
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

The George Washington University District Energy System

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The LeBlanc Lab - The George Washington University

February 16th, 2021

THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON, DC

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Q&A Will Not Be Answered Live

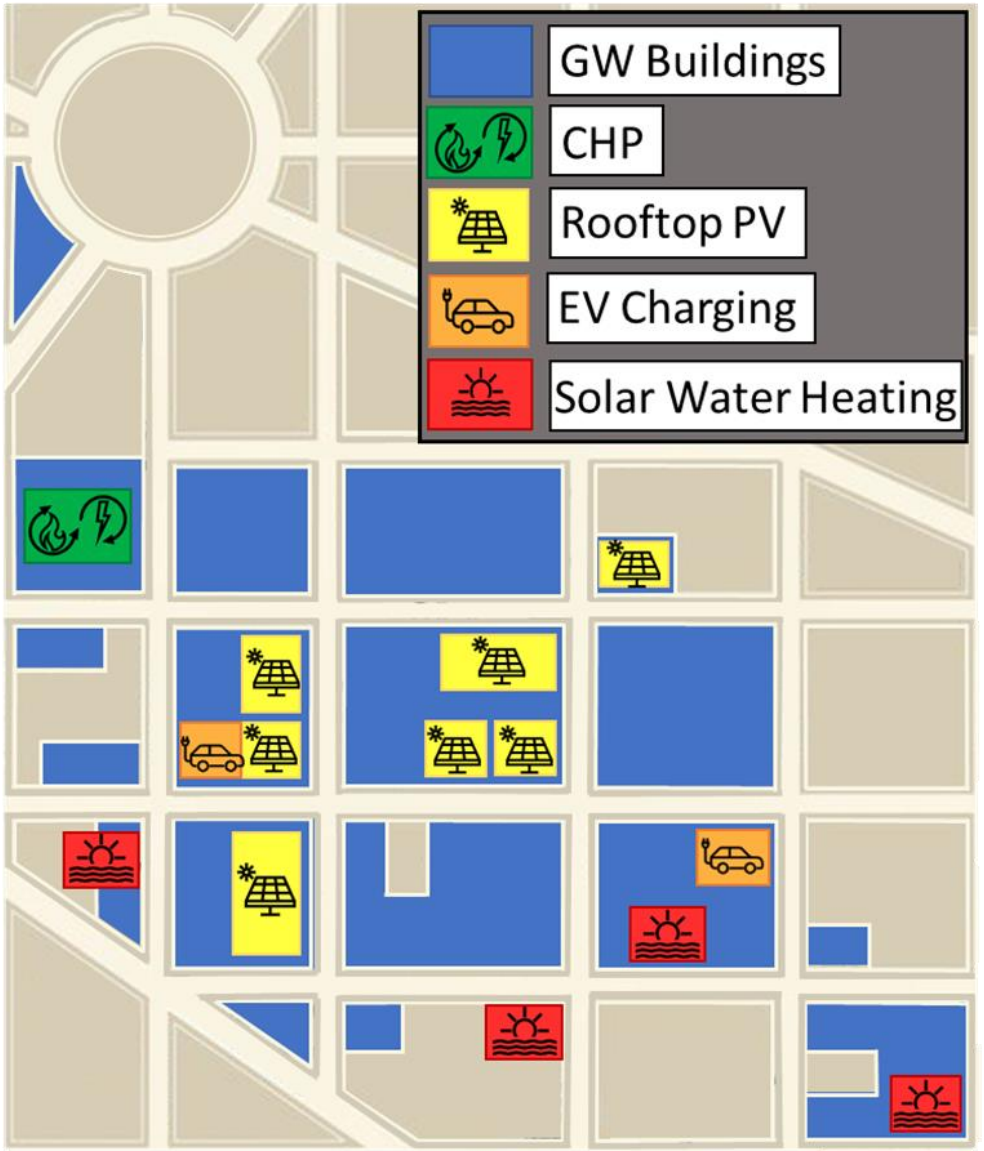
Please submit questions in the Q&A box.
The presenters will respond to questions off-line.

GW Background

- 3 Campuses
- Main Campus in Washington D.C.
- Approximately 28,000 students
- 95 Buildings on Main Campus
  - Education, Residential, Office, Public Assembly, Food Service/Sales, Lodging, Mercantile, Services
- Metro, Hospital, Fire station

GW's District Energy System

- 7.4 MW Combined Heat and Power Plant
  - Supports 2 academic and 4 residential buildings
- 52 MW solar farm (Capital Partners Solar Project)
  - 50% of GW's Electricity
- 2 electric vehicle charging stations
- 4 solar water heating systems
  - 2/3 of hot water used by 4 residential buildings
- 497 kW campus rooftop solar

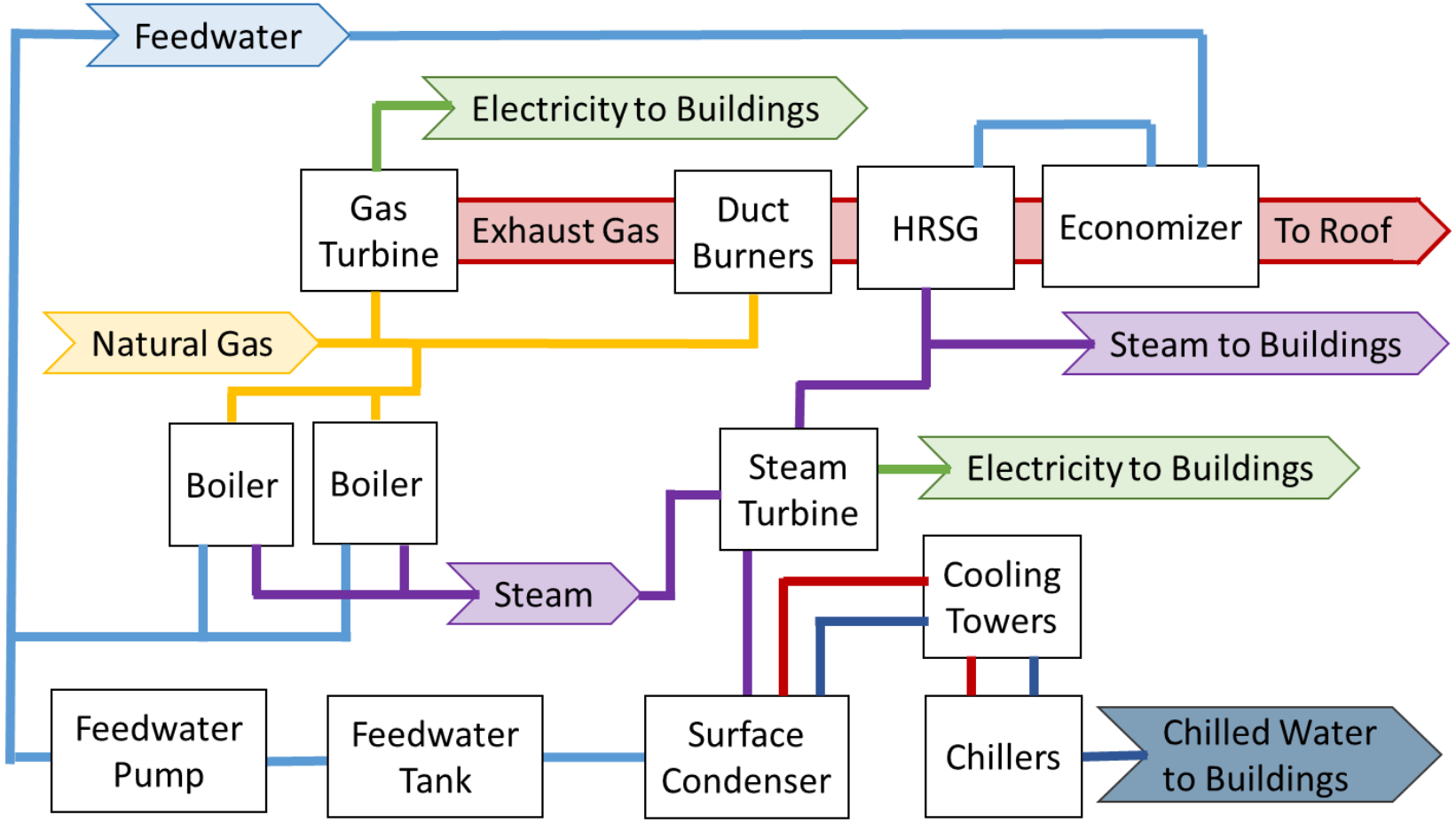


GW's District Energy System Challenges

Seasonal	Technical	Financial	Location	Impacts
• Winter: excess electricity • Summer: excess steam	• Solar panels in front of the meter • Energy generation and distribution in blocks • Data integrity	• 700 kW buffer from utility • Unable to sell excess electricity to utility	• Environmental and noise regulations • Limited space	• CHP operates at 57% of rated capacity • CHP electricity generation efficiency is 25.8% • Unable to support GW or surrounding community during emergencies

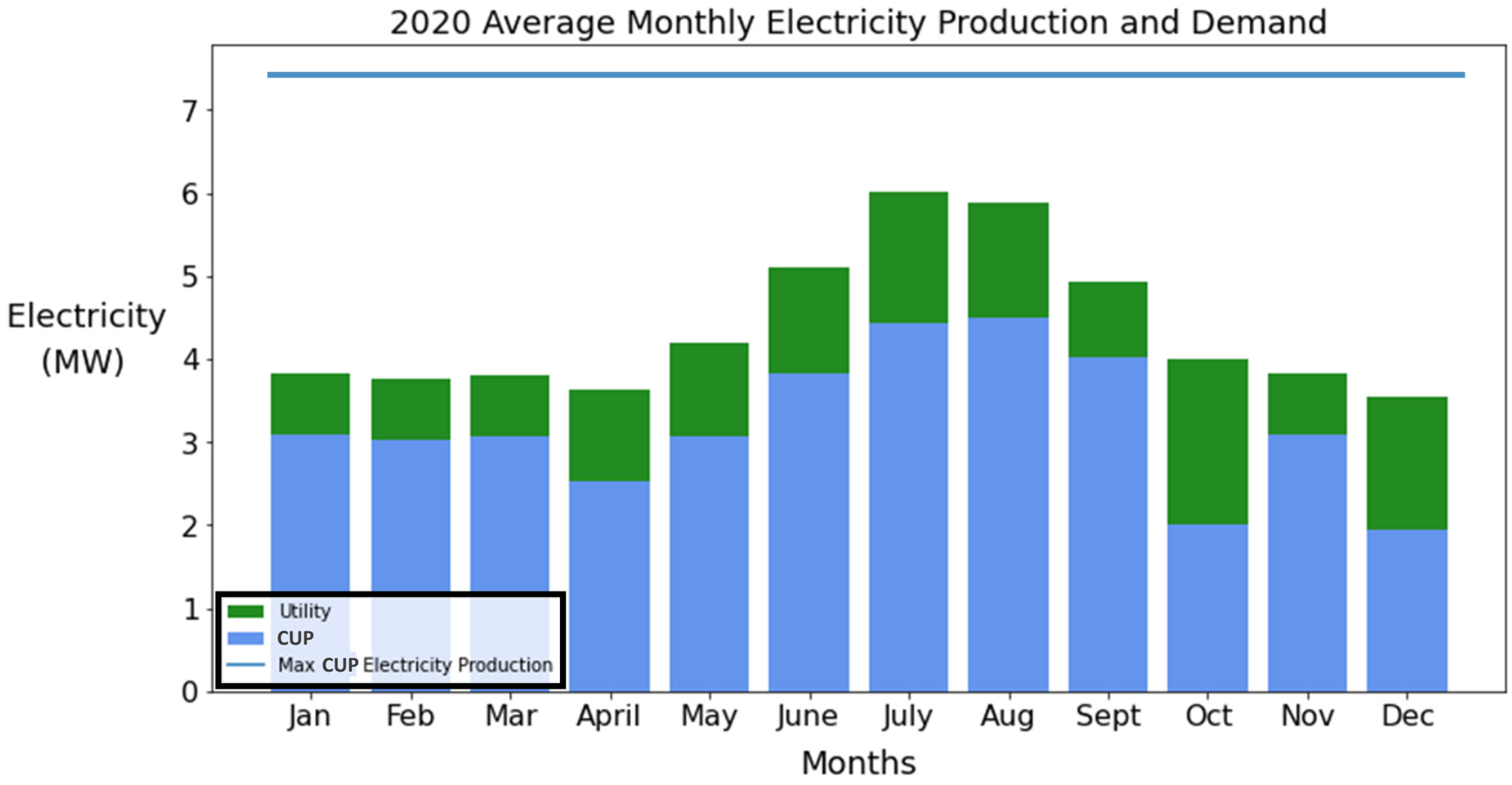
GW's Central Utility Plant (CUP)

- Houses our CHP plant
- Supplies electricity, steam and chilled water to 2 academic/research and 4 residential buildings
- Small footprint



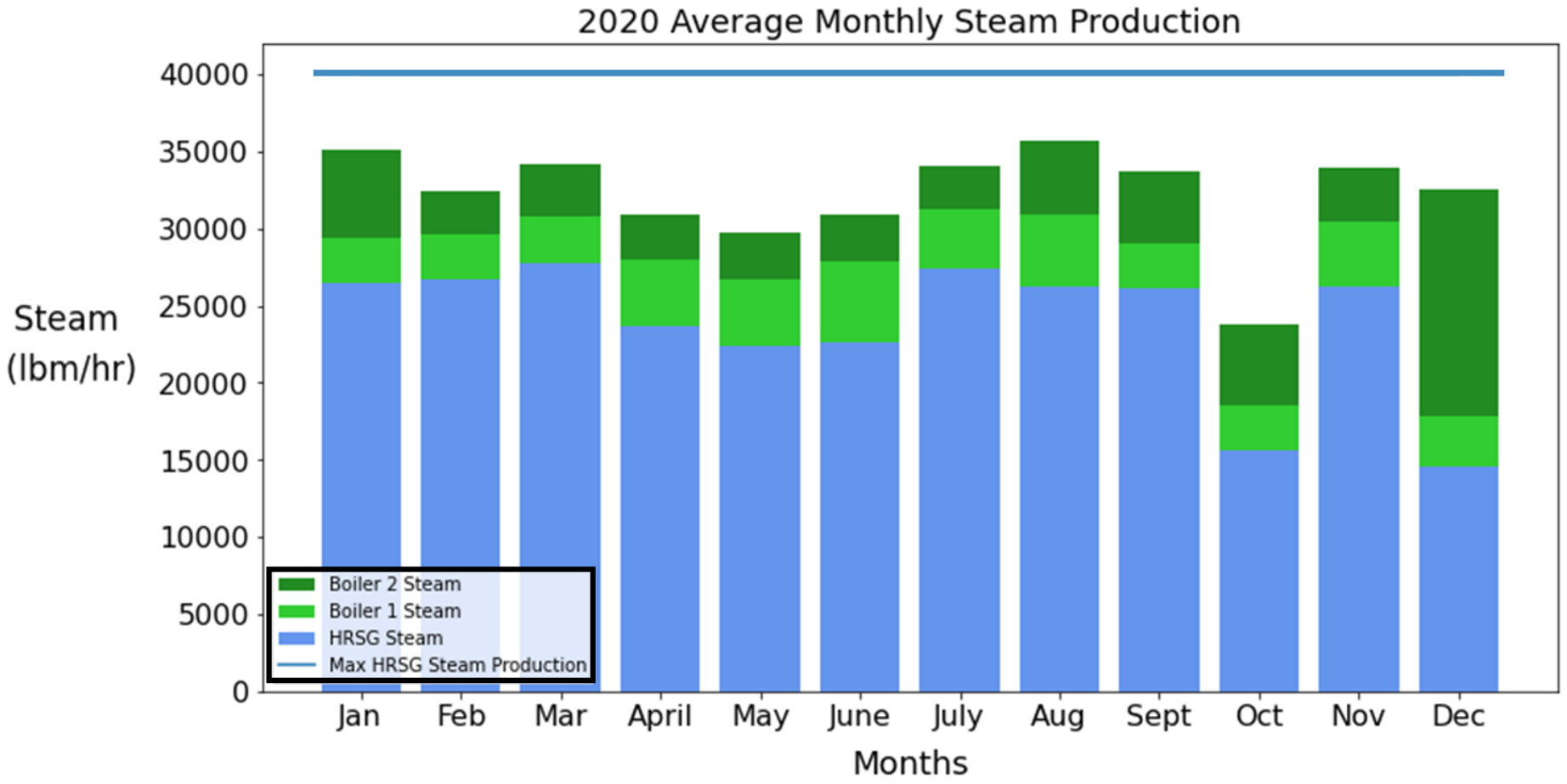
CUP Electricity Production and Demand

- Operating at 34 – 57% of CUP capacity
- Demand is less than CUP capacity
- Peak electricity demand in the summer



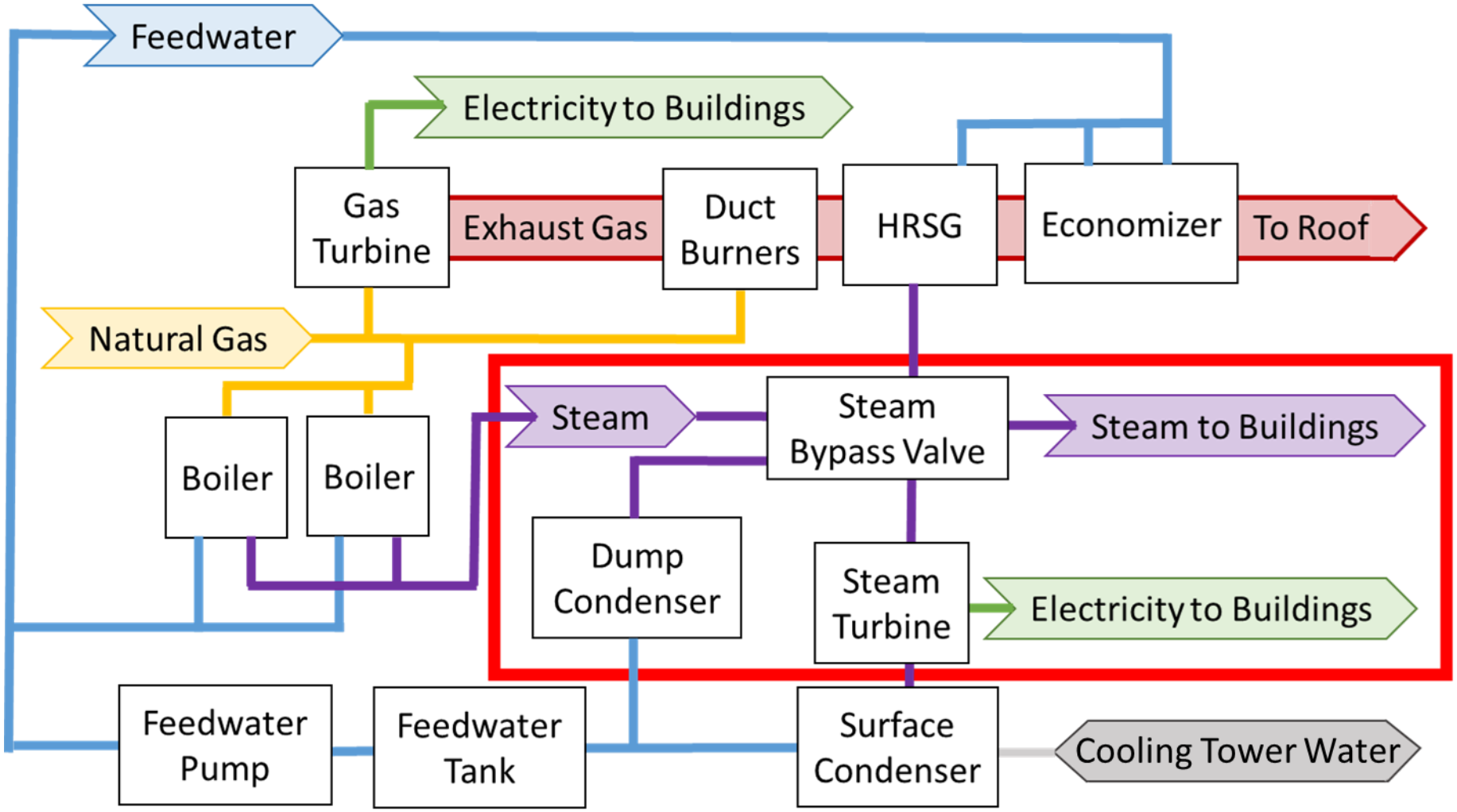
CUP Steam Production

- Operating at 40 – 65% of HRSG capacity
- Demand is less than HRSG capacity

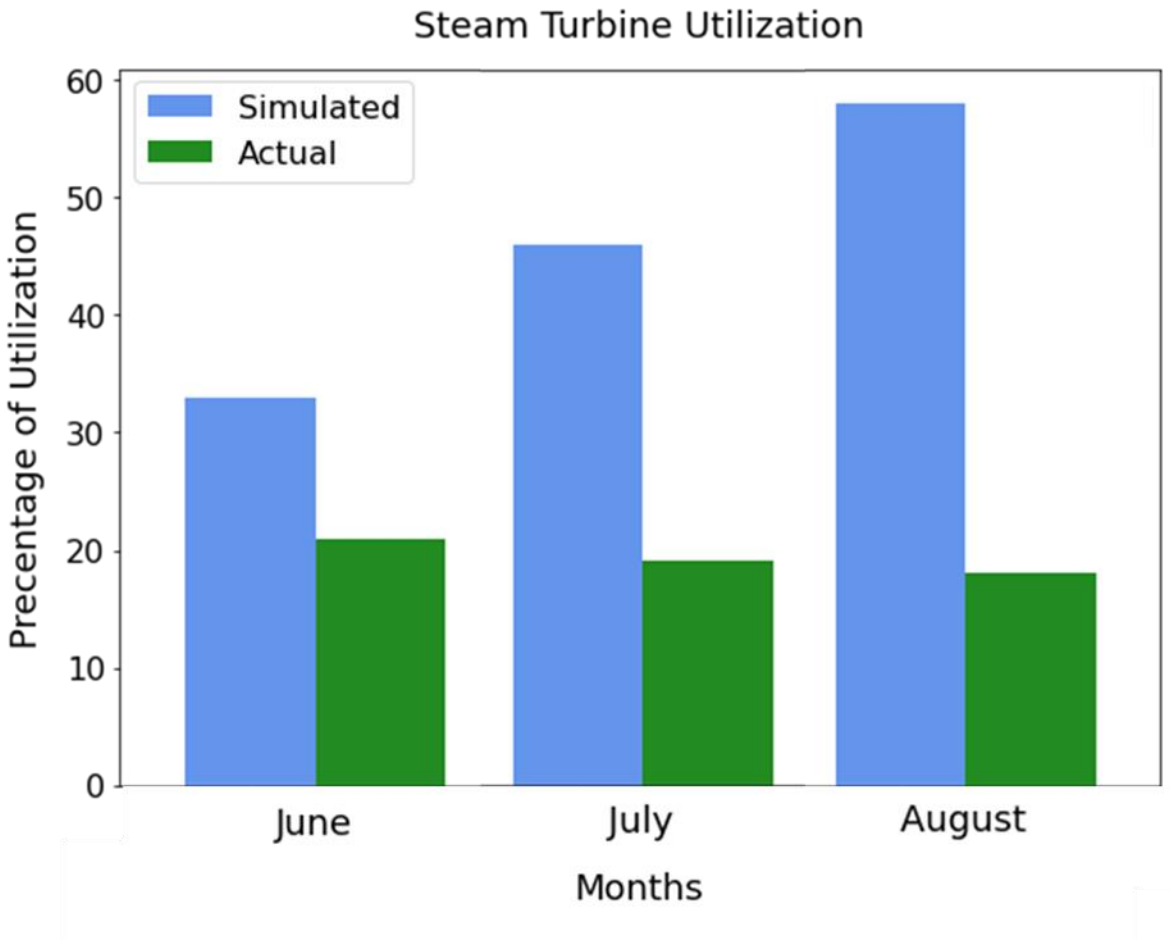


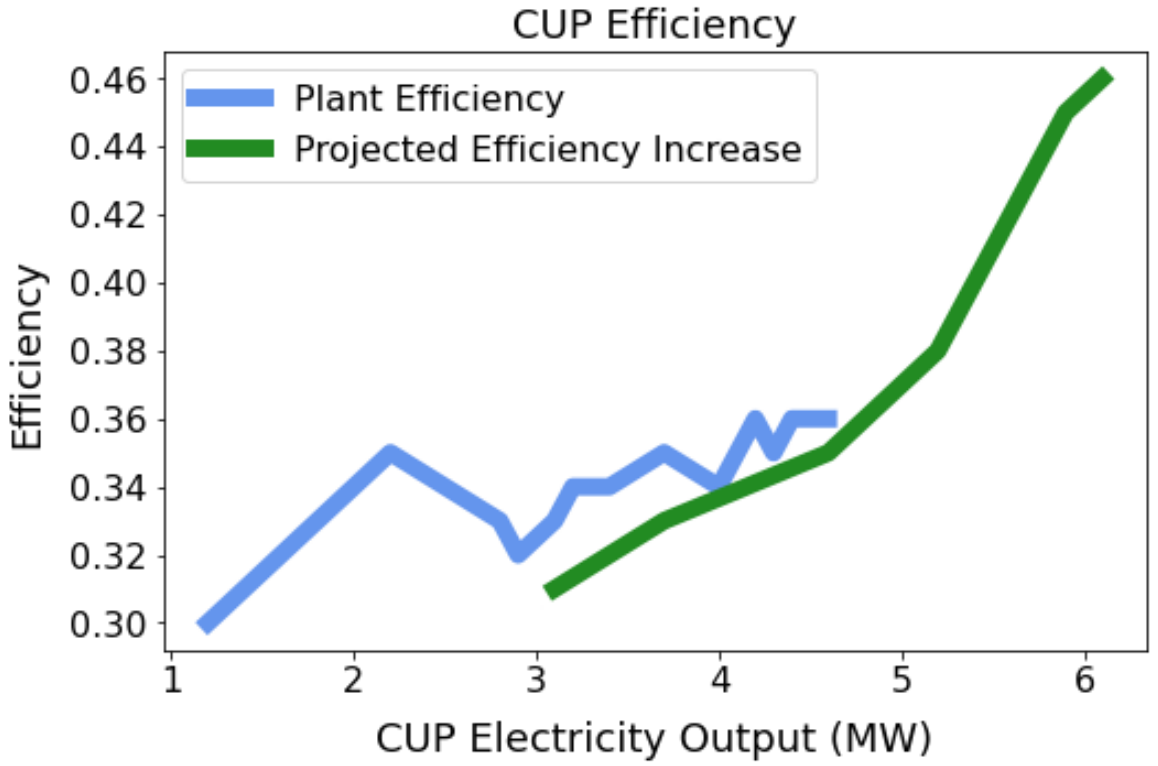
Excess Steam Solution: Dump Condenser

- CUP modeled with MATLAB Simulink using the Thermolib library
- Analyzed impact of adding dump condenser and steam bypass valve



Modeling Results

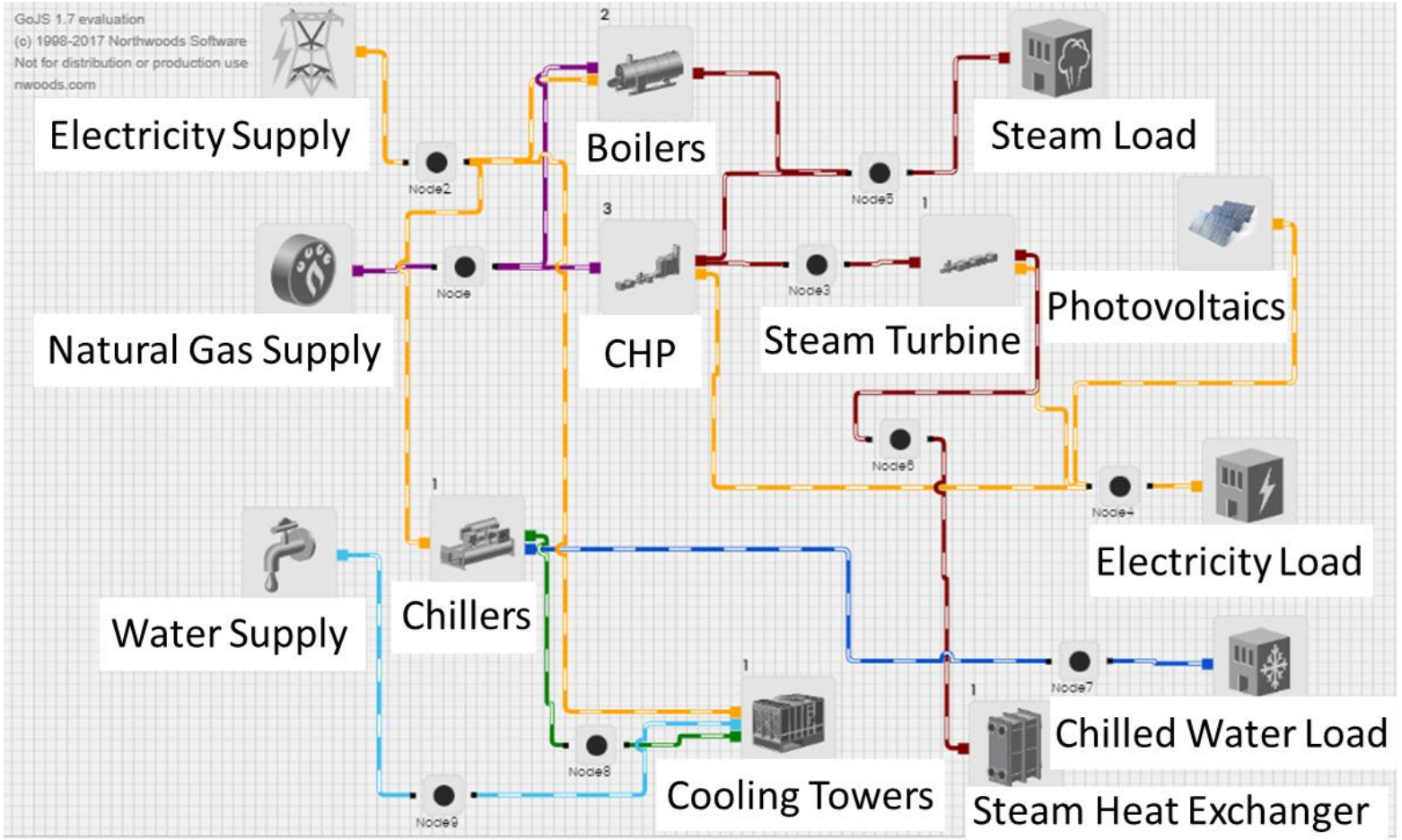




*Blumen, J., Welch, R. & Yu, R. Design and Modeling of a Steam Bypass System in a Central Utility. (2019). https://scholarspace.library.gwu.edu/concern/gw_works/bk128b591?locale=en

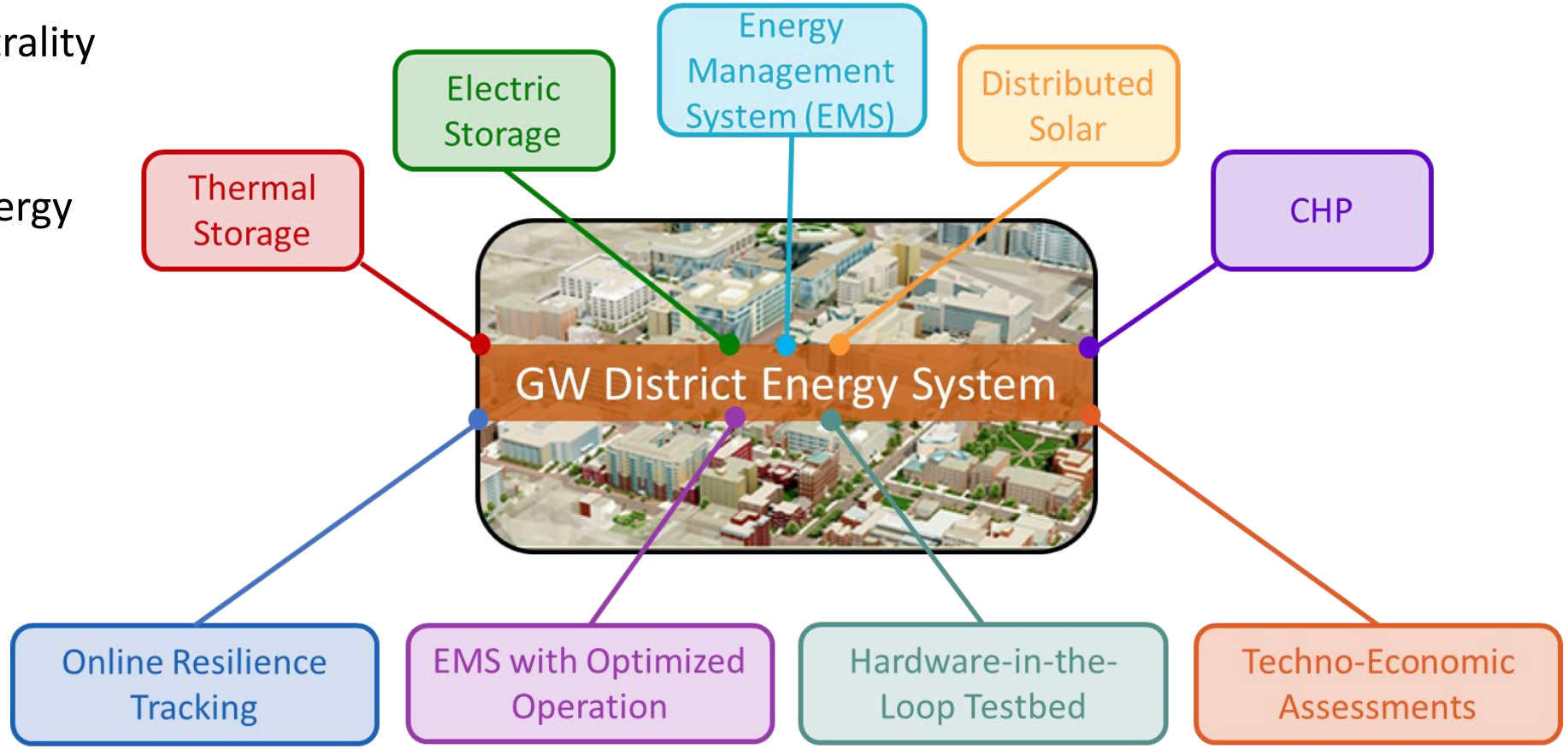
Lessons Learned

- Increase in steam turbine utilization
- Increase in plant efficiency
- Monthly savings of $100,000
- MATLAB model is limited
- New model with Johnson Control's Central Plant Optimization Planning Tool



Future Directions

- Campus carbon neutrality goal by 2040
- New DOE District Energy System Project



Acknowledgments

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  - Ryan Welch for the modeling and analysis of the central utility plant
  - GW Facilities for providing data on the central utility plant

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- Johnson Controls Inc. for providing access to their Central Plant Optimization Planning Tool and their support on this project

- For further modeling and analysis on GW's Central Utility plant, including energy efficiency improvements, please attend Janine Helwig's conference presentation.

Thank You

Please feel free to reach out to us with any comments or questions.

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