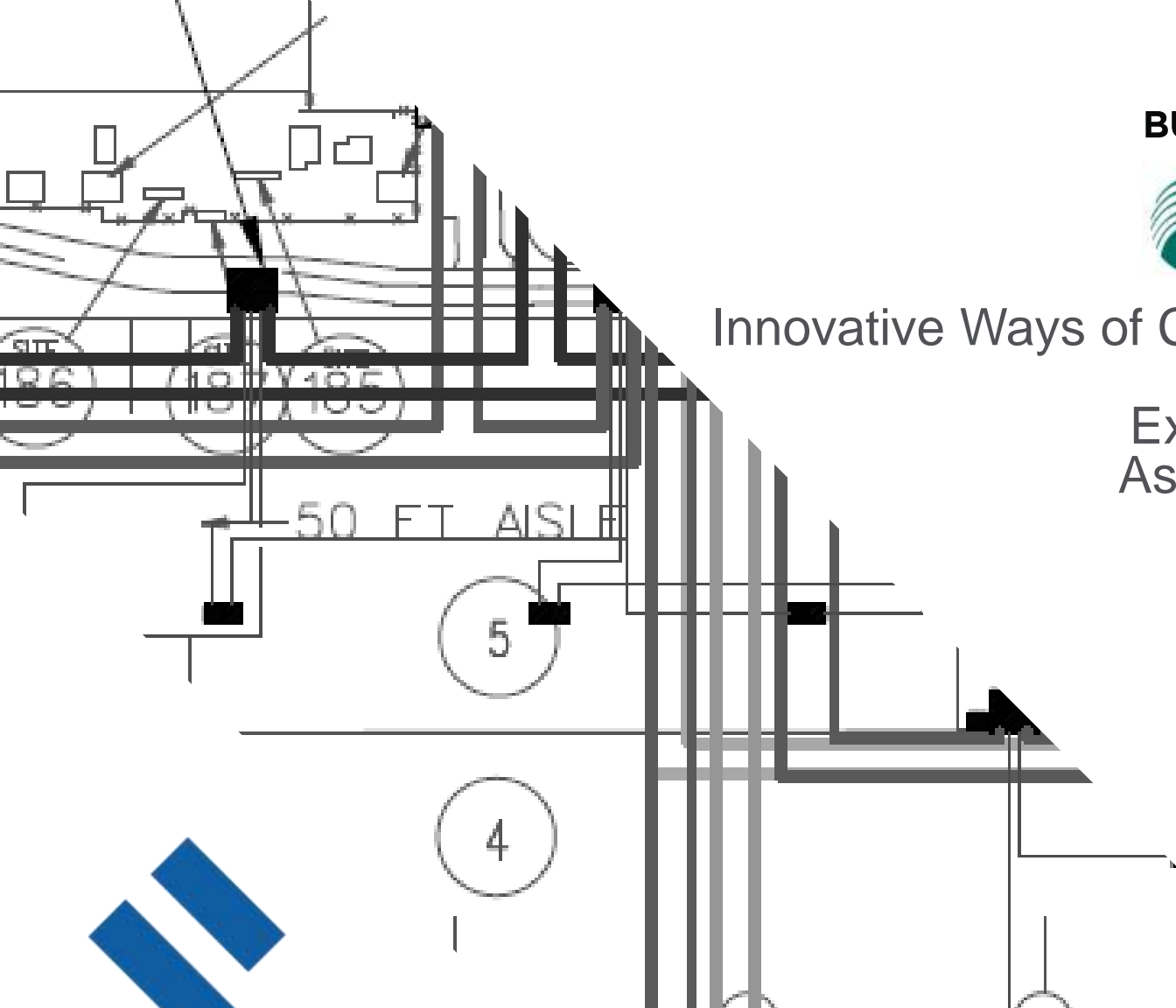


Innovative Ways of Creating Microgrid Capacity with Existing Generation Assets and Controls

Michael Dempsey





Agenda

Project Background

Campus Overview

Electrical Distribution
System

Existing Generation
Assets

Critical Medical/Research
Facilities

Critical Building Diesel
Generators

Required Modifications

Project Background

► Overall Issues:

- Critical Medical Research Facility Expansion on Campus
- Customer Expectation of Continuous Reliable Electrical Power
- Desire to Move Toward More Distributed Generation Model



Campus Overview

- ▶ East and West Campus Separated by Iowa River
 - Most Critical Medical Research Facilities Located on West Campus
 - Power Plant and Water Plant Located on East Campus
 - Chilled Water Loop Serves Both Campuses
 - Separate Substations for Each Campus



Project Background

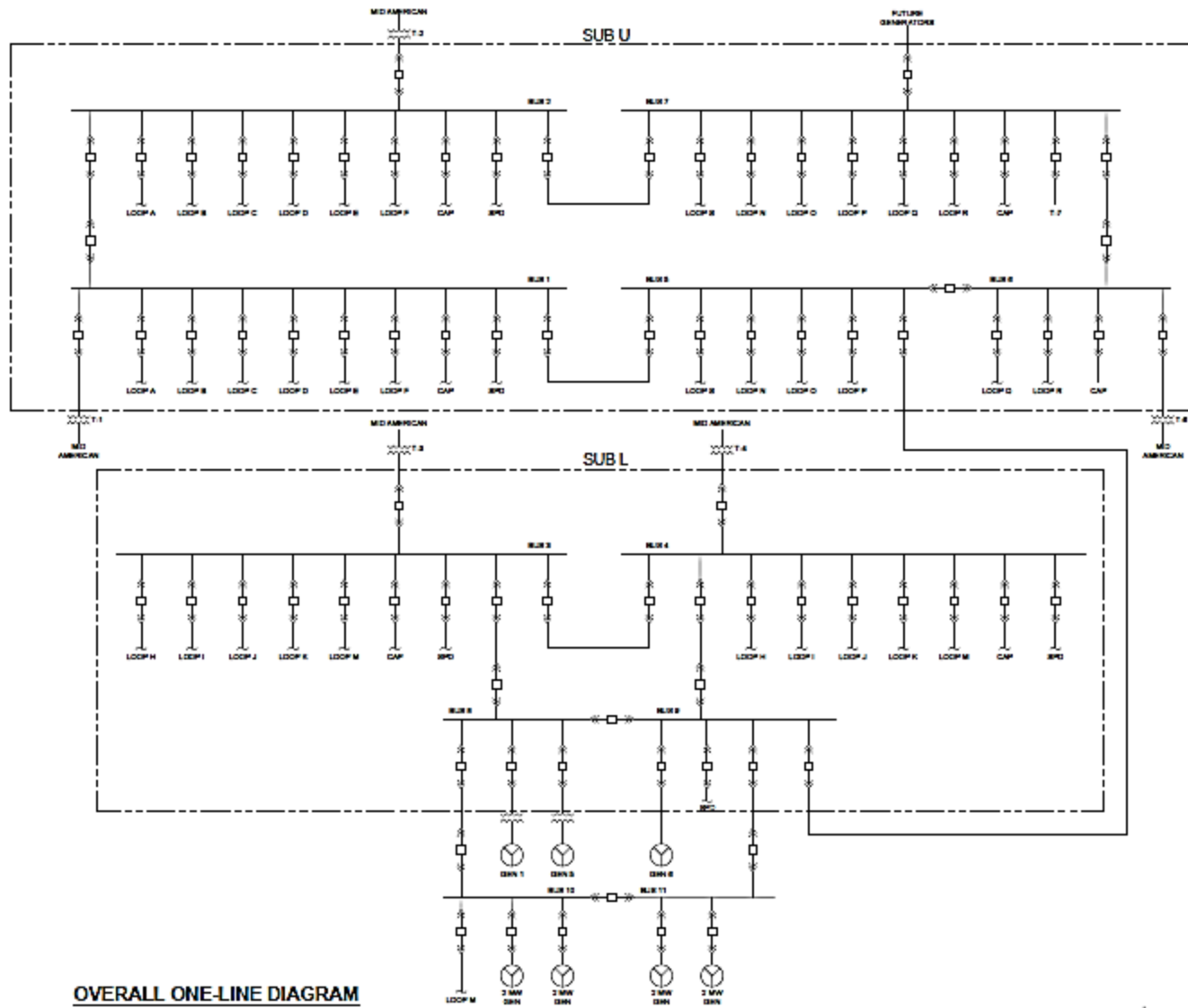
- ▶ Current Configuration:
 - Individual Buildings Equipped with Emergency Diesel Generators
 - Generators Not Sized to Serve Entire Building Load
 - Power Plant Boilers Serve STGs and Steam-Driven Chillers
 - 1500kW Diesel Generator and 8000kW NG Generators at Power Plant



Electrical Distribution System

- ▶ Substation L – East Campus
 - Four-Breaker Ring Bus
 - Two Utility Interconnections
 - Two Power Plant Buses
- ▶ Substation U – West Campus
 - Four-Breaker Ring Bus
 - Three Utility Interconnections
- ▶ 24MW Across Campus Tie
- ▶ 13.8kV Primary Distribution
 - Loop with Normal Open Point
 - Manual Switching





OVERALL ONE-LINE DIAGRAM

Existing Generation Assets

- ▶ East Campus
 - Numerous Individual Building Diesel Generators
- ▶ East Campus Power Plant
 - Three Steam-turbine generators
 - 1500kW Emergency/Blackstart Generator
 - 4 – 2050kW NG Recip Generators
- ▶ West Campus
 - Numerous Individual Building Diesel Generators



Critical Medical Facilities

- ▶ Carver Biomedical Research Bldg (CBRB)
- ▶ Bowen Science Bldg (BSB)
- ▶ Medical Education Research Facility (MERF)
- ▶ Medical Research Center (MRC)
- ▶ Westlawn
- ▶ Eckstein Medical Research Bldg (EMRB)
- ▶ Medical Labs
- ▶ Pappajohn Biomedical Discovery Bldg (PBDB)
- ▶ Water Plant
- ▶ Power Plant
- ▶ Building Load – Meter Data
- ▶ Coincident Peak 7730kW
- ▶ Average 5600kW

Building Generators

- ▶ Critical Building Diesel Generators
- ▶ CBRB 1100kW
- ▶ BSB 1500kW
- ▶ MERF 1250kW
 - Also serves PBDB life safety and fire pump
- ▶ Water Plant 1250kW
- ▶ Power Plant 1500kW
- ▶ Total Rated 6600kW
- ▶ 70% Total 4620kW
- ▶ Standby Rated – 70% Load Factor by Definition
- ▶ All designed for Parallel Operation Except BSB – Peak Shaving



Proposed Building Generator Microgrid Control

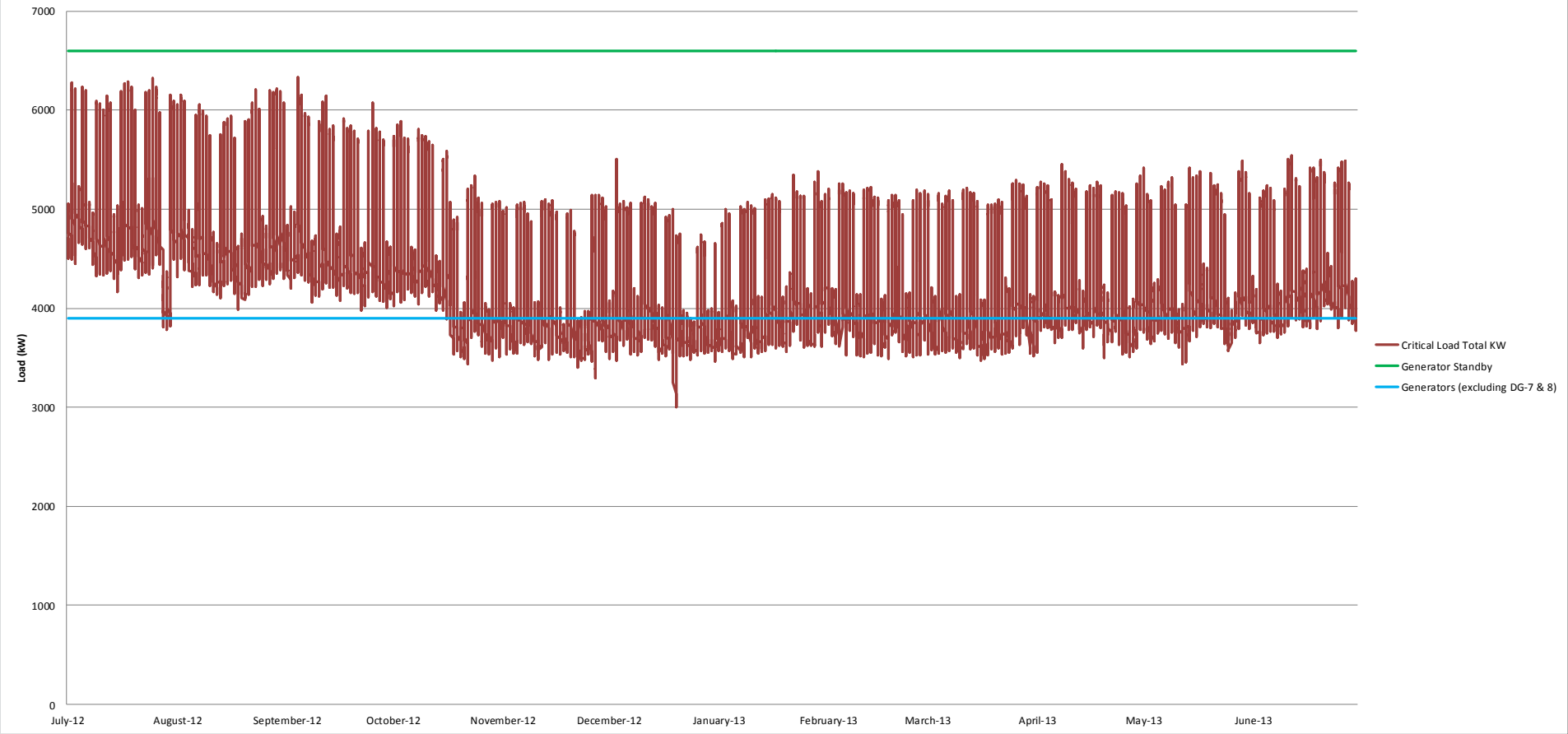
- ▶ Load Share Building Diesel Generators
- ▶ Automated Generator Deployment
- ▶ Full Rating Available – 70% Load Factor
- ▶ Remote Monitoring and Control
- ▶ Remote Breaker Control
- ▶ Improved Transient Response to Load Swings
- ▶ Building Switchgear Controls Modifications Required
- ▶ New Generator and Breaker Controllers



Critical Load Summary

Average (kW)	Max (kW)	Max Date	Min (kW)	Min Date	PBDB Average (est) (kW)	PBDB Max (est) (kW)	Average with PBDB (kW)	Max with PBDB (kW)	Critical Loads in this graph include: Energy Usage for CBRB, MERF, BSB, Medical Labs, Westlawn, EMRB, and the Water Plant. Chilled Water Loads are excluded from this graph.
4444.3	6332.2	9/4/12 15:00	3005.5	12/20/12 3:00	1120	1400	5564.3	7732.2	

Critical Load Summary (Excluding Chilled Water)



Required Modifications

- ▶ CBRB/MERF
 - Parallel Capable
- ▶ Generator Control
 - EasYgen
- ▶ Main Breaker Control
 - LS-521
- ▶ Eliminate Peak Shave Mode
- ▶ Hardwire Annunciator
- ▶ Remove PLC
- ▶ Eliminate Sync Scope and Lights



Required Modifications

- ▶ Power Plant DG-7
 - Parallel Capable
- ▶ Generator Control
 - EasYgen
- ▶ Main Breaker Control
 - LS-521
 - Main-Tie-Main
 - Automate AK breakers
- ▶ Eliminate Peak Shave Mode
- ▶ Controlled by SEL-451 relay
- ▶ Eliminate Sync Scope and Lights



Required Modifications

- ▶ Water Plant DG-8
 - Parallel Capable
 - Cummins PowerCommand
- ▶ Generator Control
 - EasYgen
- ▶ Main Breaker Control
 - LS-521
 - Main-Tie-Main
 - Automate AK breakers
- ▶ Eliminate Peak Shave Mode
- ▶ Eliminate Sync Scope and Lights

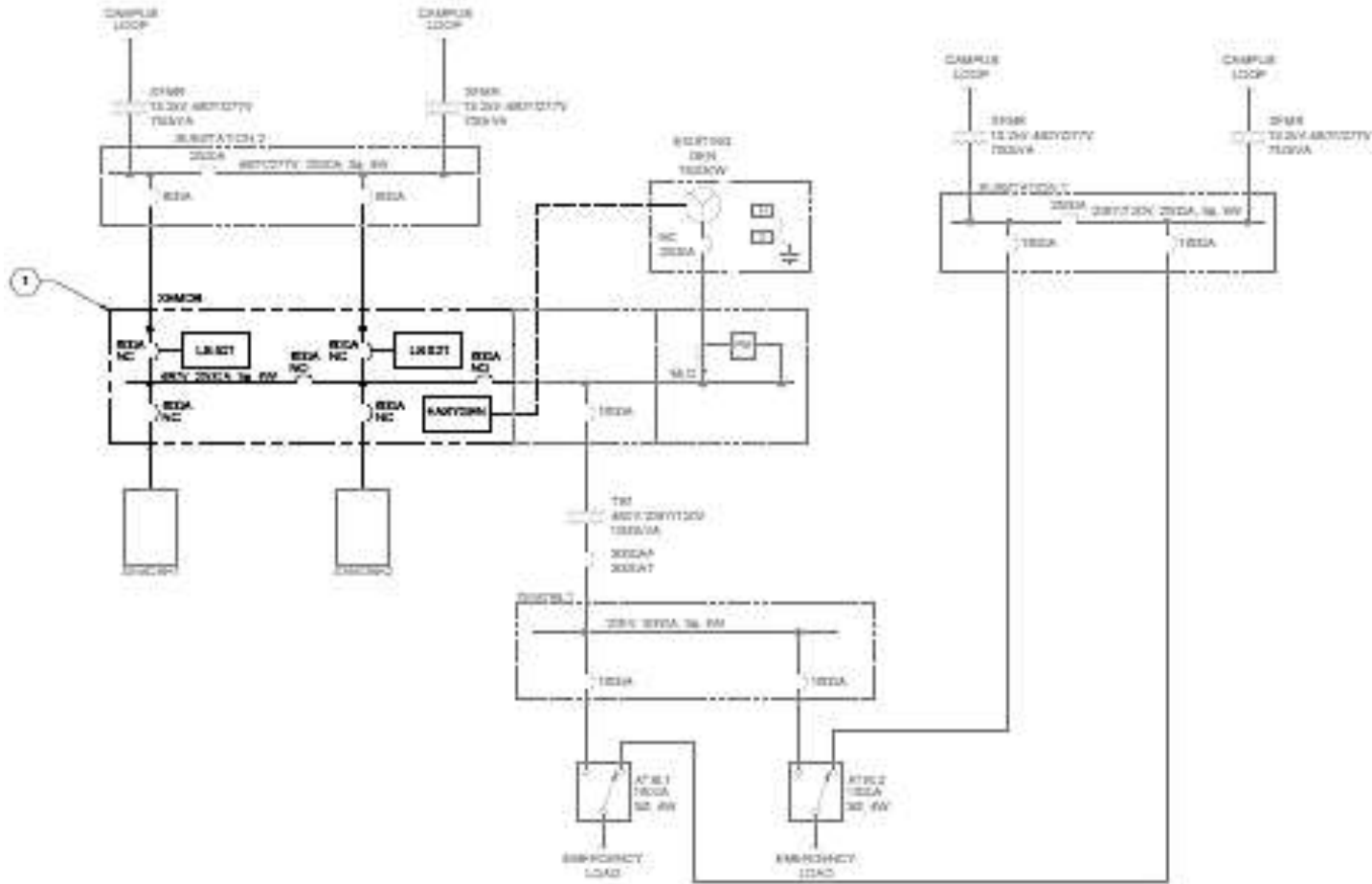


Required Modifica

- ▶ BSB
- ▶ Standby only
 - Not parallel capable
 - ATS connected essential load
- ▶ DG Governor and Voltage Regulator Upgrade
- ▶ New Switchgear
- ▶ Generator Control
 - EasYgen
- ▶ Tie Breaker Control
 - LS-521



Required Modifications



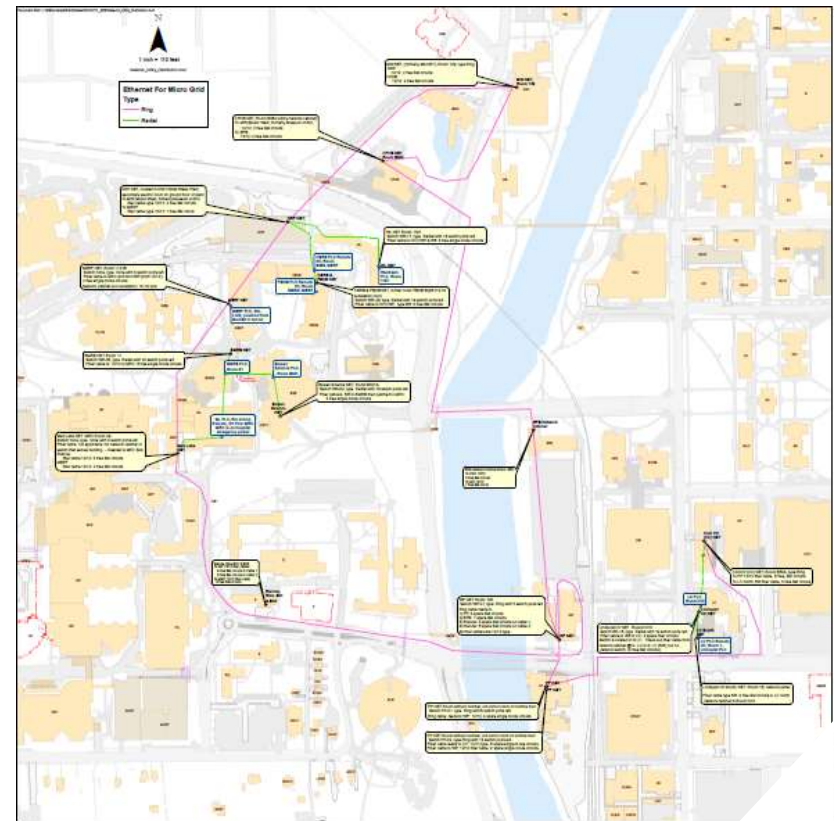
Required Modifications

- ▶ Establish Required I/O
 - Enough but not too much
- ▶ Expand CANBUS Network
 - Loadshare
- ▶ Create MODBUS Network
 - Monitor and Control
- ▶ Existing Utility Network Fiber
- ▶ Interface with ABB/Bailey Power Plant Control System
- ▶ Interface with Substation Controls
 - SEL RTAC



Implementation

- ▶ Temporary Diesel Generators
 - Buildings remain operable
- ▶ Load Banks for Testing
 - Resistive – governor verification/tuning
 - Reactive – voltage regulator verification/tuning
- ▶ Phasing
 - One at a time
 - All at once



Conclusion

- ▶ Project Maximizes Use of Existing Generation Assets
- ▶ Leverage Existing Assets
- ▶ Minimize Cost
- ▶ Maximize Flexibility
- ▶ Keep Critical Facilities Online





[BURNMCD.COM/ONSITE](http://burnsmcd.com/onsite)

CONTACT

Michael Dempsey, P.E.
Electrical Department Manager
P 817-733-8186
E mdempsey@burnsmcd.com