



## Gainesville Regional Utilities: Reciprocating Engine CHP

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# Agenda

*To provide a high level overview of the history of CHP at GRU and the considerations of utilizing a REG as a CHP asset in an existing facility.*

- ▶ GRU/Shands Partnership
- ▶ Phase 1 Evaluation
- ▶ Phase 2 Analysis and Technology Overview
- ▶ Design/Implementation
- ▶ Next Steps?

# In the Beginning.....

- ▶ 2006 Master Plan
  - Phase 1:
    - ▶ Cancer Hospital (200 Beds)
    - ▶ 500,000 SF
    - ▶ Level 1 Trauma
  - 35 Year Plan
    - ▶ 3,000,000 SF
    - ▶ 1200 bed
    - ▶ 15 MW of Generation
    - ▶ 16,000 Tons of Cooling



# GRU/Shands Partnership

- ▶ Partnership between hospital and municipal utility
- ▶ Combined heat & power for efficient generation of utilities
- ▶ Multiple levels of redundancy
  - Capable to fully island
  - Capable of providing all critical loads
- ▶ Fully load diesel generators during testing
- ▶ CHP yields 80% efficient operation
- ▶ Hospital achieved LEED Gold certification thanks to Energy Center
- ▶ **Concentrate on core business**



# Phase 1 Complete

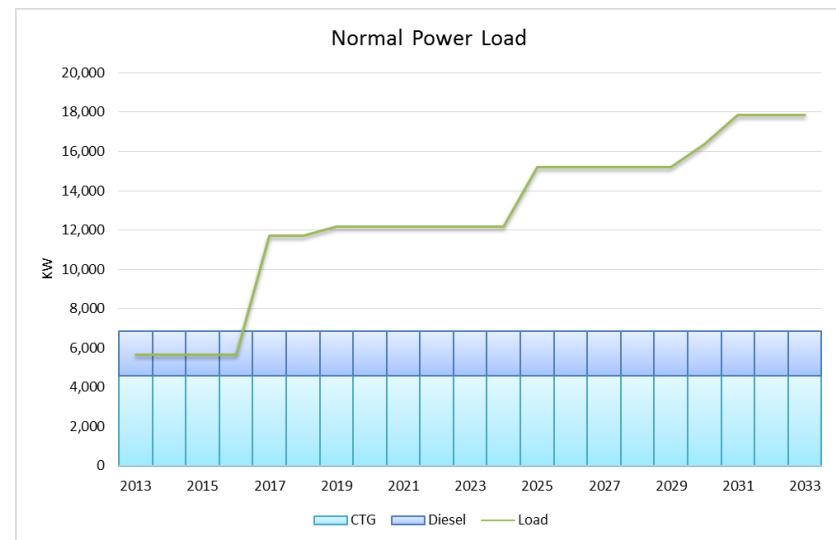
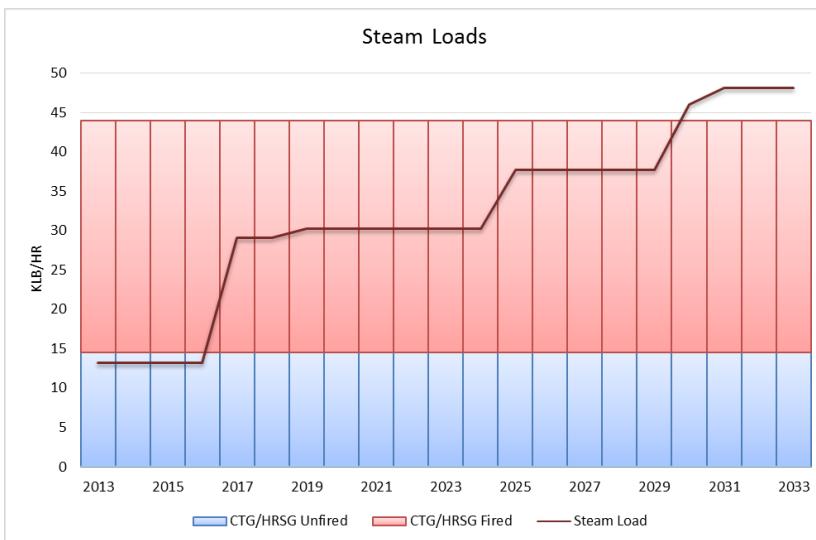
- ▶ Phase 1 Complete in 2008:
  - South Energy Center
    - ▶ 4.6 MW recuperated CTG
    - ▶ 45,000 lb/hr Fired HRSG
    - ▶ 30,000 lb/hr back-up boiler
    - ▶ 4,200 Tons of chilled water
    - ▶ 500 kW black start diesel
    - ▶ 2,250 kW emergency diesel
  - Future Expansion Plans
    - ▶ 4.6 MW CTG w/ HRSG
    - ▶ 2,250 kW emergency diesel
    - ▶ 1,500 ton chiller

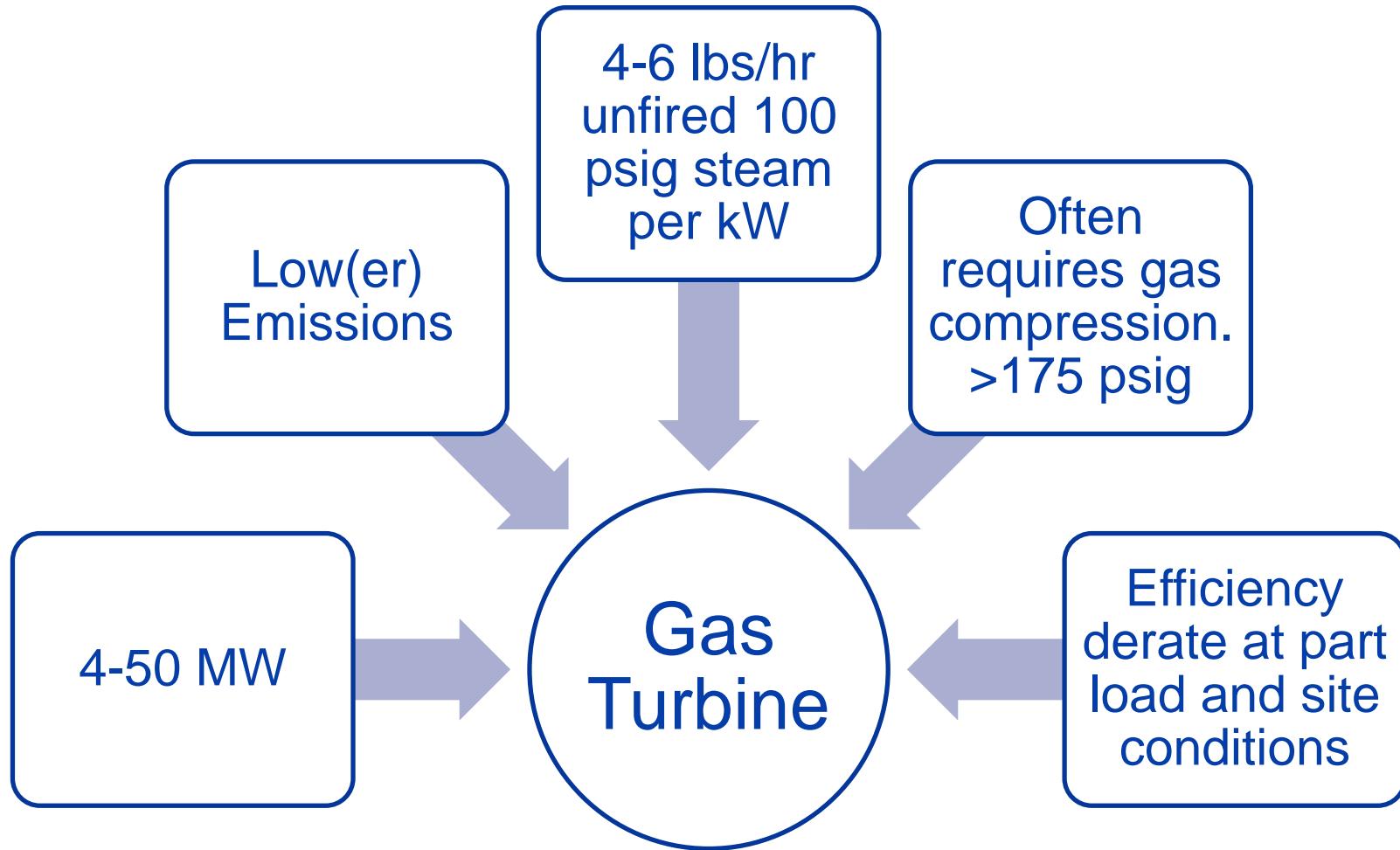


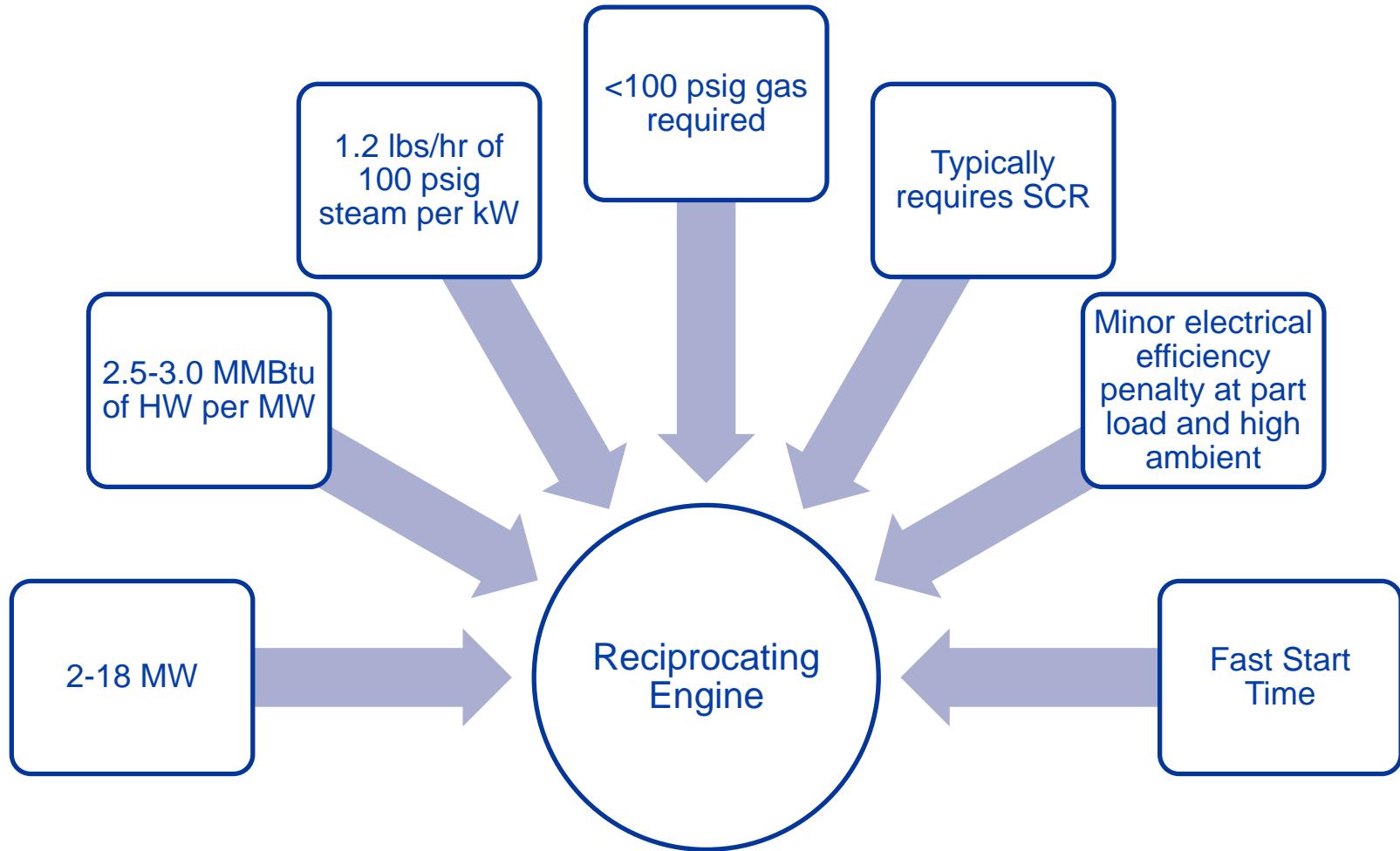
# Phase 2 – SEC Expansion

## ► Expansion Feasibility Study

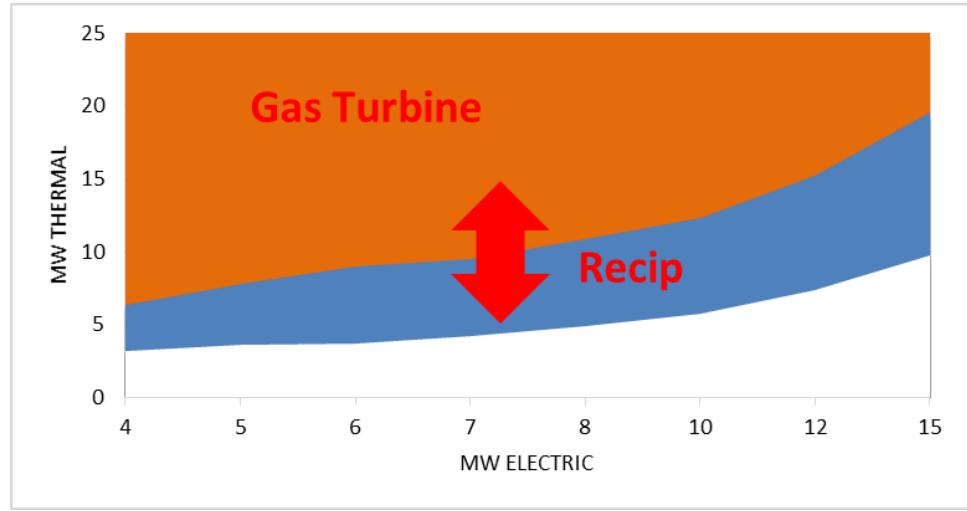
- Original calculated thermal loads ~ 30% greater than actual loads
- SEC had excess steam capacity
- Needed chilled water and power generation capacity
- Evaluated **CTG** and **Reciprocating Engine(REG)** based CHP addition



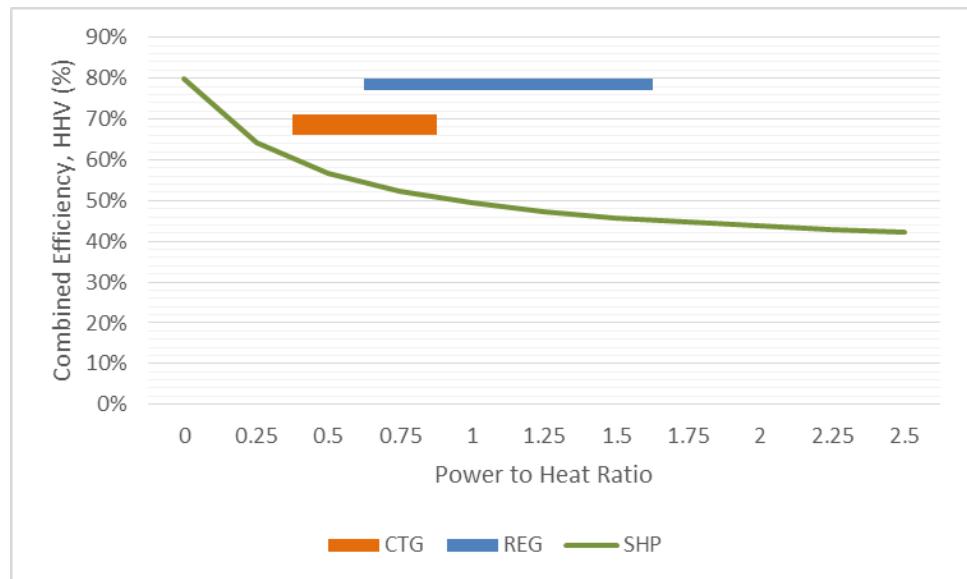




Gas Turbine		
MW	MWt	Power / Heat
3.5	6.3	0.553
4.6	7.8	0.590
5.7	8.9	0.638
6.3	9.5	0.666
8.0	10.9	0.736



Recip		
MW	MWt	Power / Heat
4.0	3.8	1.041
4.5	4.2	1.071
5.4	3.7	1.456
6.5	5.8	1.123
7.4	4.9	1.523



- Recip. thermal performance based on availability to recover engine heat

# Economic Analysis

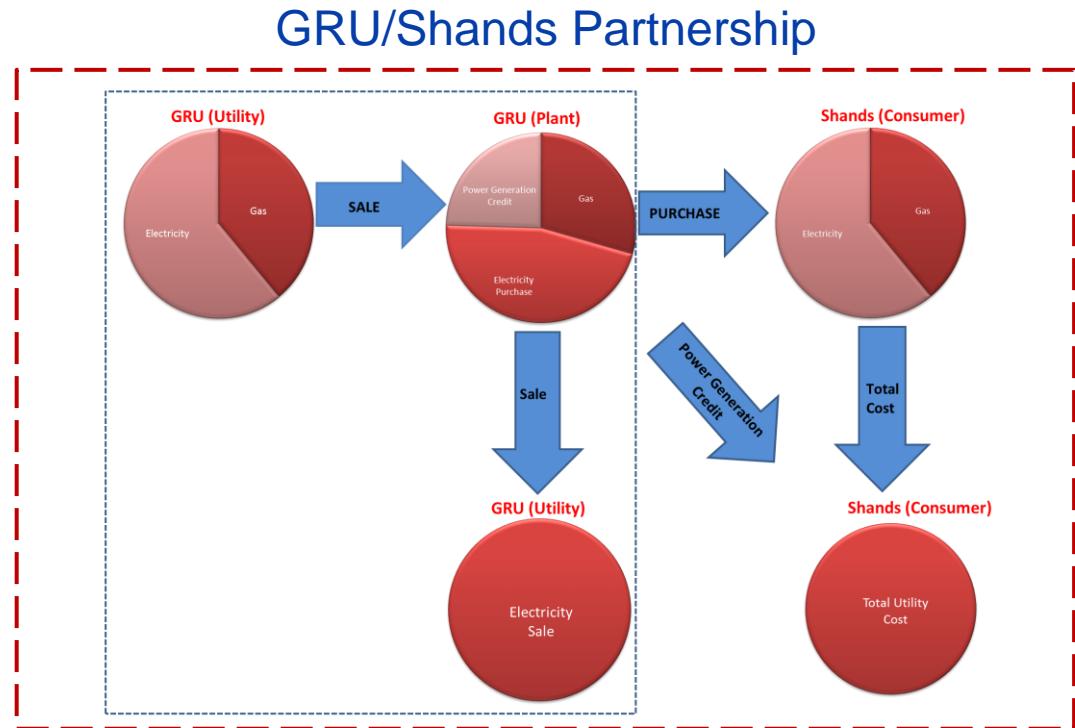
- ▶ Option Configurations:

- Prime Mover Options:

1. CTG (~4.6 MW)
2. **REG (4-9 MW)**

- Chilled Water Options:

1. Replace Existing Steam Chiller
2. **Add Electrical Chiller**
3. Add Steam Chiller

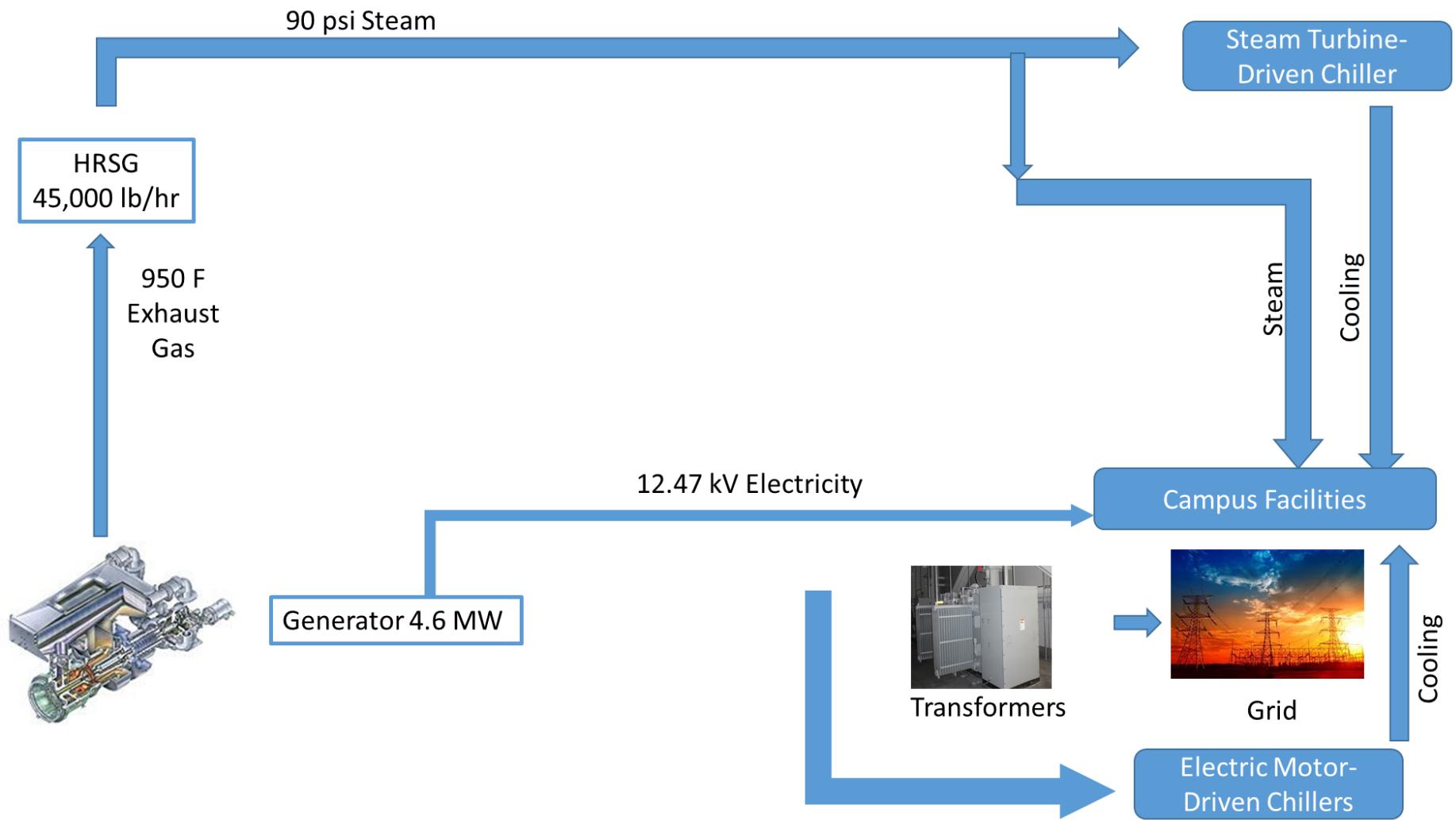


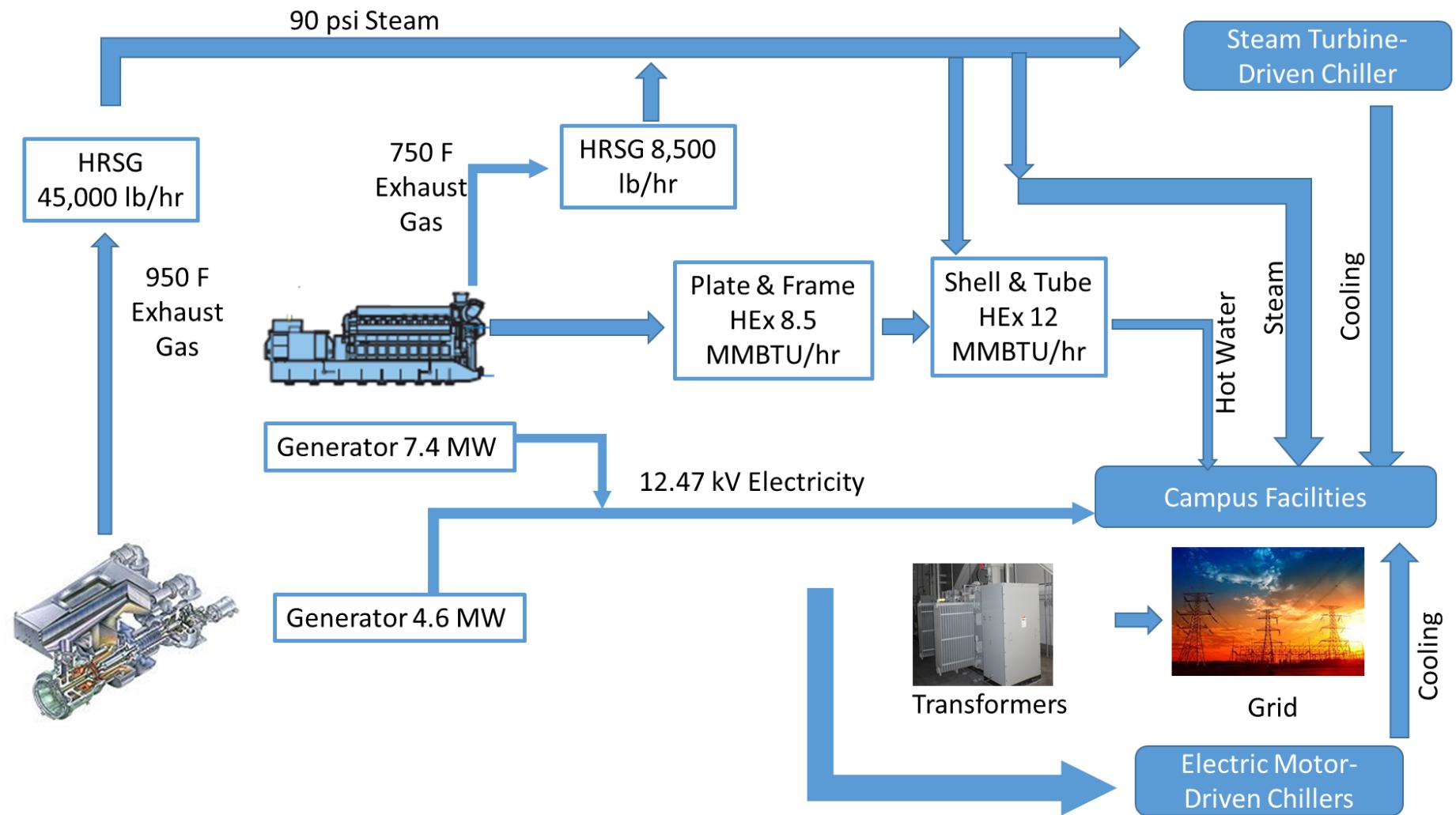
# Wartsila 16V34SG

- 7.4 MW Power Generation
- 8,775 lb/hr 110 psig steam
- 8,500 MBH of 140°F- 160°F

Hot Water



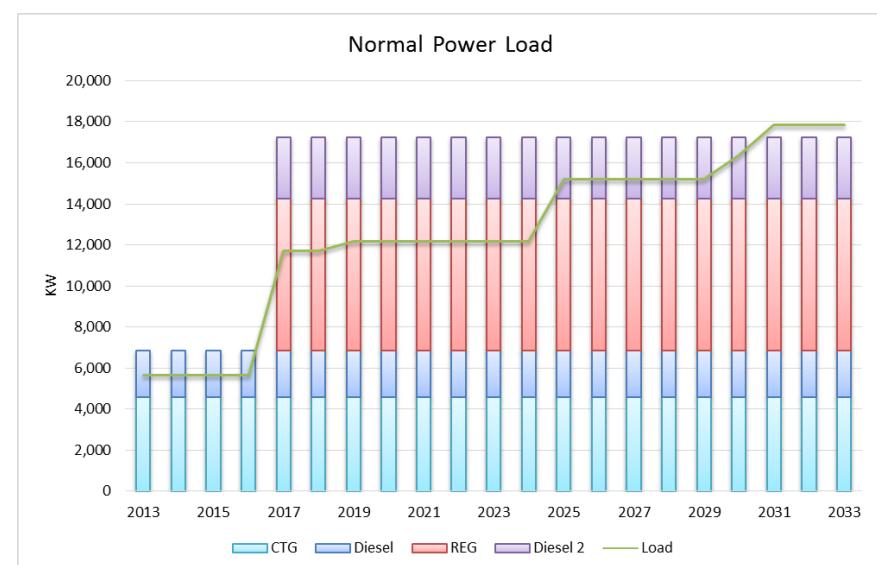
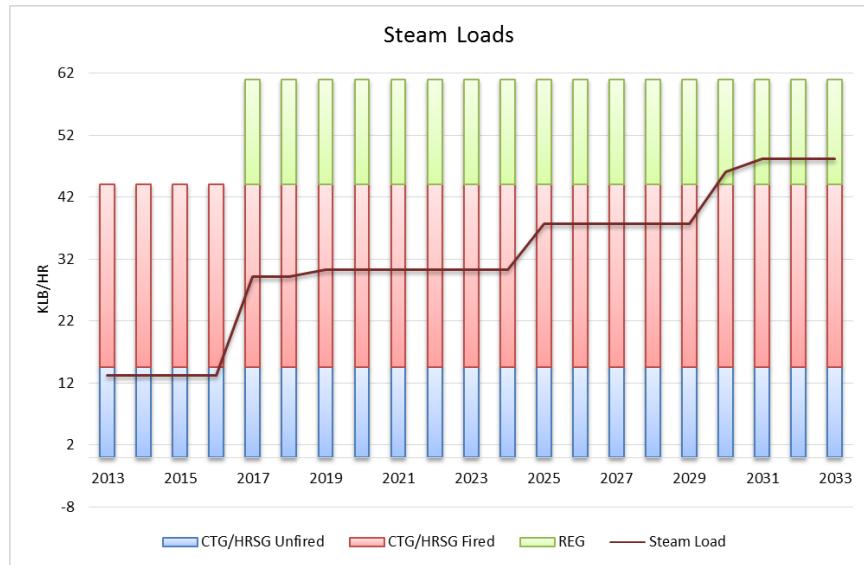




# Phase 2 – SEC Expansion

## ► Load Impact

- Excess steam/hot water capacity throughout the full load projections
- Power generation capacity to serve normal power loads over the next 10-15 years
- Most likely future expansion will be driven by critical power and chilled water demand



Electrical

Footprint

Sound

Heat Recovery

## Design and Implementation



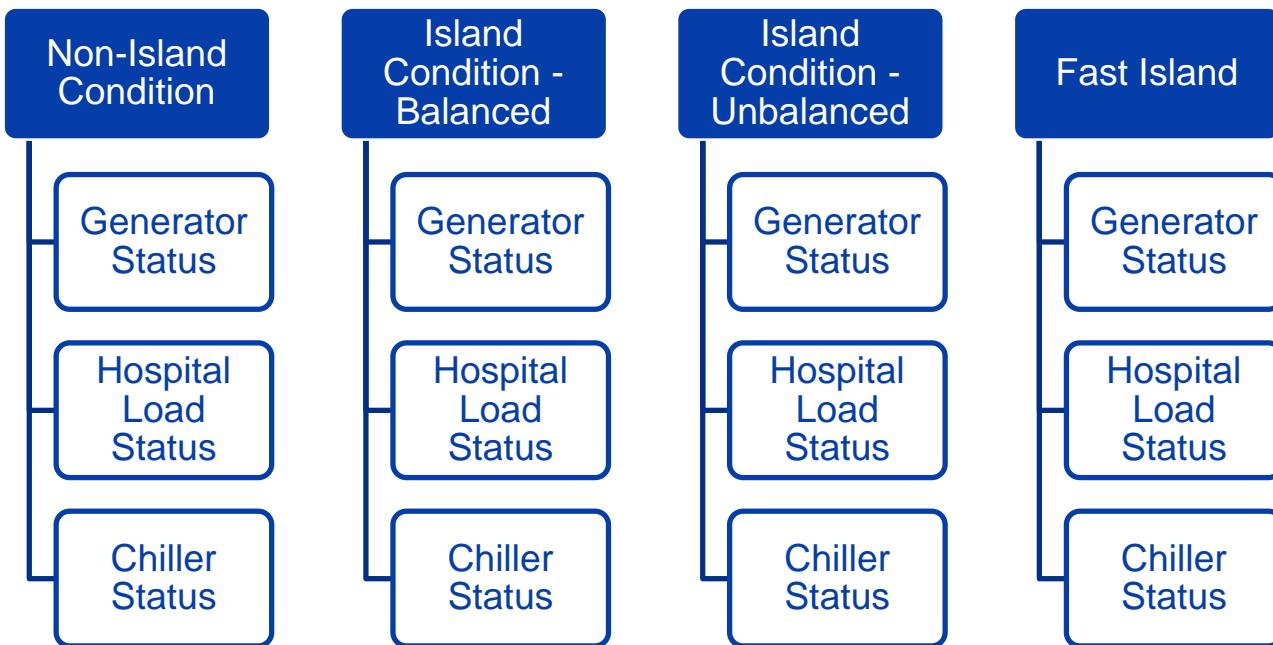
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# Stability Study

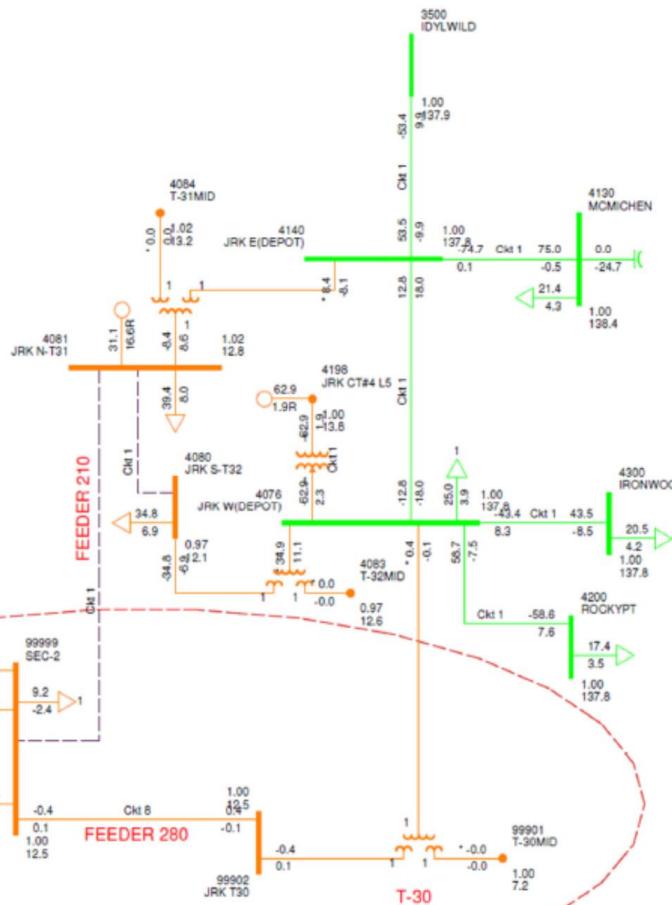


## Electrical

## Footprint

## Sound

## Heat Recovery



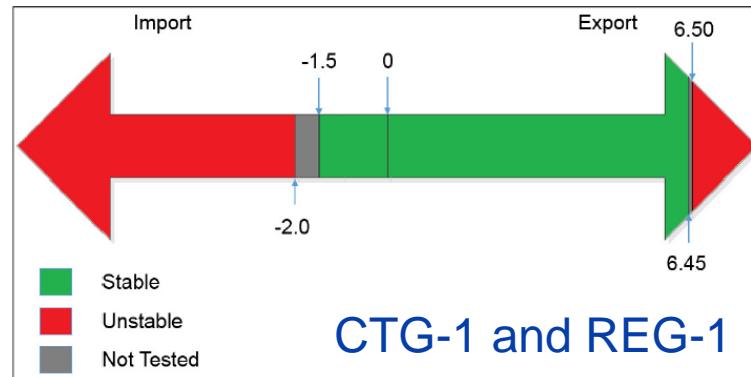
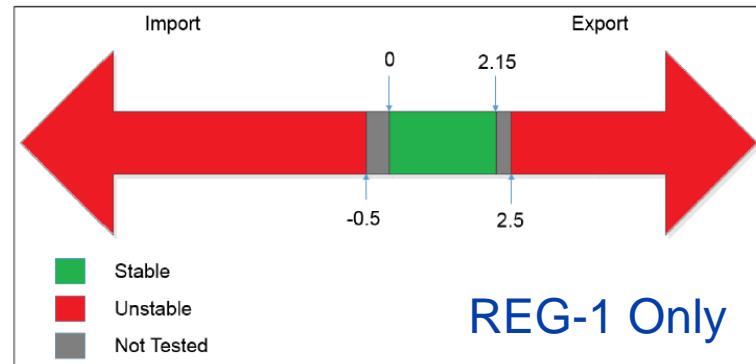
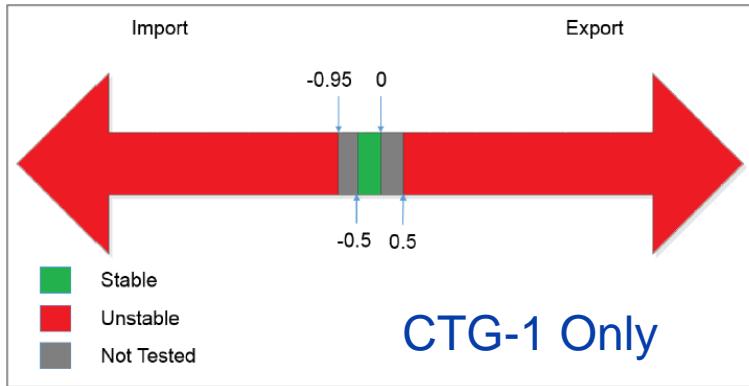
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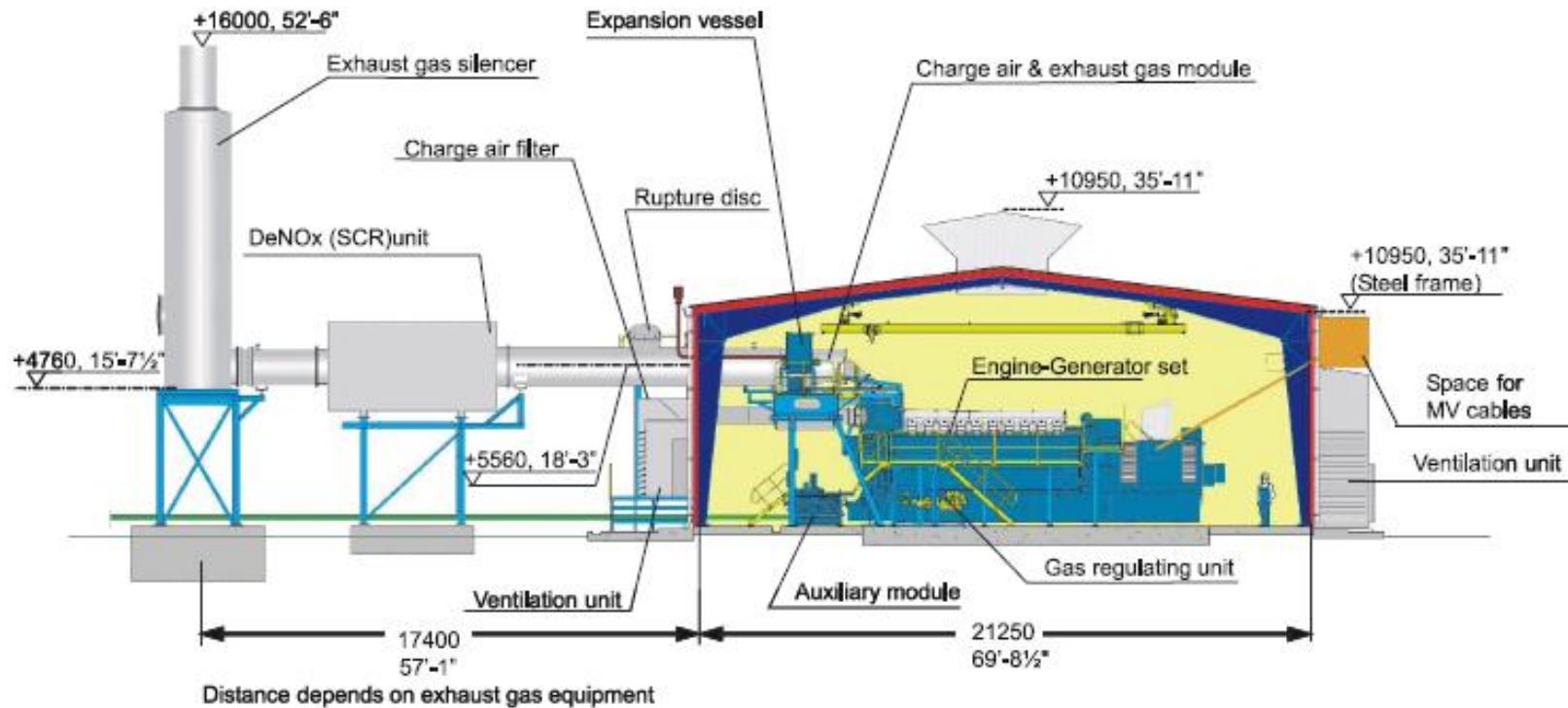
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\*From Wartsila 34SF Reference Manual

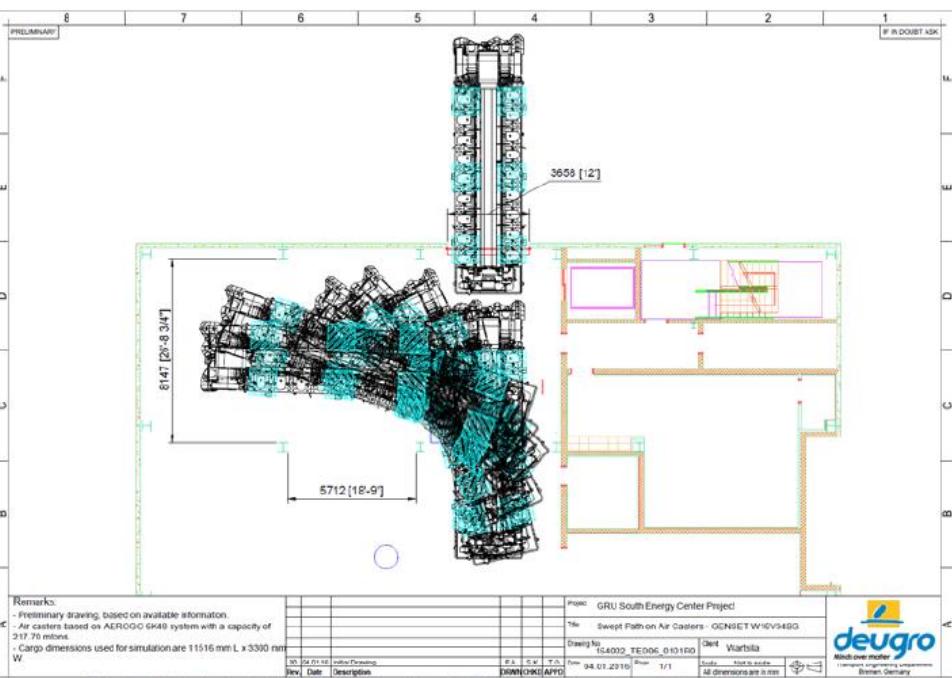
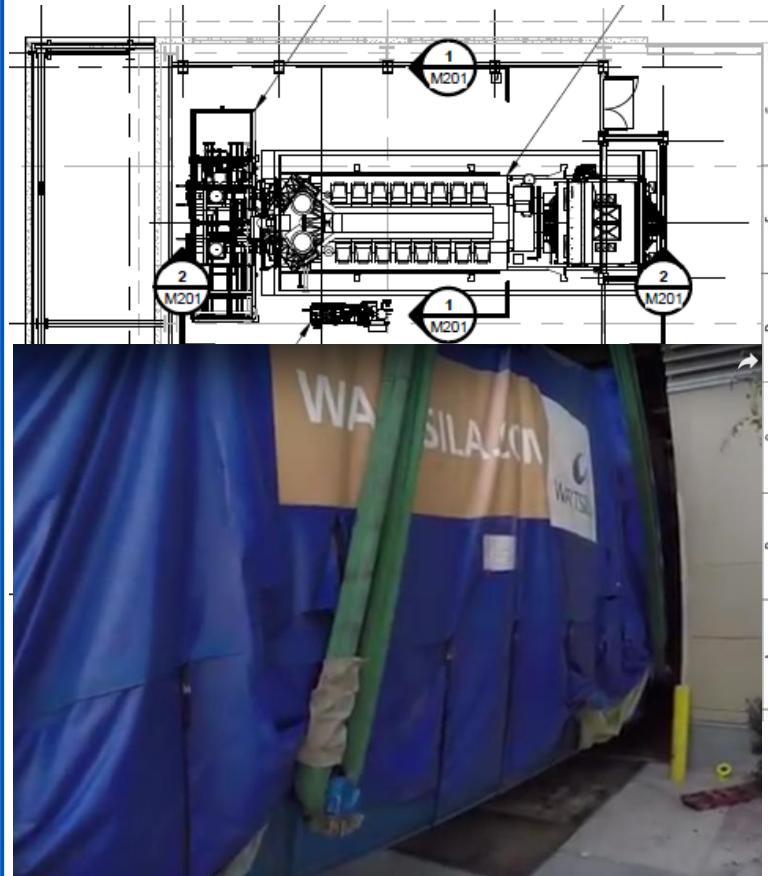
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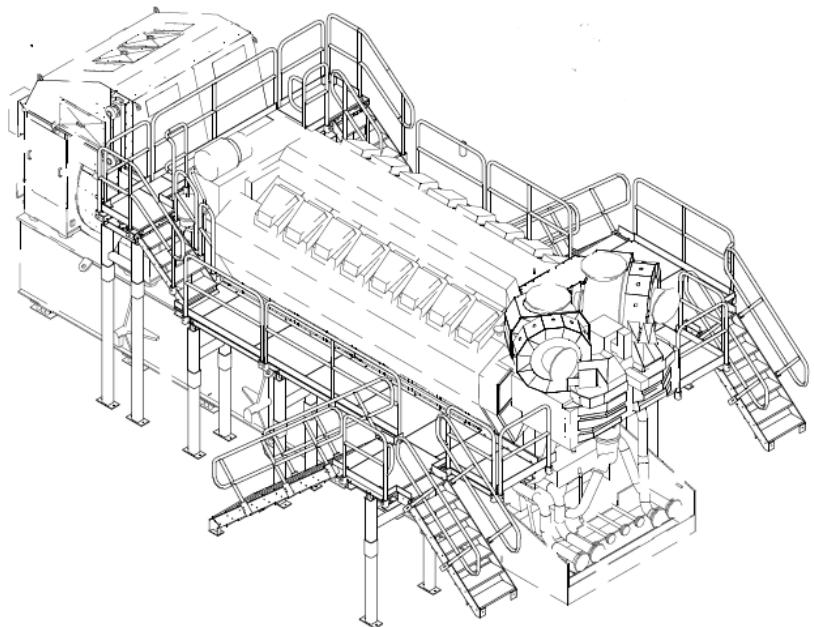
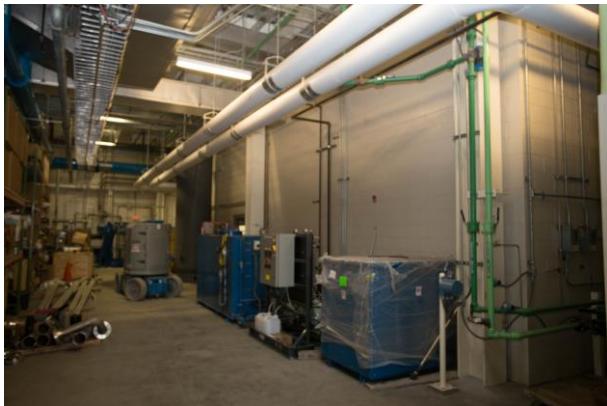
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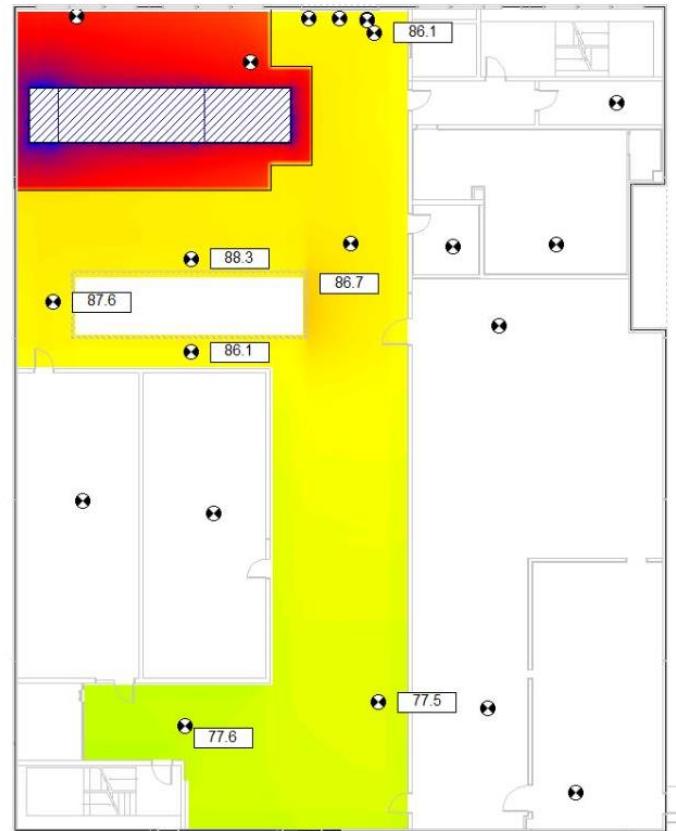
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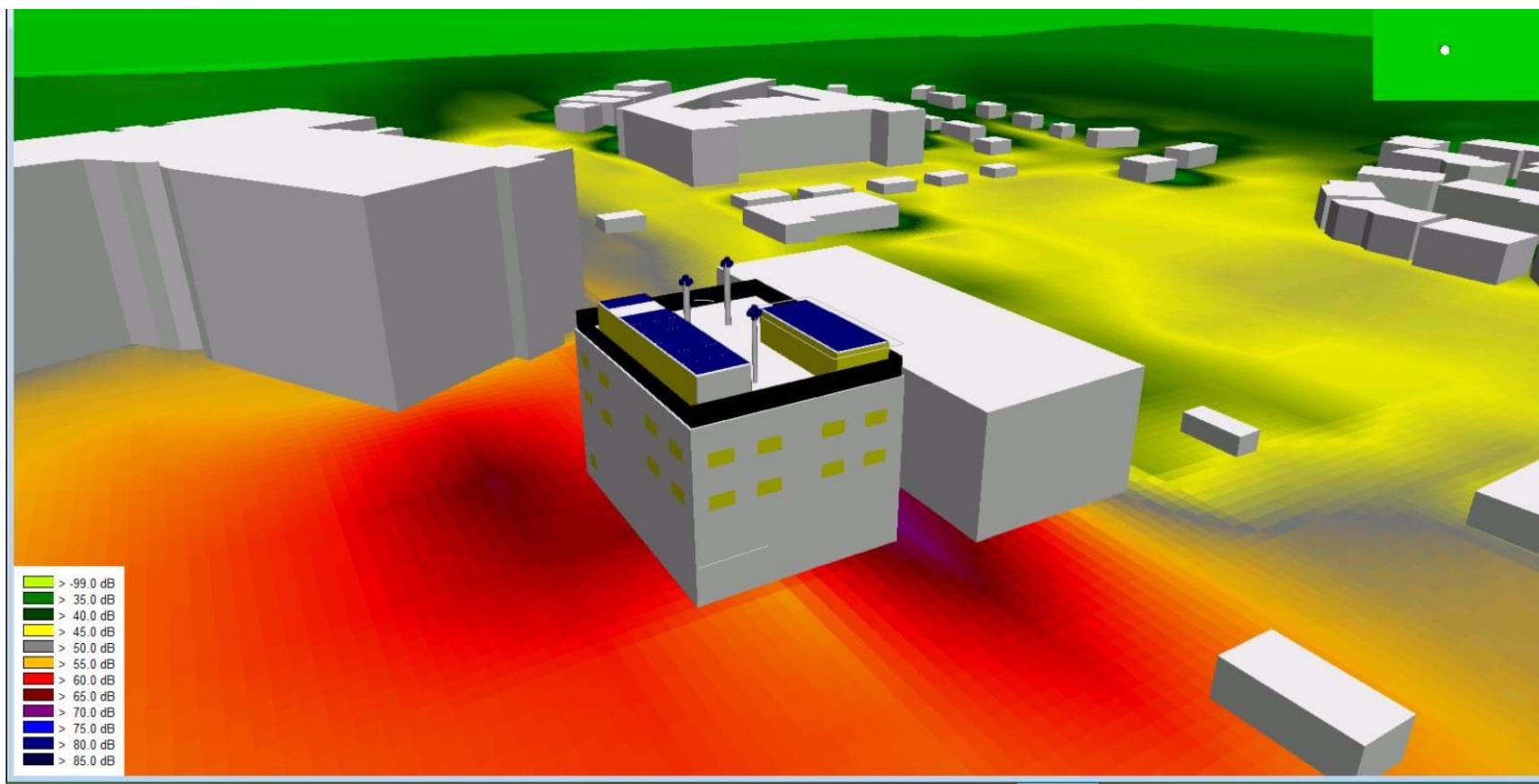


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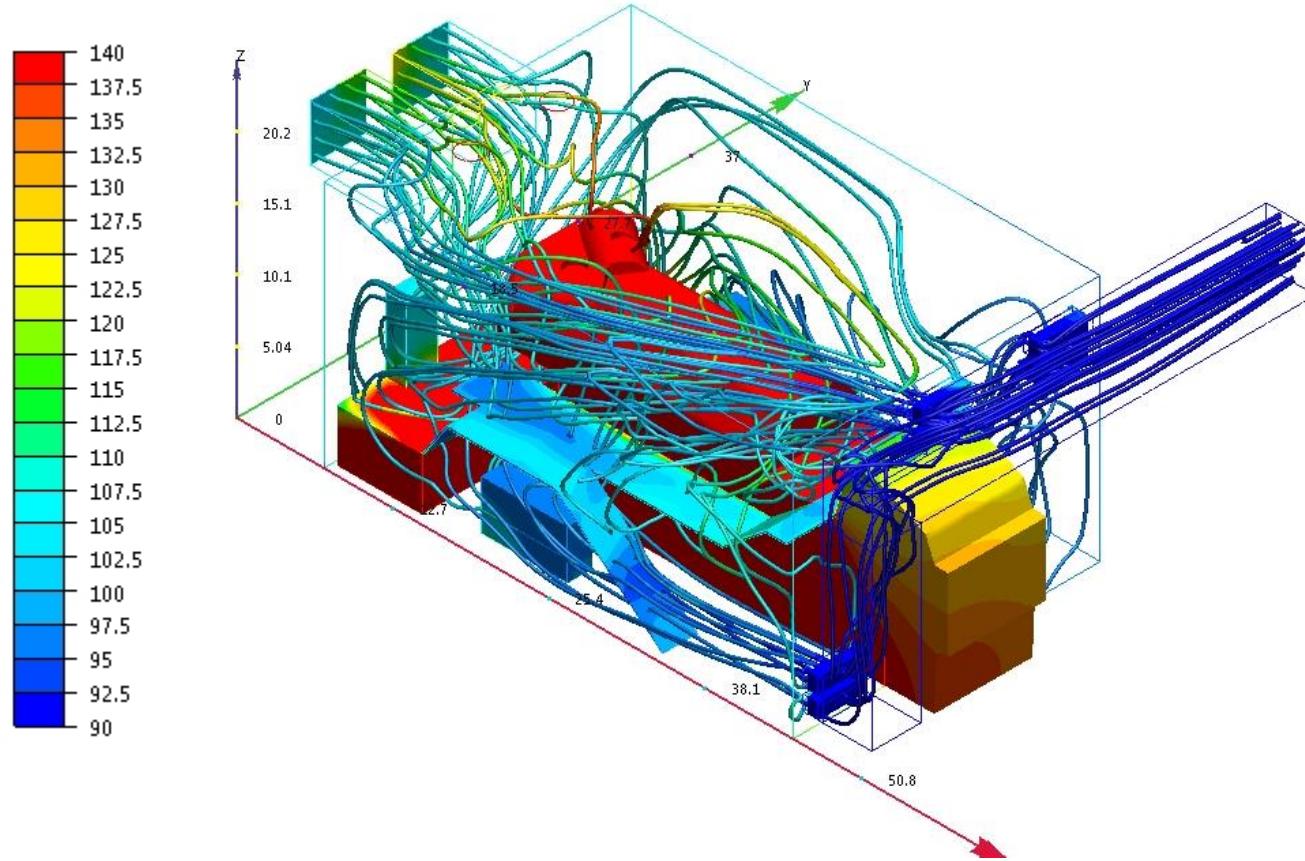
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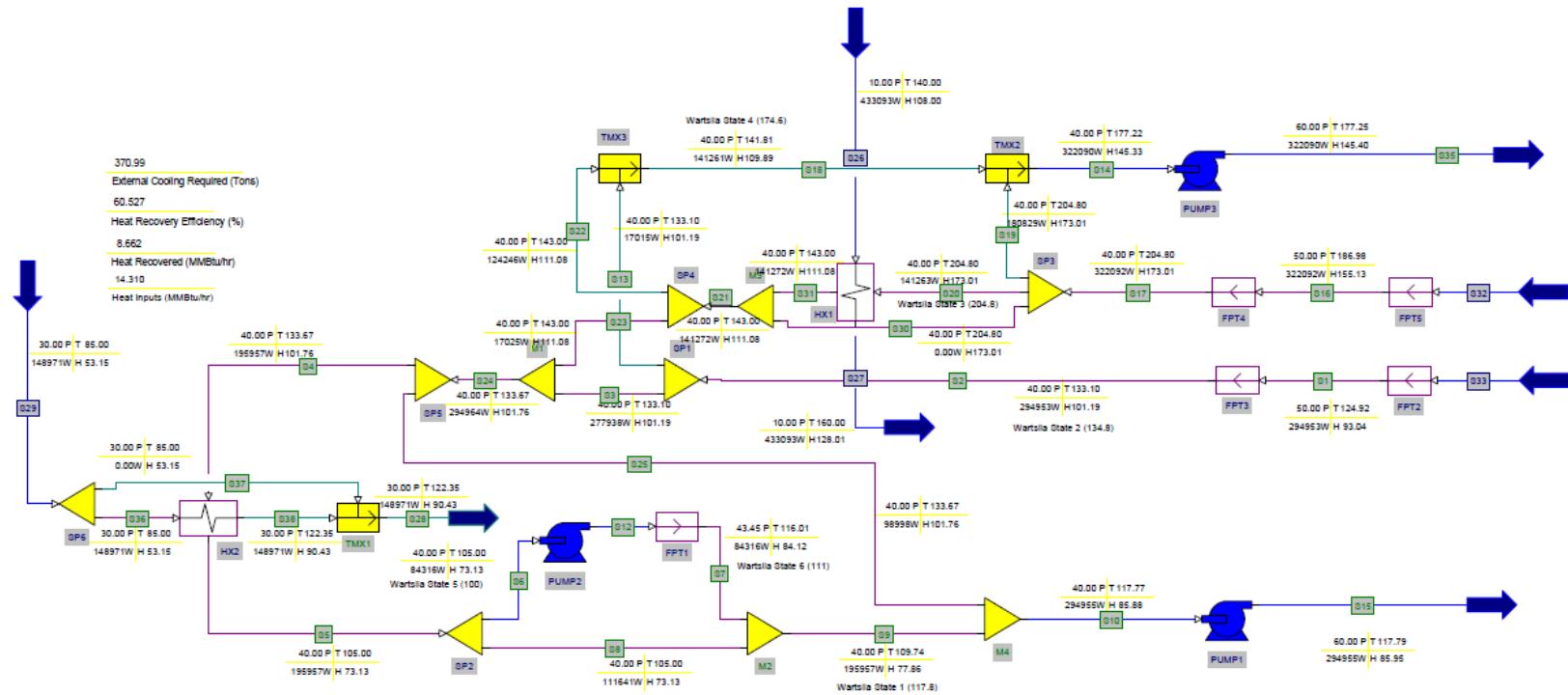
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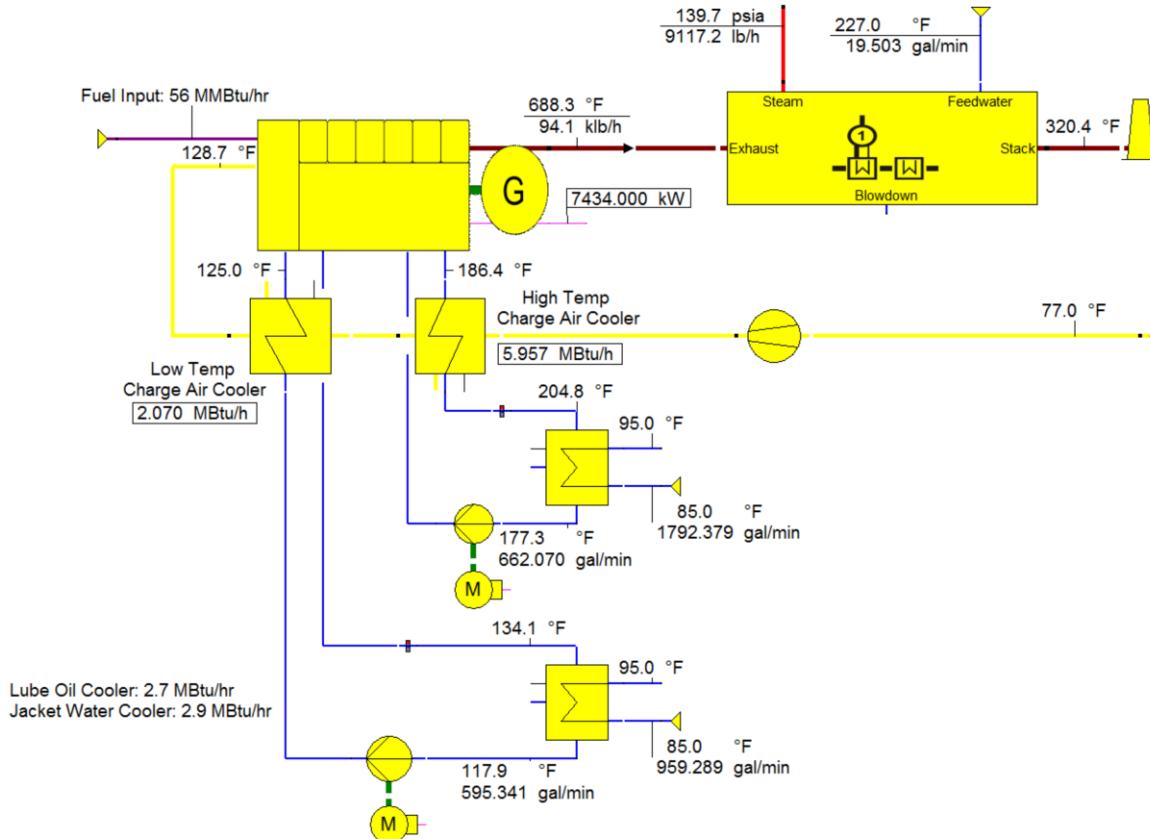
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# Design and Implementation



# Summary

- Load Evaluation is Key
- Utility Interconnection Evaluation (Stability Study)
- Space Availability
- Sound Study
- Heat Recovery

# Next Steps?

Construction Complete Spring 2017

Future Building Expansion?

# Question/Answers?



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