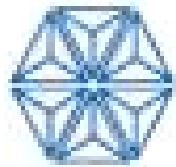


# **4MW Cogeneration Project**

**Unique Approach to Packaged Onsite  
Generation at**



**Bristol-Myers Squibb**

**WMM** Group Engineers

**Smart solutions that work.**

**Feb 11<sup>th</sup>, 2016**

# Background

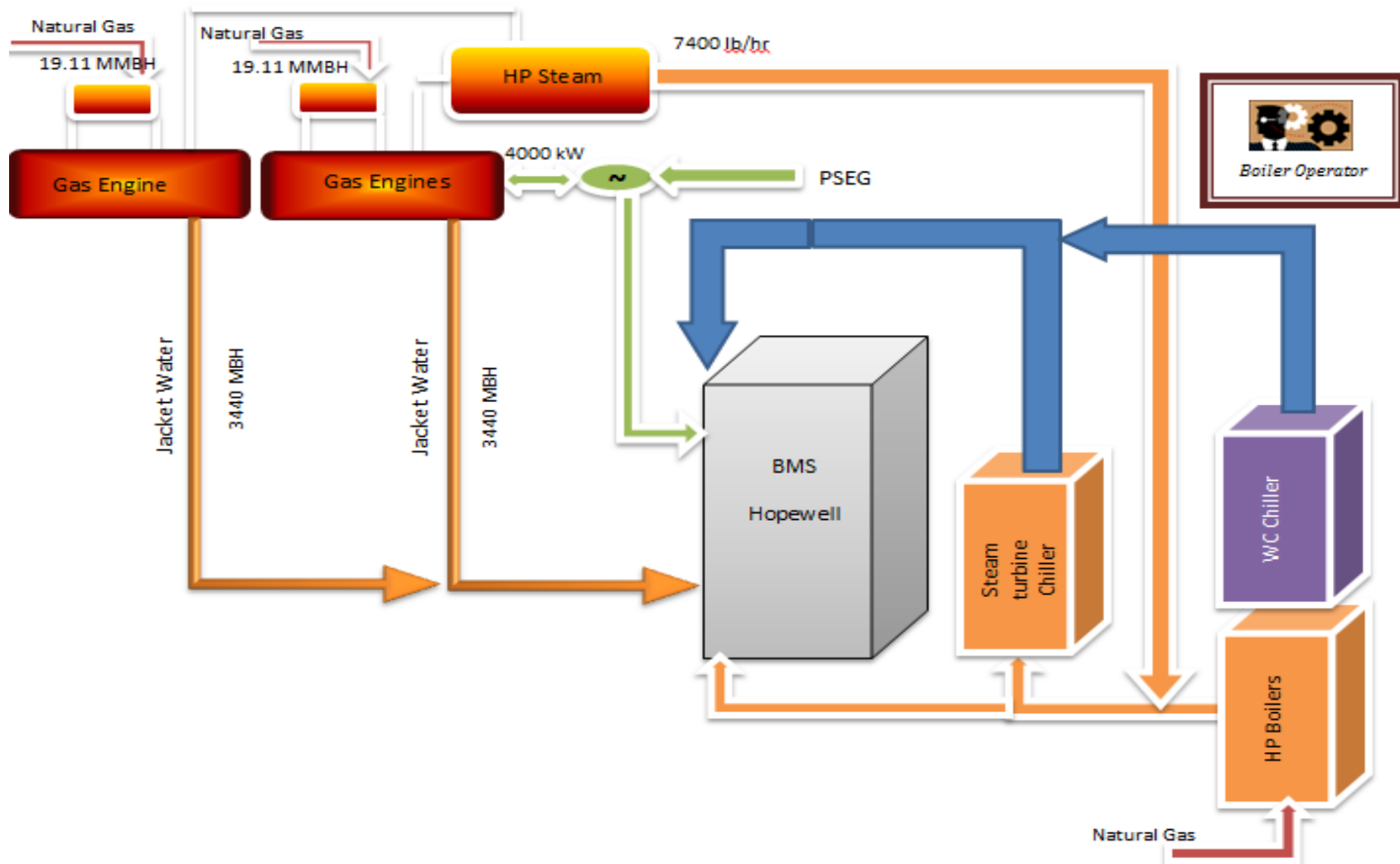
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- Post Sandy BMS considered upgrading the utility infrastructure for reliability
- Previous attempts to install Cogeneration failed due to unreasonable payback based on energy savings only.
- NJ BPU grant of \$1.98 millions combined with energy savings of \$1.12 million and PJM annual revenue of \$1.4 million provided ROI of 5 years and the project was approved.

# Designed for Reliability

- Two independent 2MW each system with a single point of failure was the basic focus of the design
- Three mode of operations further improved system reliability
  - Grid Parallel Mode – Standard Cogen operation in sync with grid.
  - Storm Anticipation Mode – Critical loads, walk away from the grid.
  - Black Start Mode – Black-out to restart the cogen.

# Overview - 2 x 2 MW Engine Based Cogen System



# Packaged System

Boilers and  
Heat X'gers

Urea Tank

SCR

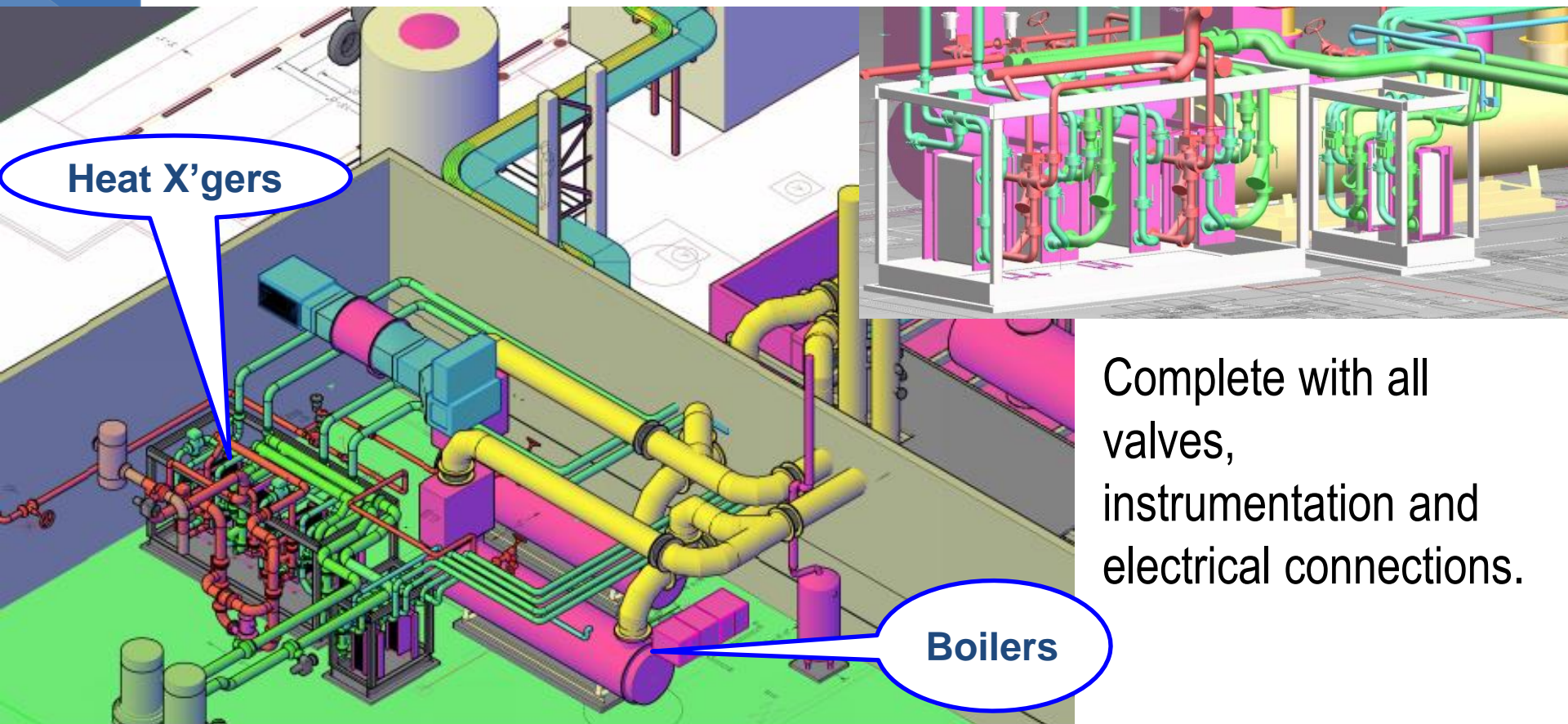
15 kV Switchgear  
Room

2 x 2 MW  
Gas Engines

OxyCat



# Pre-fabricated Skids



Complete with all valves, instrumentation and electrical connections.

# Storm Anticipation Mode

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- ATS to regulate step loading in accordance to the engine block load capability.
- In 40 min, critical buildings to be disconnected from the utility and fed from the onsite generators
- Maintain mode till grid reliability is improved.

# Information Display

WELCOME

[Log In](#)

## Bristol Myers Squibb Cogeneration Plant

**Commitment to Conservation of Energy & Environment**





# Thoughts behind the information display

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- User friendly and System approach to information
- Able to indicate instantaneous system efficiency.
- Instantaneous Calculations of acres of trees saved
- Ease of navigation and system understanding
- Reports for regulation agencies
- Electronic design documentations

# Input Screen

# of Units

Heat Recovery

Mode of  
Operation

GEN 1

GEN 1 Steam

ON

Match System Psig

Parallel  
Mode

kW Set

GEN 2 Steam

OFF

Match System Psig

Island  
Mode

GEN 2

GEN 1 HW

ON

Match System °F

kW Set

GEN 2 HW

OFF

Match System °F

Black  
Start

*Alarm*

*Status*

*Running*

*Shut  
Down*

*Start*

*Modify*

# System Overview

Performance

Generator

HRS

Heat  
Exchanger

Exhaust  
System

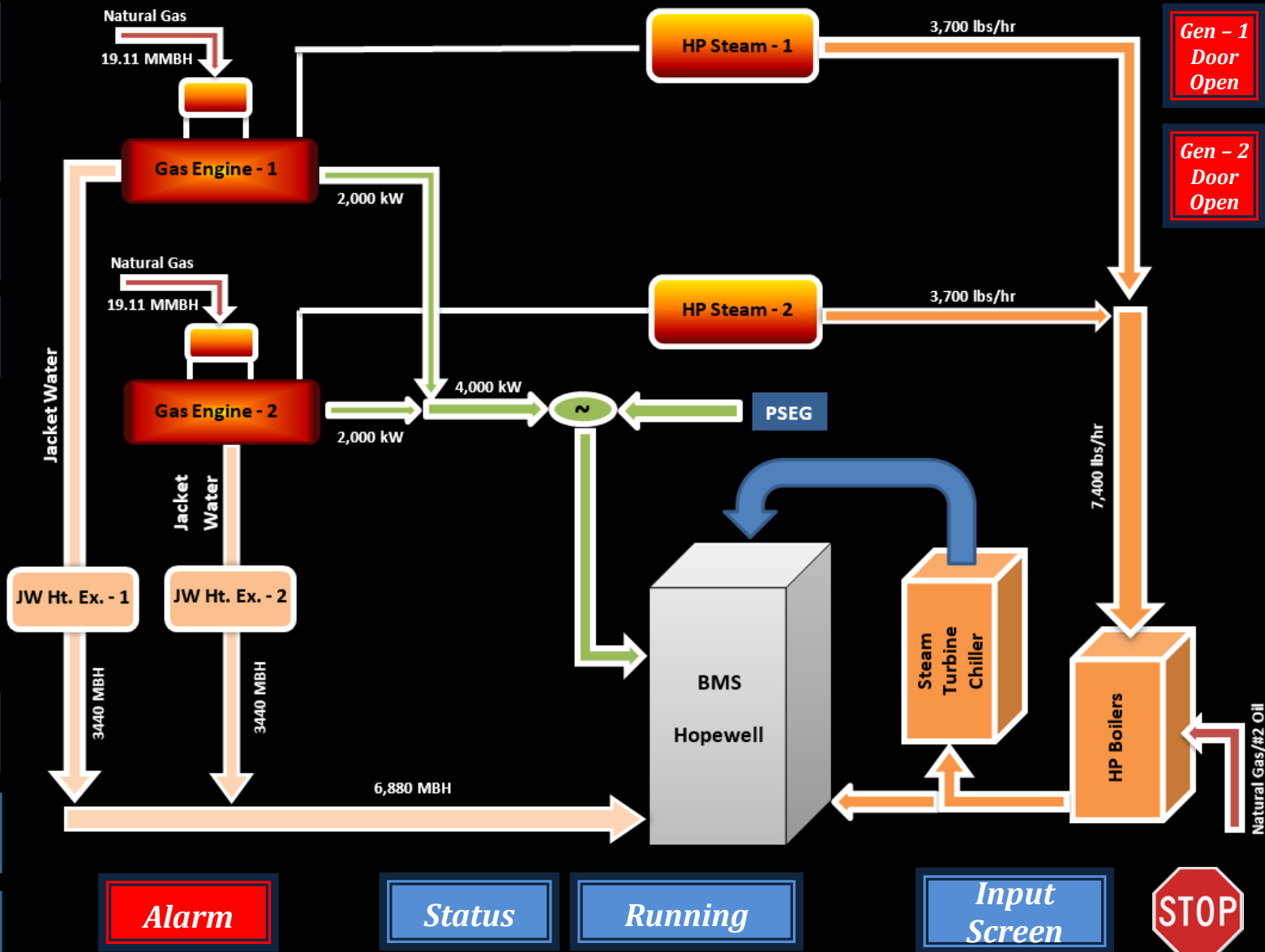
Natural Gas

Air System

Alarms

Reports

Documents



# Performance

Natural Gas Input 100%

Useful Energy 76.7%

Losses 23.3%

Electrical Output 38.7%

Historical Trends



Equivalent CO<sub>2</sub> Reduction

Tons of CO<sub>2</sub>

Acres of Trees

Other Losses 4.8%

Exhaust Losses 18.5%

Hot Water Output 20.0%

Steam Output 18%

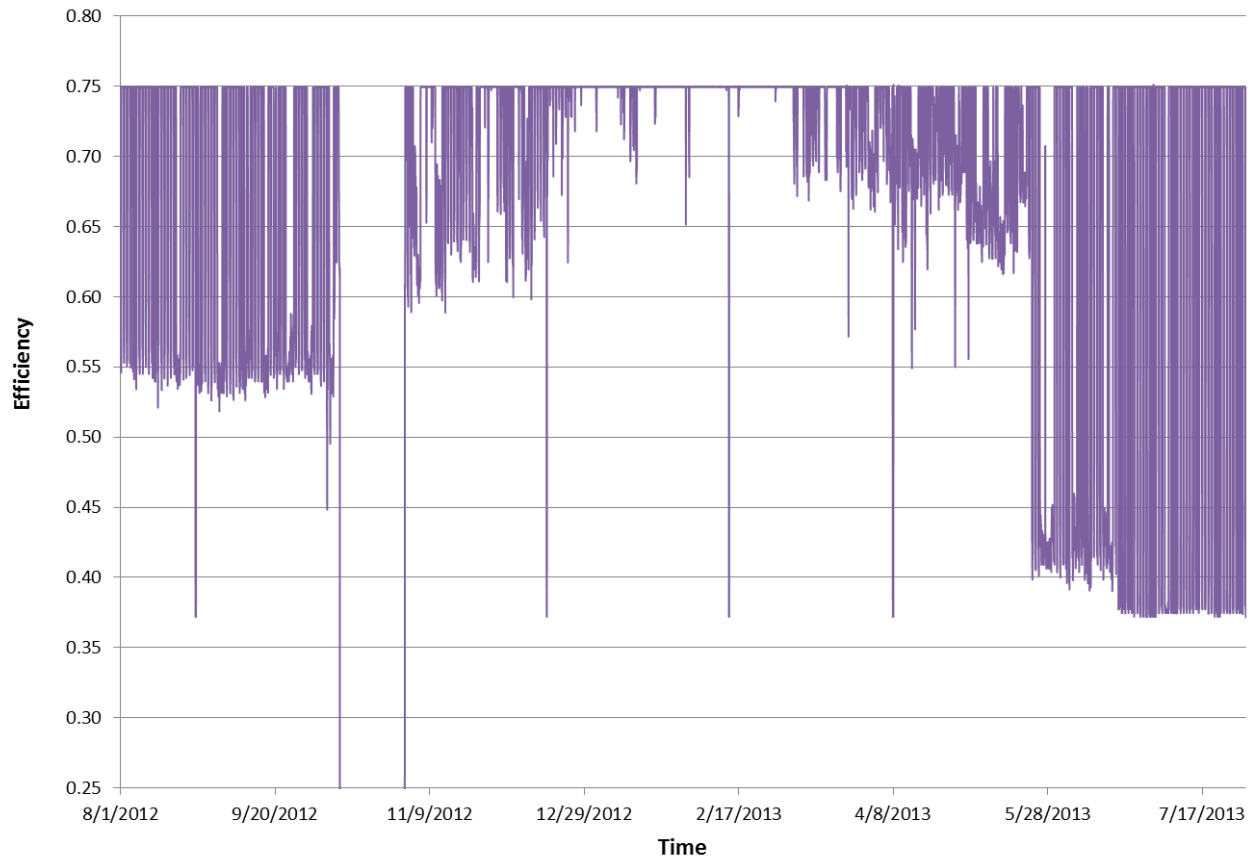
Gen - 1 Daily	<input type="text" value="η"/>	Gen - 2 Daily	<input type="text" value="η"/>	HRSG - 1 Daily	<input type="text" value="η"/>	HRSG - 2 Daily	<input type="text" value="η"/>
Gen - 1 Weekly	<input type="text" value="η"/>	Gen - 2 Weekly	<input type="text" value="η"/>	HRSG - 1 Weekly	<input type="text" value="η"/>	HRSG - 2 Weekly	<input type="text" value="η"/>
Gen - 1 Monthly	<input type="text" value="η"/>	Gen - 2 Monthly	<input type="text" value="η"/>	HRSG - 1 Monthly	<input type="text" value="η"/>	HRSG - 2 Monthly	<input type="text" value="η"/>
Gen - 1 Yearly	<input type="text" value="η"/>	Gen - 2 Yearly	<input type="text" value="η"/>	HRSG - 1 Yearly	<input type="text" value="η"/>	HRSG - 2 Yearly	<input type="text" value="η"/>

# Historical Trends

*Generator  
Performance*

*HRSG  
Performance*

*Download*



*Alarm*

*Status*

*Running*

*Input  
Screen*

*Overview*

STOP



# Generator – Main Screen

## TOTAL GENERATOR LOAD



*Generator  
One Line*

*Generator  
Data*



**BREAKER OPEN  
NO VOLTAGE  
PRESENT**



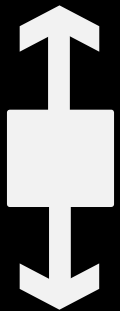
**BREAKER OPEN  
VOLTAGE  
PRESENT**



**BREAKER CLOSED  
NO VOLTAGE  
PRESENT**



**BREAKER CLOSED  
VOLTAGE  
PRESENT**



**BREAKER  
RACKED  
OUT OF CELL**

*Alarm*

*Status*

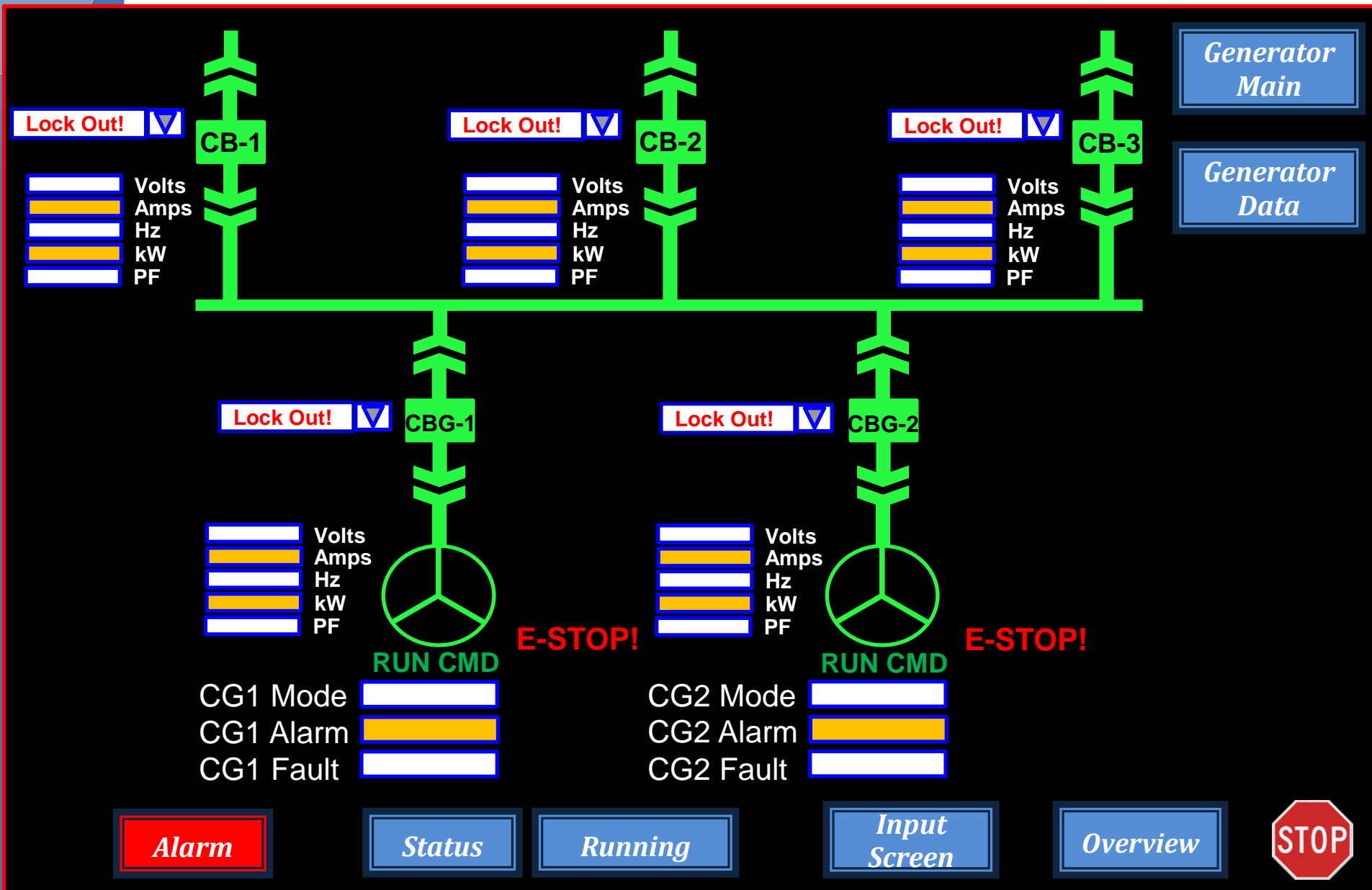
*Running*

*Input  
Screen*

*Overview*



# Generator – One Line Screen



# Generator – Data

Generator  
Main

Generator  
One Line

## ENGINE DATA

Pre-Filter Oil Pressure	<div></div>	psig
Oil Pressure	<div></div>	psig
Oil Temperature	<div></div>	°F
Coolant Pressure (HT)	<div></div>	psig
Coolant Pressure (LT)	<div></div>	psig
Coolant HT	<div></div>	°F
Intake Manifold	<div></div>	°F
Fuel Pressure	<div></div>	psia
Throttle Position	<div></div>	%
Mass Flow Rate	<div></div>	lbs/hr
Battery Voltage	<div></div>	VDC
Engine Speed	<div></div>	RPM

## GENERATOR DATA

	A	B	C	Avg/TTL
Volts L-L	<div></div>	<div></div>	<div></div>	<div></div>
Volts L-N	<div></div>	<div></div>	<div></div>	<div></div>
Amps	<div></div>	<div></div>	<div></div>	<div></div>
kW	<div></div>	<div></div>	<div></div>	<div></div>
kVAR	<div></div>	<div></div>	<div></div>	<div></div>
kVA	<div></div>	<div></div>	<div></div>	<div></div>
Stator Temp (°F)	<div></div>	<div></div>	<div></div>	<div></div>

Total Operating Hours	<div></div>
Total kWH Produced	<div></div>
Total kVARH Produced	<div></div>
Bearing Temp. (NDE)	<div></div>
Bearing Temp. (DE)	<div></div>

Alarm

Status

Running

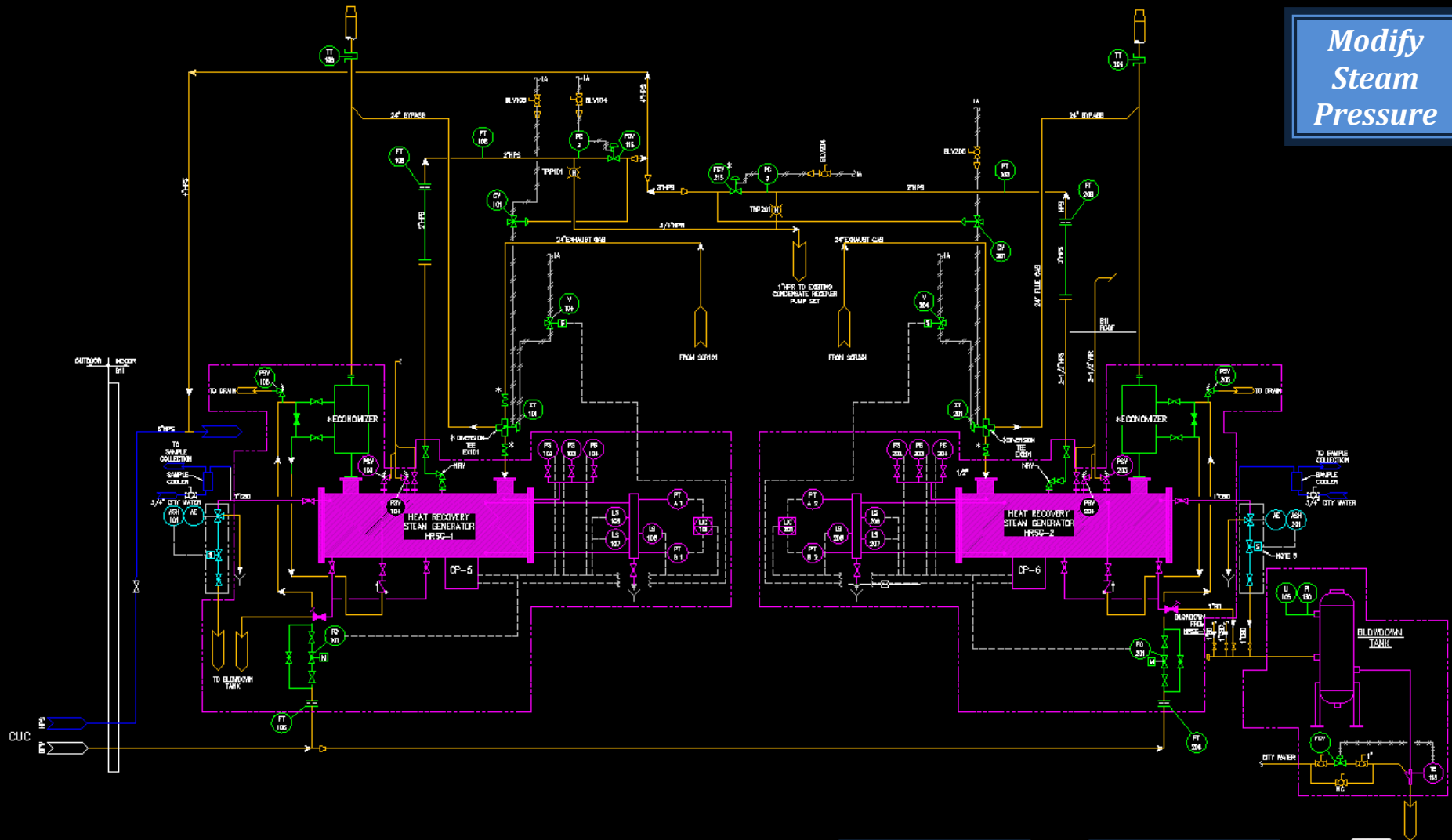
Input  
Screen

Overview



# HRSG

*Modify  
Steam  
Pressure*



**Alarm**

**Status**

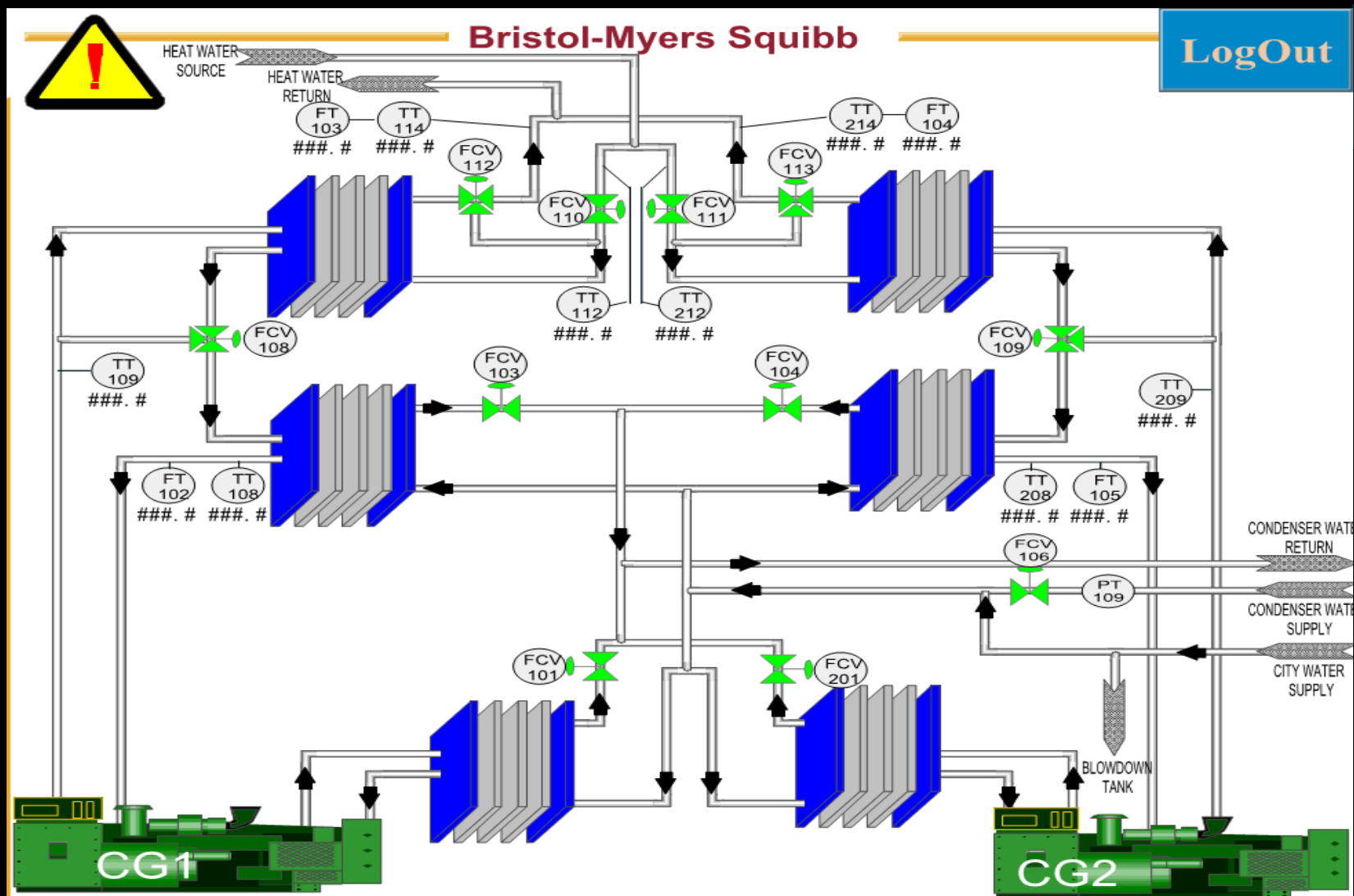
**Running**

**Input  
Screen**

**Overview**



# Heat Exchanger – HT Skid



Modify  
HW  
Temp

LT Skid

Alarm

Status

Running

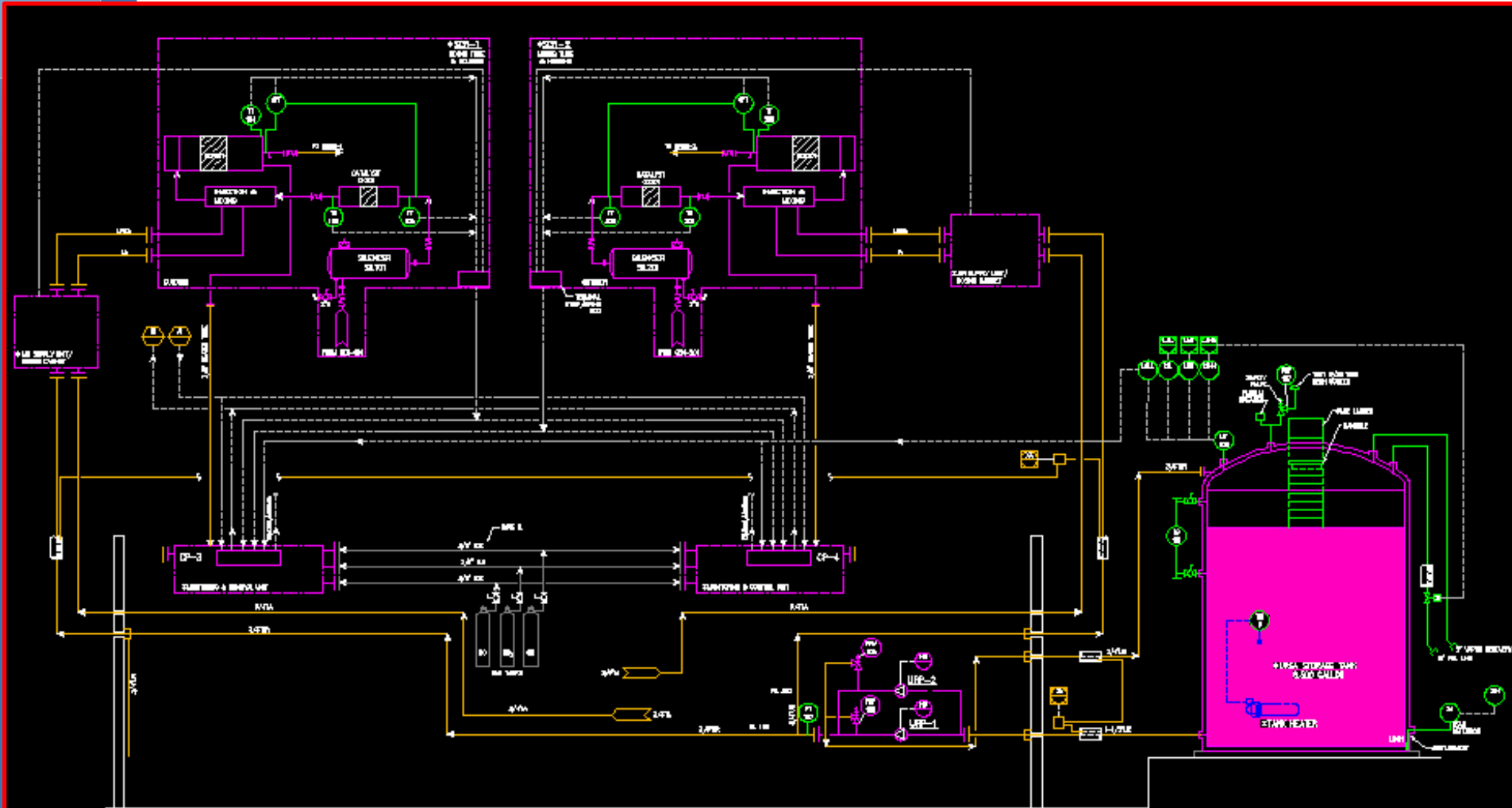
Input  
Screen

Overview





# Exhaust System



Alarm

Status

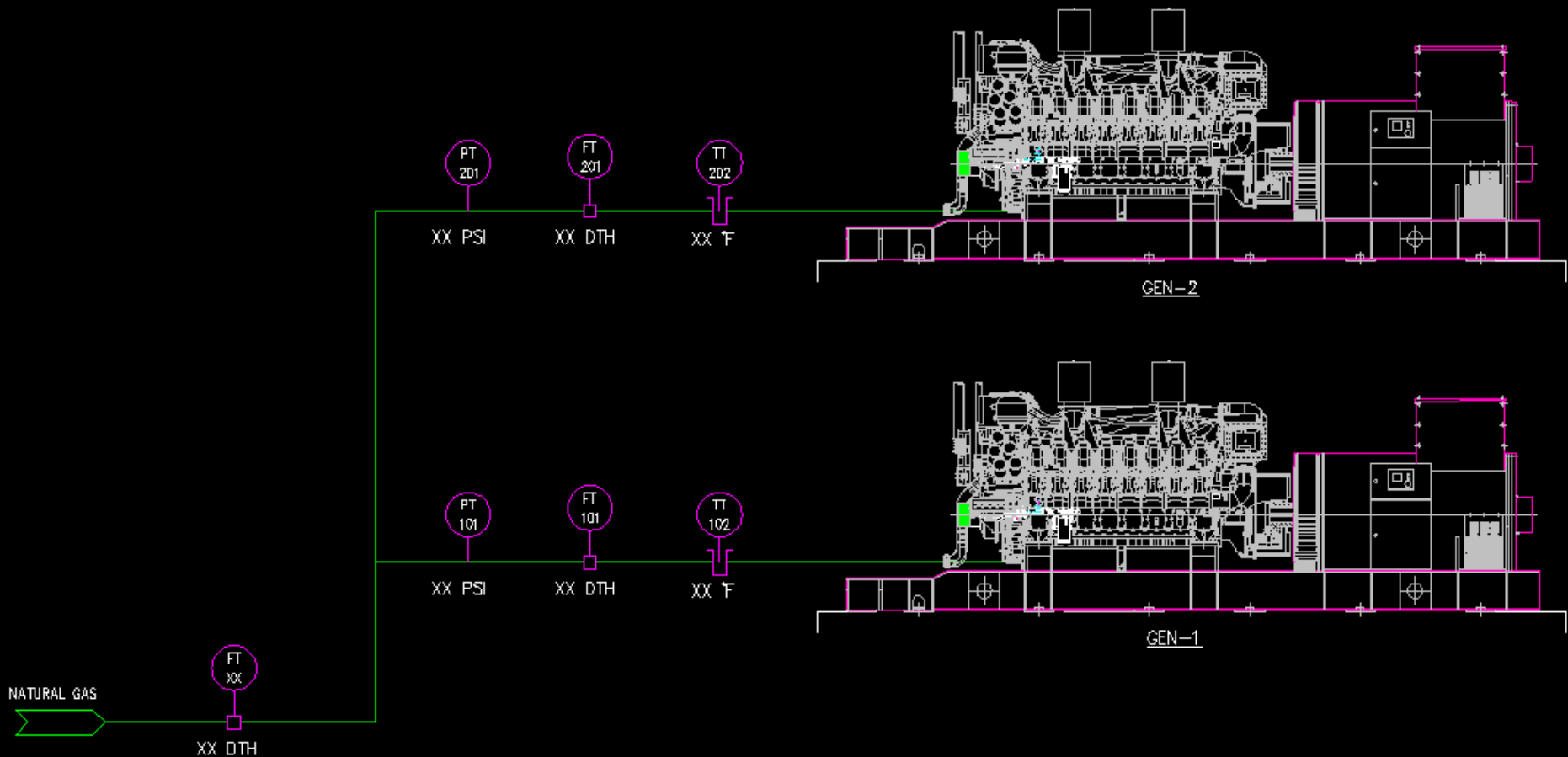
Running

Input  
Screen

Overview

STOP

# Natural Gas



**Alarm**

**Status**

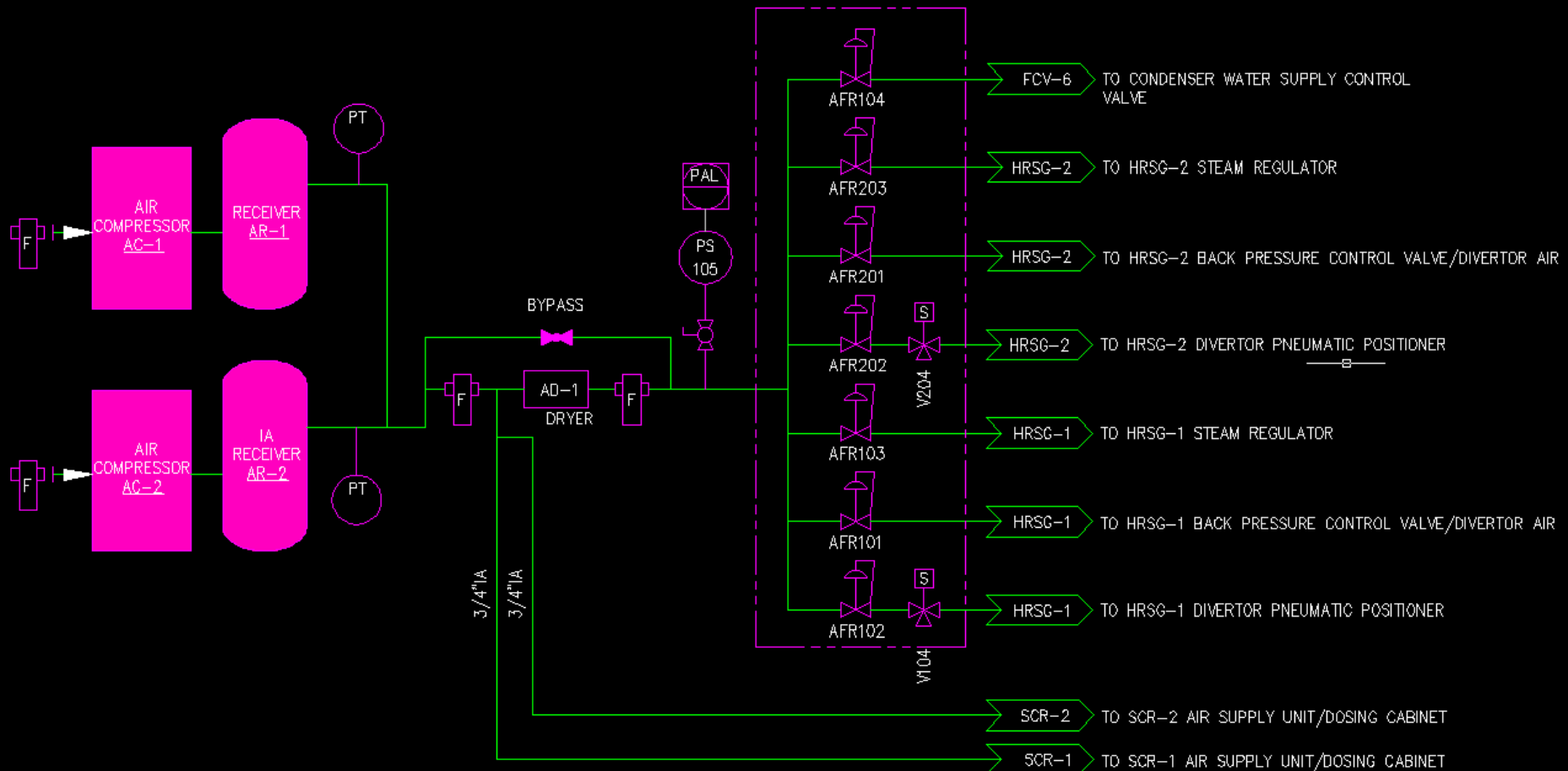
**Running**

**Input  
Screen**

**Overview**



# Air Systems



Alarm

Status

Running

Input  
Screen

Overview



# Alarms

## Current Alarms

Ack

Ack All

Reset

Refresh

Event Time

Alarm Name

Message

Acknowledge Time

Alarm and Event Summary Design View

No message selected.

# 0

🔔 0

✅ 0

🔔 0

❓ 0

Filter: Not Filtered Sorted by: Event Time (As

*Alarm*

*Status*

*Running*

*Input  
Screen*

*Overview*



# Reports

Gen - 1

Gen - 2

Power	<div></div>	MWh
Natural Gas	<div></div>	MMBtu
Steam Utilized	<div></div>	MLb
Hot Water Utilized	<div></div>	MMBtu
System Efficiency	<div></div>	%
Run Hours	<div></div>	Hours

Fuel Firing Rate	<div></div>	MMBH
Power Output	<div></div>	MW
Engine Load %	<div></div>	%
Reactant Flow	<div></div>	Gal/hr
Inlet Temperature	<div></div>	Deg F
Outlet Temperature	<div></div>	Deg F
Pressure Drop	<div></div>	Psig

Download / Print  
BPU Report

Download / Print  
Air Permit Report

Alarm

Status

Running

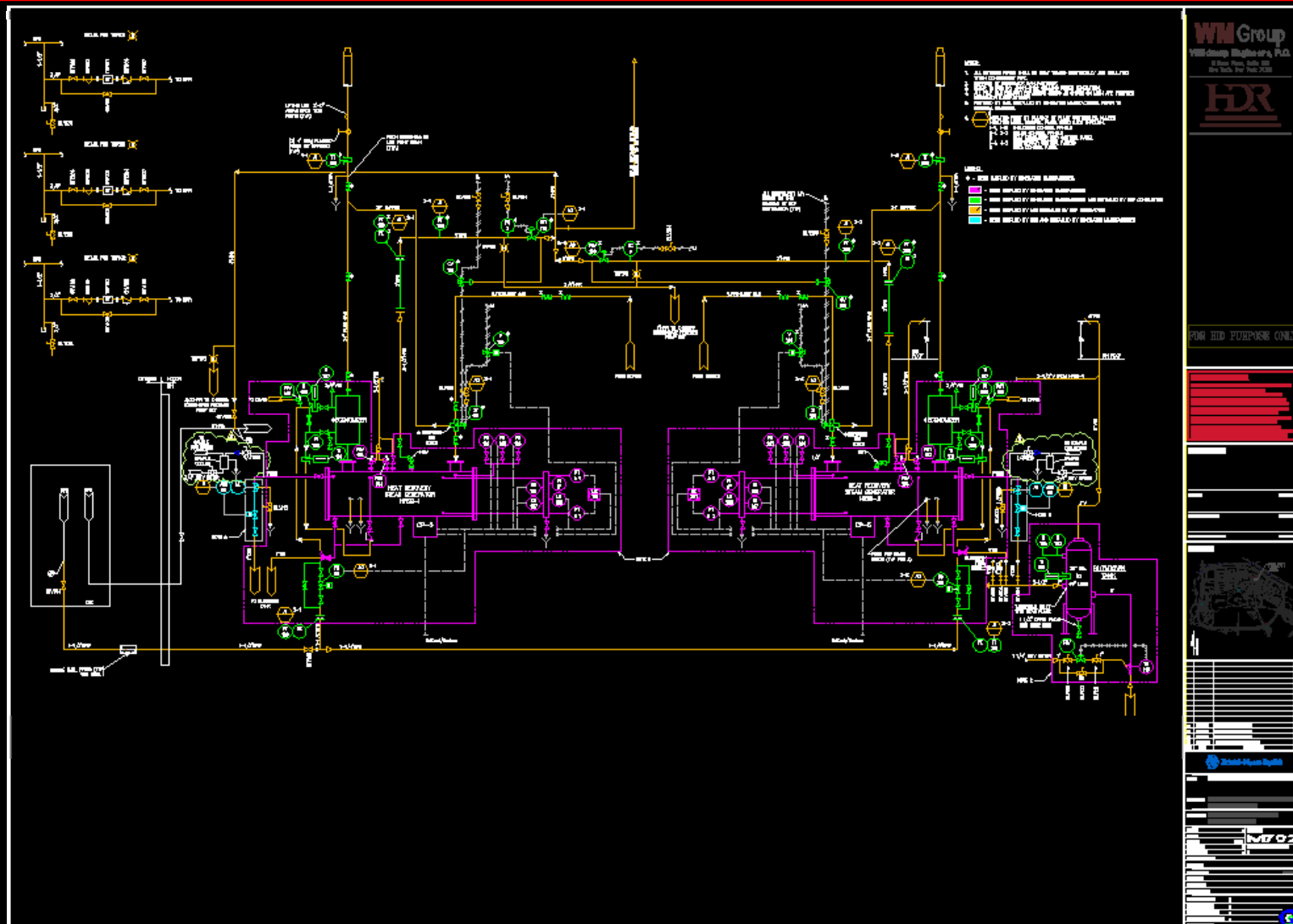
Input  
Screen

Overview





# Documents



## P&ID Drawings

## Wiring Diagrams

## Equipment List

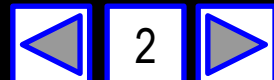
## Sequence of Operation

## Daily Logs / Checks

## Maintenance

## Spare Parts

???



## Alarm

## Status

## Running

## Input Screen

## Overview



# Incentives and PJM Market Rewards

- The project received \$1.98M incentive from NJ Board of Public Utilities
- The configuration allows BMS to participate in PJM market and work on economic dispatch
- Estimated Savings (Cogen Operation) - \$1.12M (5500 hrs of operation)
- Estimated PJM Market Revenue - \$1.4M

# Lesson Learnt

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- Integrated system approach was key to the success of the project.
- Pre-planning and detailed wiring diagrams are a must on any complex project.
- Enough time should be allocated to commissioning and testing of system specifically when this is an active site.



**THANK YOU**