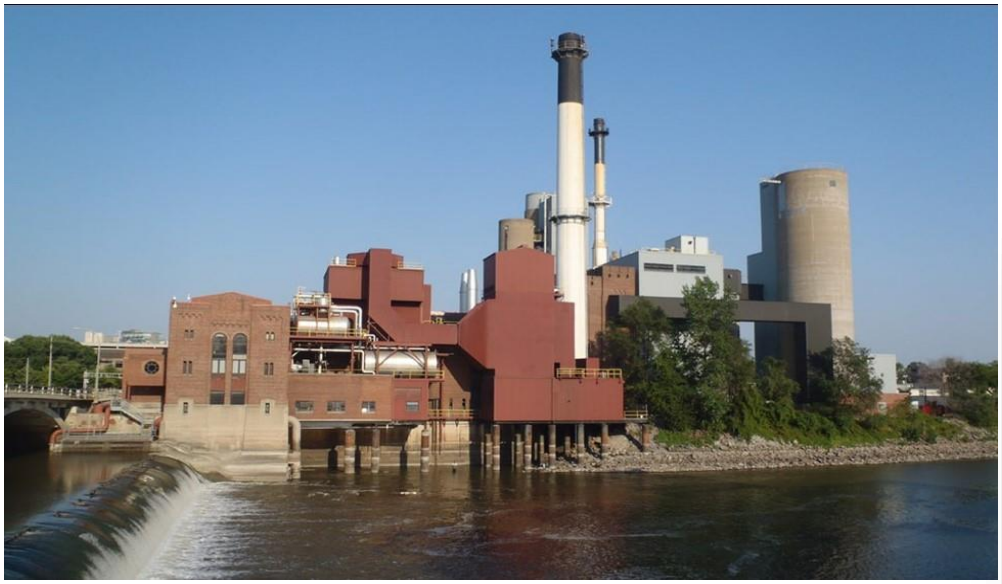
University of Iowa – Microgrid Approach



THE UNIVERSITY OF IOWA

PRVN CONSULTANTS, INC.

AGENDA

- Main Campus Approach to Microgrid
- Oakdale Research Campus Approach to Microgrid
- Considerations On Design Approach
- Risks to Microgrid Approach
- Q&A

MICROGRID CONSIDERATIONS

- Microgrid goal: Black plant/campus restart?
- Prevent an outage?
- Peak shaving?
- What will the microgrid support?
- Micorgrid prime movers
- Restart of tripped assets
- Automation/Control philosophy

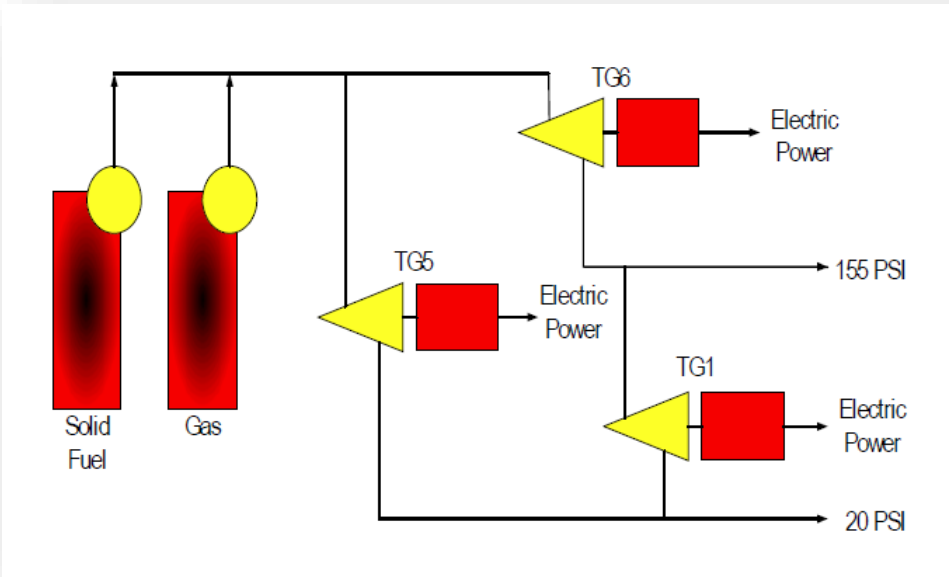
MAIN CAMPUS MICROGRID GOALS

- Prevent loss of steam to campus including hospital and critical research
- Restore electrical power to power plant to restore steam quickly
- Within 2 hours supply backup power to critical research buildings *(on the other side of campus)*
- Long term outage restore steam turbine generators and pickup additional critical facilities (not whole campus)
- Chilled water *in the future*

MAIN CAMPUS POWER PLANT OVERVIEW

- Four (4) boilers: 600+ klb/hr
- Three (3) steam turbine generators: 24.7 MW
- Six (3) off-site natural gas boiler
- Four (4) 2MW natural gas engine generators: 8 MW

Turbine	Installed	Type	Capacity (kW)
TG-01	1946	Back Pressure Steam Turbine	3,000
TG-05	1960	Back Pressure Steam Turbine	3,000
TG-06	1976	Back Pressure Steam Turbine	18,000
DG-07	1985	Diesel Engine Generator	1,700



University of Iowa
Main Campus Utilities

Substation U
161 kV

Substation L
69 kV

West Campus

East Campus

Across Campus Tie

Power Distribution West

Power Distribution East

Water Treatment Plant

Potable Water Distribution West

Potable Water Distribution East

Main Power Plant

Natural Gas Boilers

Solid Fuel Boilers

Steam Turbine Electric Generators

Natural Gas Engine Electric Generators

Natural Gas Boilers
WCB 1 WCB 2

7 8 10 11

Steam Distribution West

Steam Distribution East

West Chiller Plant

Northwest Plant

North Chiller Plant

Steam Chillers (3)

Steam Chiller (1)

Steam Chillers (3)

UIHC
Natural Gas Boiler

Electric Chillers (8)

Electric Chillers (1)

Chilled Water Distribution West

Chilled Water Distribution East

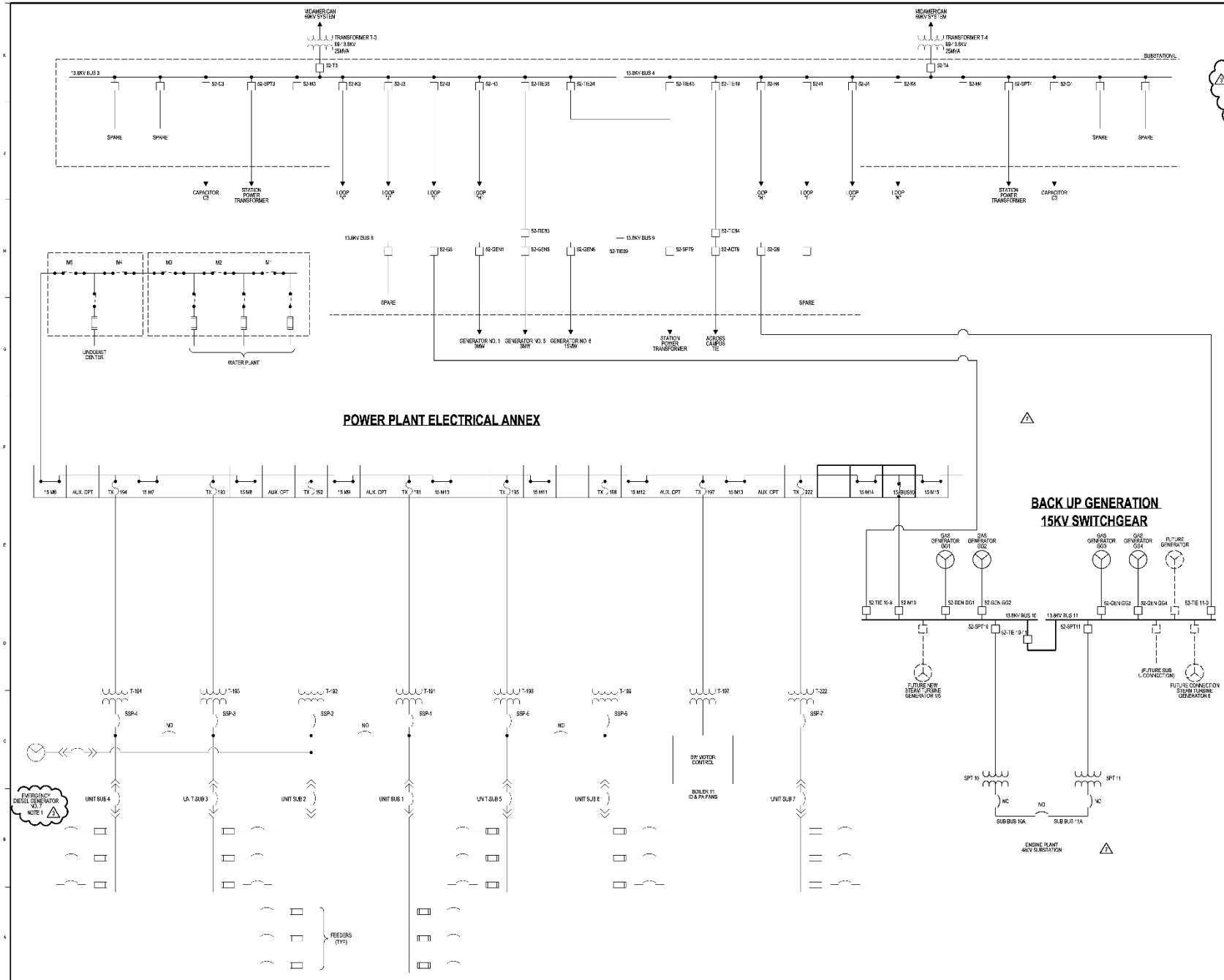
Legend:

Electrical

Steam

Chilled Water

Potable Water



NOTES:

1. CONTRACTOR SHALL PROCURE SERVICES FROM ESCO AUTOVATION TO MODIFY THE DIESEL GENERATOR T CONTROL LOGIC. THE CONTROL LOGIC SHALL BE MODIFIED TO REMOVE THE AUTOMATIC STARTUP RESPONSE TO A POWER OUTAGE AND MAINTAIN THE ABILITY TO LOCALLY START AND OPERATE THE GENERATOR. COORDINATE WITH OWNERS REPRESENTATIVE 7 DAY PRIOR TOC AND DURING PROPOSED MODIFICATIONS. ESCO SHALL PROVIDE COMMISSIONING AND OPERATOR TRAINING AS WELL AS WRITTEN OPERATIONAL PROCEDURES TO PERFORM MANUAL OPERATION OF DG7.

LEGEND:

C-01 | C-01 — CONTRACT IDENTIFICATION: NUMBER AT LEFT INDICATES CONTRACT FURNISHING NUMBER AT RIGHT INDICATES CONTRACT INSTALLING.

ISSUED FOR BID

NO.	REVISIONS	CHK'D	DATE
3	ADDENDUM 1	P.R.P.	3/4/2013
2	ISSUED FOR C-01 BID	P.R.P.	1/15/2013
1	REVISED FOR BIDDING	P.R.P.	1/3/2013

THE UNIVERSITY OF IOWA - IOWA CITY, IA
POWER PLANT - INSTALL BACK-UP POWER AND AUXILIARIES
UI PROJECT 0353801

ELECTRICAL ONE LINE DIAGRAM
OVERALL SWITCHING

SCALE: NONE | PROJ NO.: 11008
DATE: OCT. 26, 2012
ENGINEER: R.C. VOSS | CHECKED: R.C. VOSS
DRAFTER: N.A. GOTUM

NO. E001 | REV 3

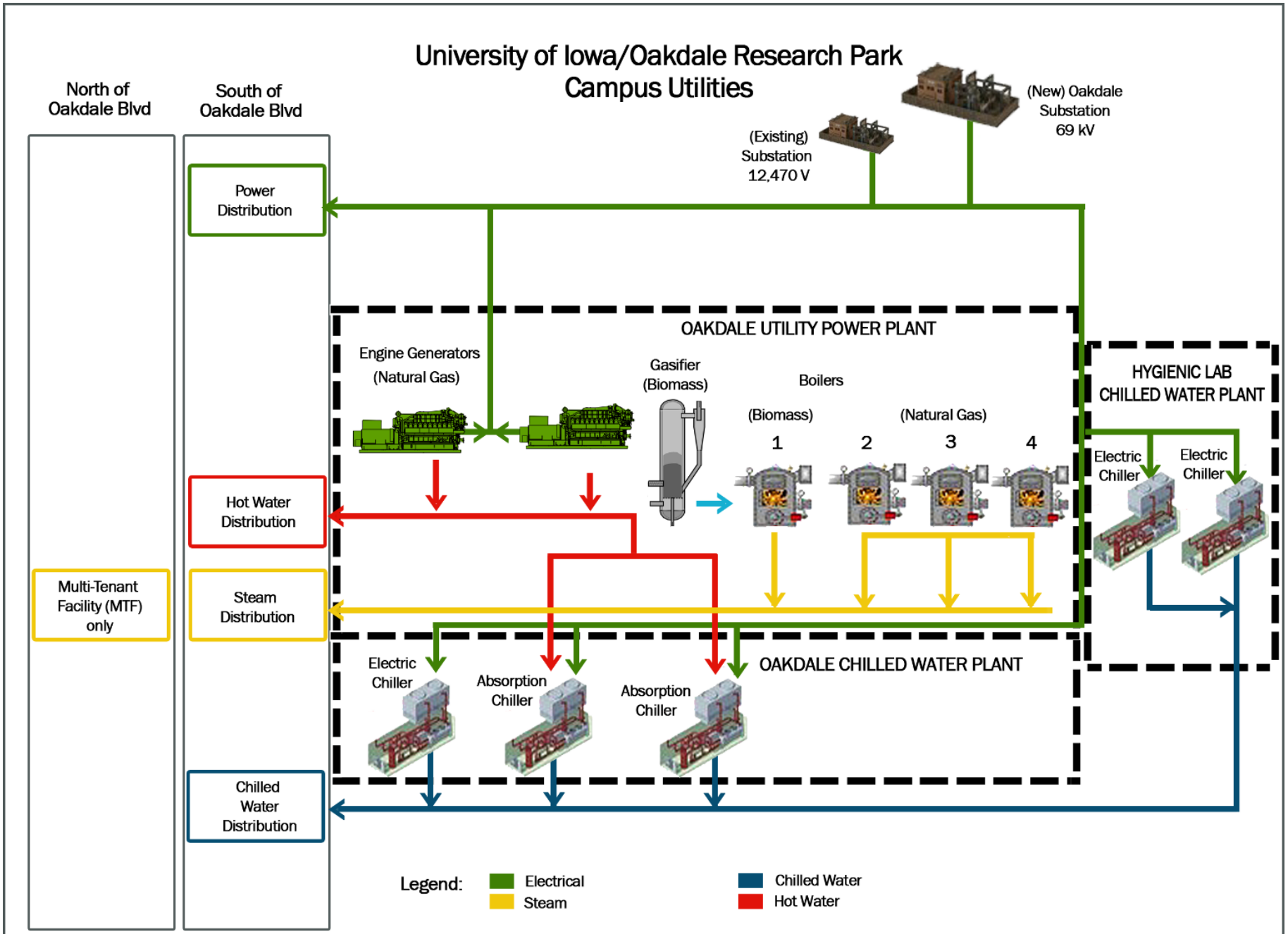
POWER PLANT - INSTALL BACK - UP POWER AND AUXILIARIES : UI PROJECT NO. 0353801

MAIN CAMPUS AUTOMATION

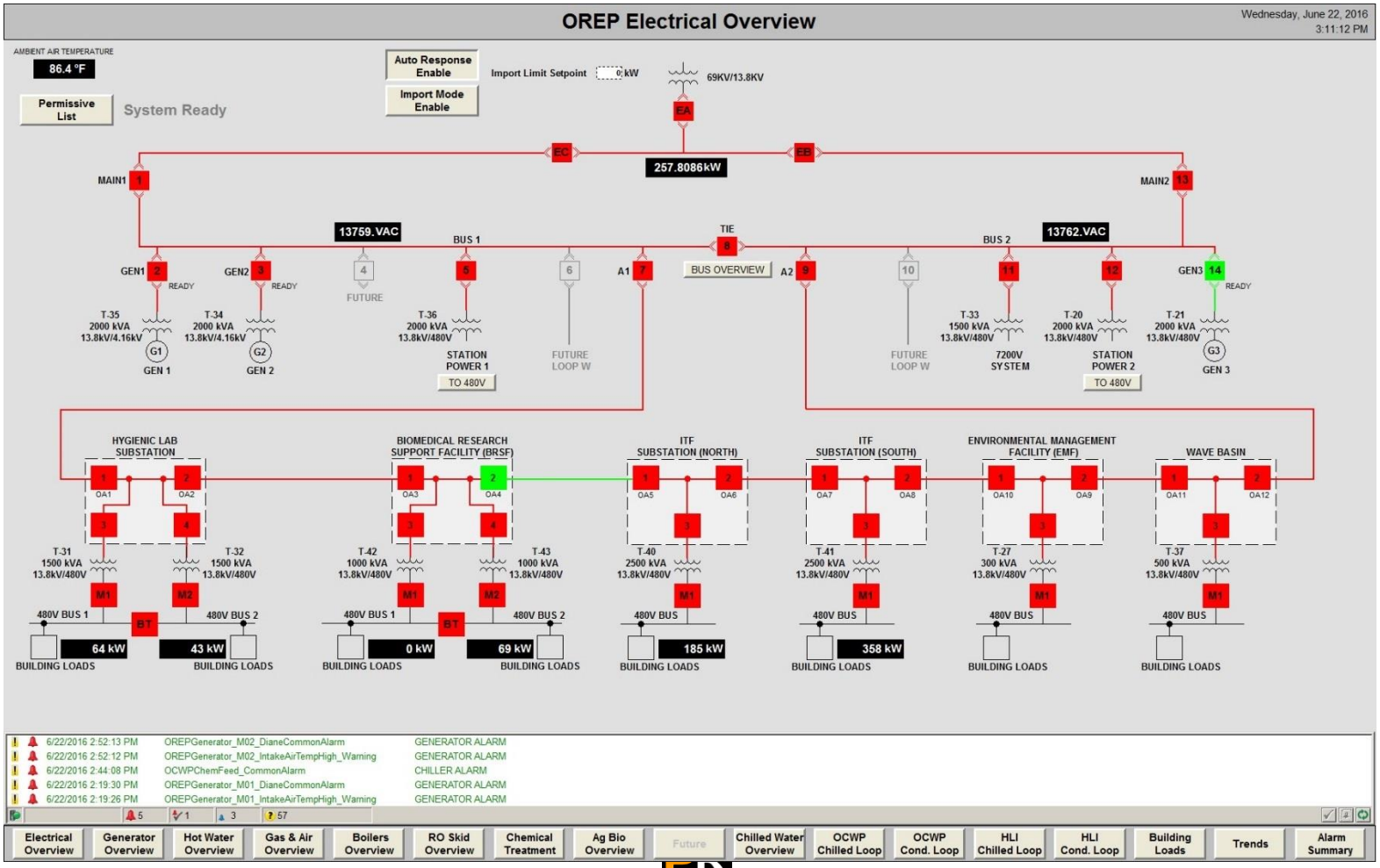
- Addition of Power Plant DG-7 and Water Plant DG-8 to microgrid

OAKDALE RESEARCH CAMPUS GOALS

- Prevent steam, electricity, hot water, and chilled water interruptions
- Restore electrical power to power plant to restore steam, hot water and chilled water quickly
- Within 15 min supply backup power to critical research buildings (already utilizes electrical distribution automation)
- Chilled water automation already utilized


University of Iowa/Oakdale Research Park
Campus Utilities
North of Oakdale Blvd
South of Oakdale Blvd
(New) Oakdale Substation 69 kV
(Existing) Substation 12,470 V
Power Distribution
OAKDALE UTILITY POWER PLANT
Engine Generators (Natural Gas)
Gasifier (Biomass)
Boilers
(Biomass)
(Natural Gas)
1
2
3
4
HYGIENIC LAB CHILLED WATER PLANT
Electric Chiller
Electric Chiller
Hot Water Distribution
Multi-Tenant Facility (MTF) only
Steam Distribution
Electric Chiller
Absorption Chiller
Absorption Chiller
OAKDALE CHILLED WATER PLANT
Chilled Water Distribution
Legend:
Electrical
Steam
Chilled Water
Hot Water

OAKDALE DISTRIBUTION



Micro-Grid Considerations

- Micro-grid control hardware selection, where does control logic actually reside
- What is automated and what is the goal (Assets will dictate this considerably)
- System and switching complexity
- Physical proximity of assets
- What is critical time to restore utilities, which utilities are priority?

RISKS TO MICROGRID APPROACH

- System functionality risks (hoping it actually works)
- Loss of communications/Missing member during normal maintenance
- Complex switching and control logic
- How to prevent overload and tripping microgrid (who has excess capacity?)
- How does the Owner actually test it?
- Does anyone remember how it was supposed to work?

COMMISSIONING APPROACH… MAYBE IN 2018