasibility Study
- 156-acre campus with 64 buildings
- (2) 1.8MW gas fired turbines
- 2.5MW steam driven turbine
- \$1.5M Annual Energy Savings
- 23% Reduction in GHG Emissions

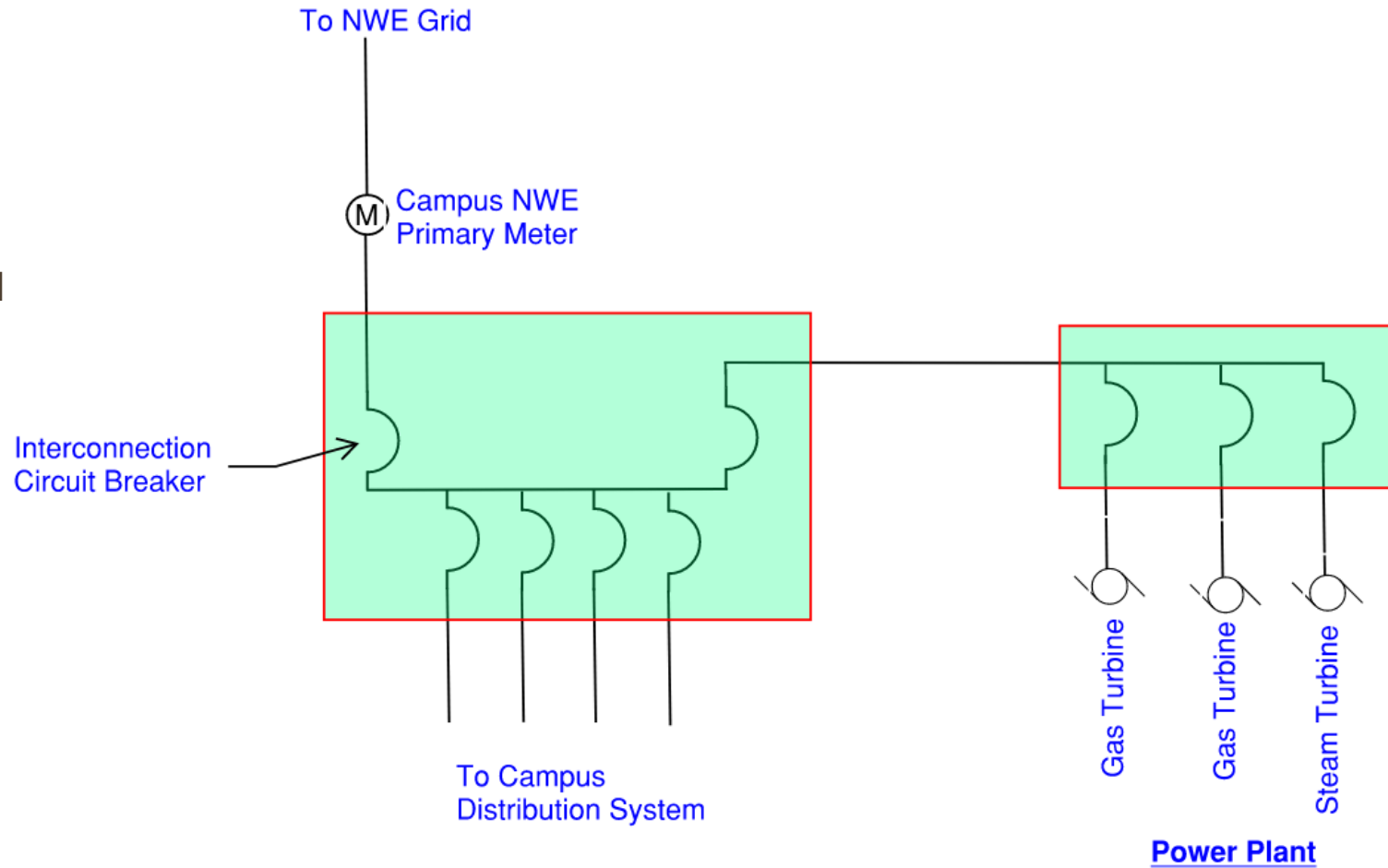




# Project: University of Montana CHP Plant

## Modes of Operation

- Load Following Grid Parallel
- Island Mode
- Non-export



# Project: University of Montana CHP Plant

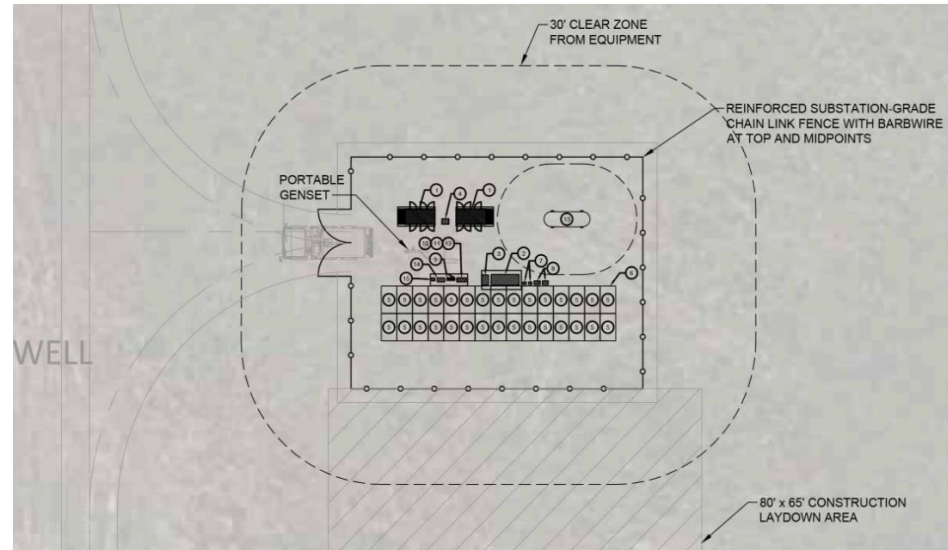
## Challenges/Lessons Learned

- Utility Company Interconnection
- Supply Chain/Lead Times
- Integration of multiple equipment manufacturers
- Congested utility yard



# Project: Pacific Gas and Electric

- Various locations in California
- Solar PV arrays 2.5kW – 15kW
- BESS: 17kWh – 67kWh
- Backup generator: 44kW





# Project: Penninsula Regional Hospital CHP

- Location: Salisbury, MD
- Combined heat and power plant
- (2) 1.56MW natural gas recip. engines
- 25kV distribution system





# Project: Multi-Building Campus

- Location: Harare, Zimbabwe
- 17 hour per day utility curtailment
- 1,000kW PV array + 2,800kWH battery energy storage system
- 5600-hour annual reduction in diesel generator operation
- Parking lot PV system; 1,412 solar PV modules
- Robotic PV cleaning system



# Summary

- Microgrids are fast gaining traction to address modern-day energy challenges.
- With many types and configurations, microgrids can support a variety of different facilities and campuses.
- Microgrids create a de-centralized power system that reduces the reliance on central power plants and transmission lines, which are vulnerable to security attacks, catastrophic weather events, and wildfires.





# Q&A

What are your  
questions for Alan?

Thank you!