# Umass Memorial Medical Center, Worcester, MA
# Combined Cooling, Heat and Power Project

Presented by:

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CampusEnergy2018
MARCH 5-9, 2018 • HILTON BALTIMORE • BALTIMORE, MD

UMassMemorial Medical Center
A Member of UMass Memorial Health Care

CHA
design/construction solutions

# Agenda


- Introduction to UMass Memorial Medical Center
- Utility Usage
- Combined Cooling, Heat and Power Drivers
- Technical Highlights of Design
- Challenges / Lessons Learned
- Key Factors of Success
- Questions and Answers

# UMass Memorial Medical Center - Worcester

- Opened in 1871 located in Worcester, MA
- Full service, tertiary care referral center
- Serves communities in Central and Western MA
- 319 beds
- Received multiple Hospital Quality and Clinical Quality awards within the past 12 months
- Central Utility Plant
  - Provides steam, hot water, and chilled water to many hospital areas / buildings

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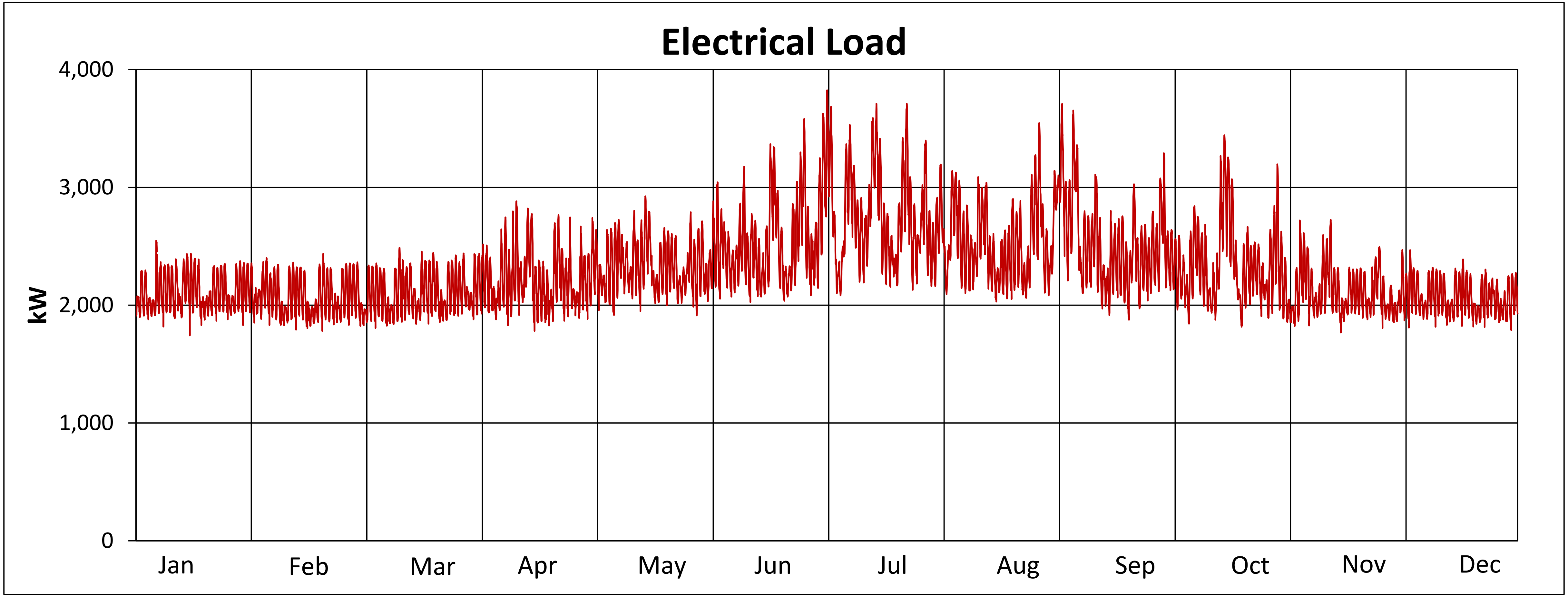
# Central Utility Plant

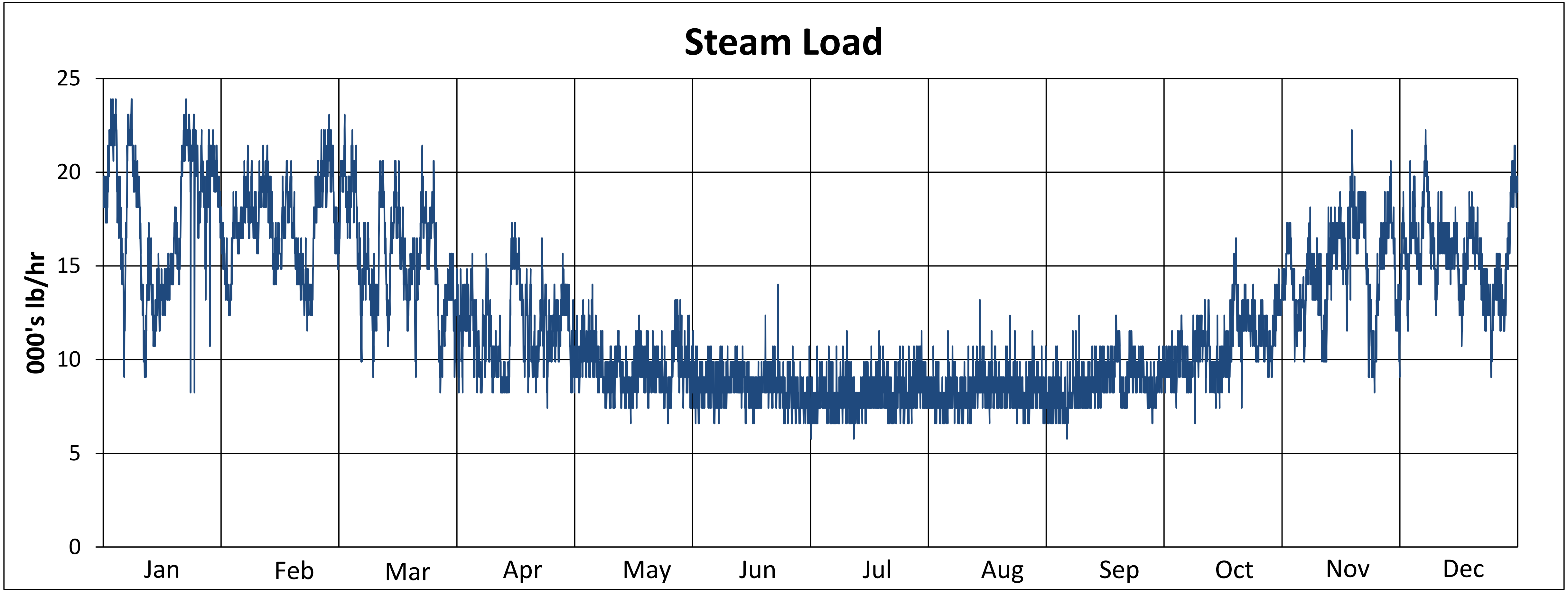
- Three Boilers
  - Natural Gas with No. 2 Fuel oil backup
  - 700 HP – 24,150 lb/hr each
  - 120 psig, saturated
- Three Chillers
  - All centrifugal chillers
  - 2 x 1,000 Ton, 1 x 1,500 Ton
- Two Cooling Towers
  - Only have capacity to support existing chillers
- Natural Gas supplied by Eversource Energy
- Electric Utility is National Grid

# Utility Usage




- Summer Average – 2,540 kW; Peak – 3,825 kW
- Winter Average – 2,100 kW

# Utility Usage




- Winter Average – 16,200 lb/hr;  Peak – 23,900 lb/hr
- Summer Average – 8,500 lb/hr

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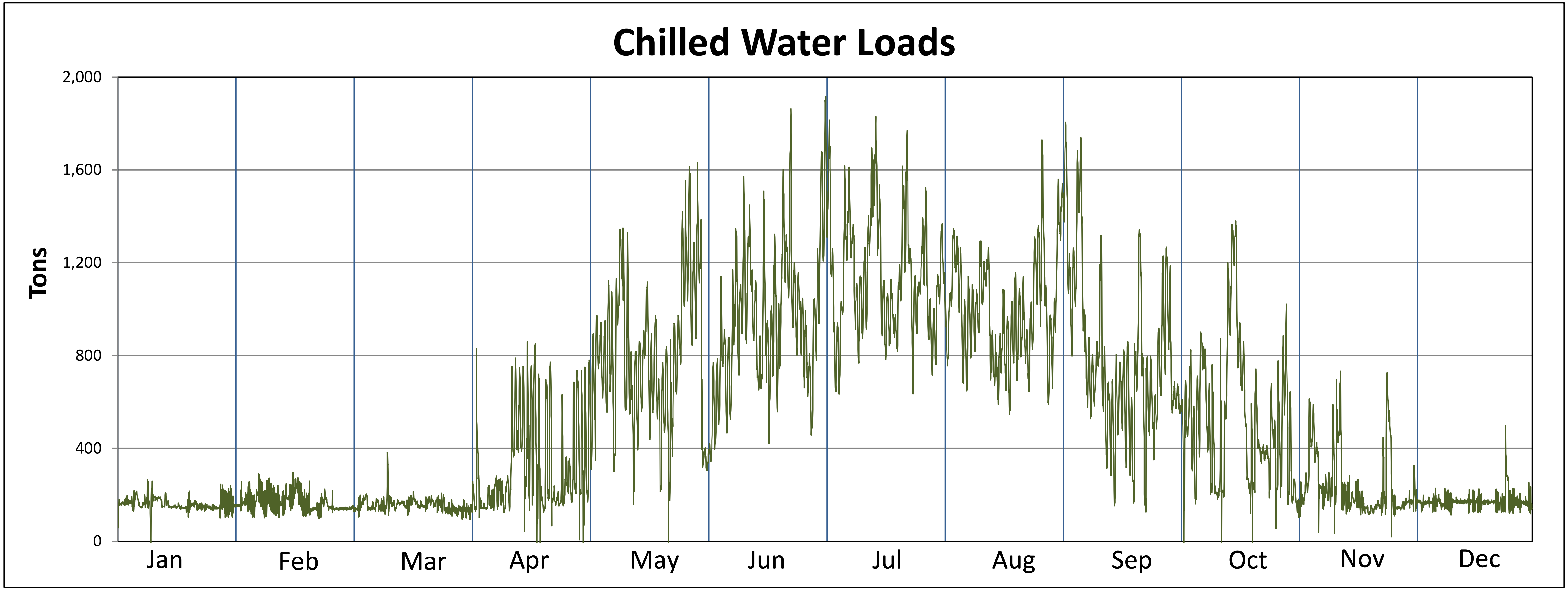
# Utility Usage




- Summer Average – 935 Tons;  Peak – 1,920 Tons
- Winter Average – 180 Tons

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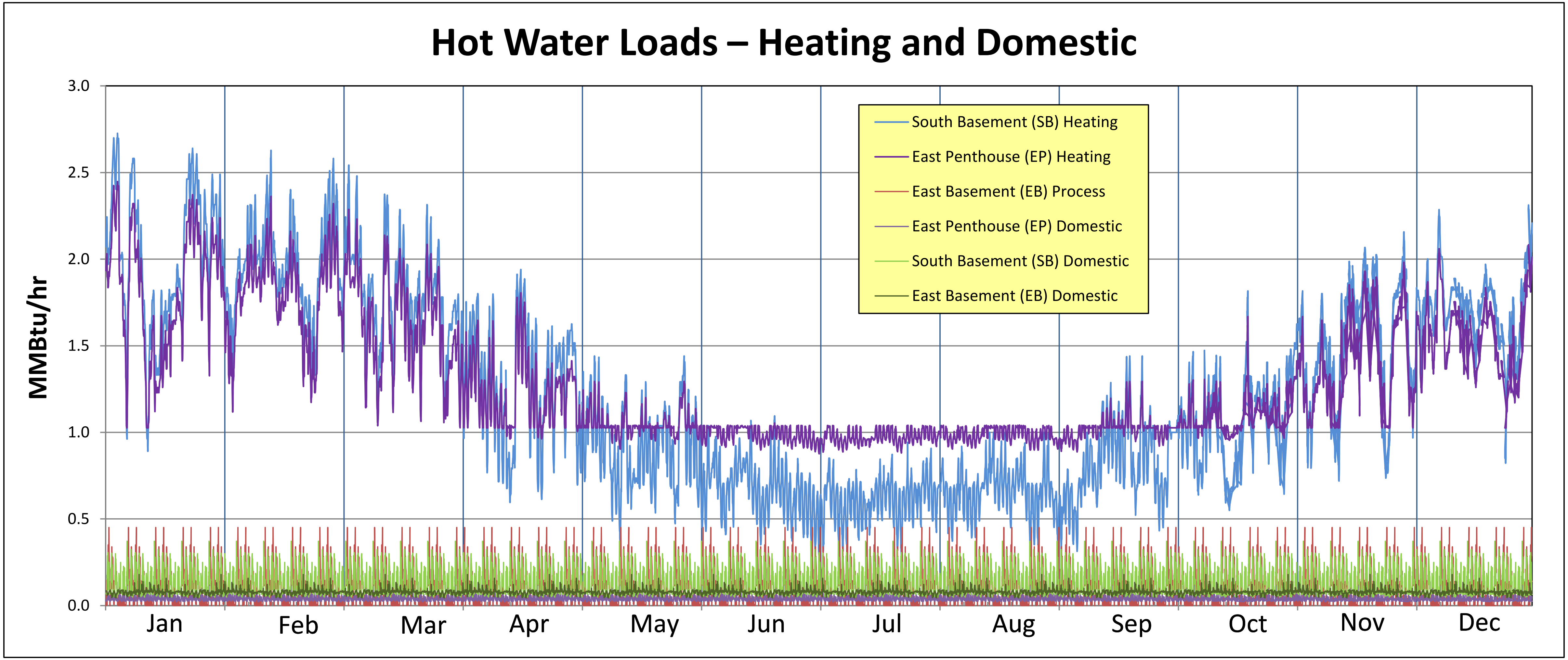


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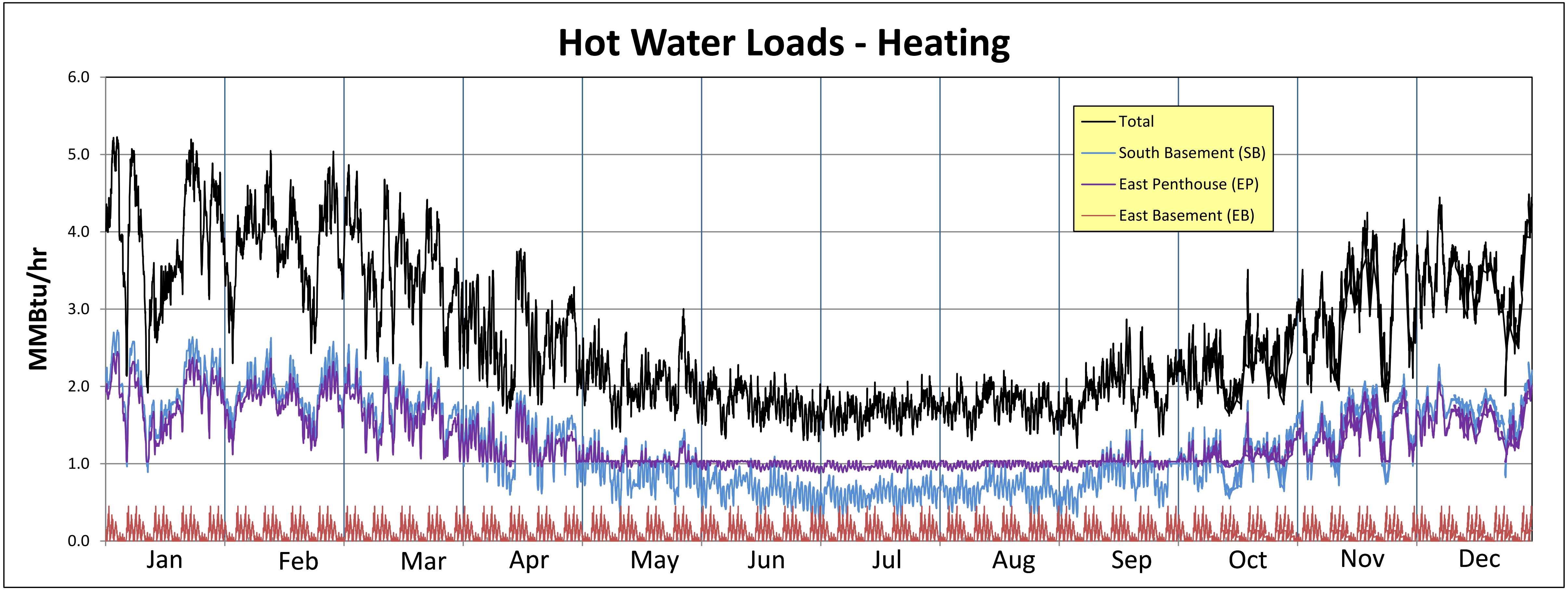


- Winter Average – 3.6 MMBtu/hr;  Peak – 5.2 MMBtu/hr
- Summer Average – 1.9 MMBtu/hr

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# Combined Cooling, Heat and Power Drivers

- Upgrades to patient and operating rooms result in changes to energy consumption patterns
- Increased sustainability and reliability
- Reduction in overall energy supply costs
- Increased utility plant operating flexibility
- Contribute to reduction in $CO_2$ emissions
- Aging existing boilers and chillers

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# Highlights of CHP Design – Gas Engine Generator

- GE JMS 616, 2.7 MW engine
- Base-load operation, exporting excess power
- 13.8 kV generator
- Drop-over enclosure suitable for outdoor installation
- SCR mounted on enclosure roof
- Complete package with control system, lube oil cooler, jacket water cooler, inlet air ventilation, etc. all on a common baseplate
- Packaged with all auxiliaries by Northeast Energy Systems (Penn Power Group)

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# Highlights of CHP Design – HT & LT Water System

- HT system collects energy from lube oil, jacket water, 1st stage intercooler, and engine exhaust
- LT system rejects energy from 2nd stage intercooler
- HT Water System
  - 6.2 MMBtu/hr – 280 gpm, 200 °F – normal operation
  - 8.3 MMBtu/hr – 280 gpm, 216 °F – without steam
- Delivers hot water to building heating, condensate preheating, and a new hot water absorption chiller
- Independent full heat rejection radiators

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# Highlights of CHP Design – HRSG

- Cain low-volume coil-tube unit
- Complete packaged and pre-assembled unit with circulating pump, economizer, feedwater controls, instrumentation and control panel
- Steam production – 2,700 lb/hr, 130 psig, sat.
- Bypass damper controls steam pressure and allows operation of gas engine without HRSG steam production
- HT water energy increased if HRSG bypassed

# Highlights of CHP Design –Absorption Chiller

- Thermax single effect, low temp. hot water chiller
- 360 Ton capacity, 865 gpm at 44°F
- Located within the existing boiler house
- Steam Heat Exchanger augments HT water energy to boost chiller production when needed
- New cooling tower dedicated to new chiller
- Siemens control system controls the chiller and the steam heat exchanger to optimize production
- Controls are tied into the existing BMS to operate in parallel with existing chillers

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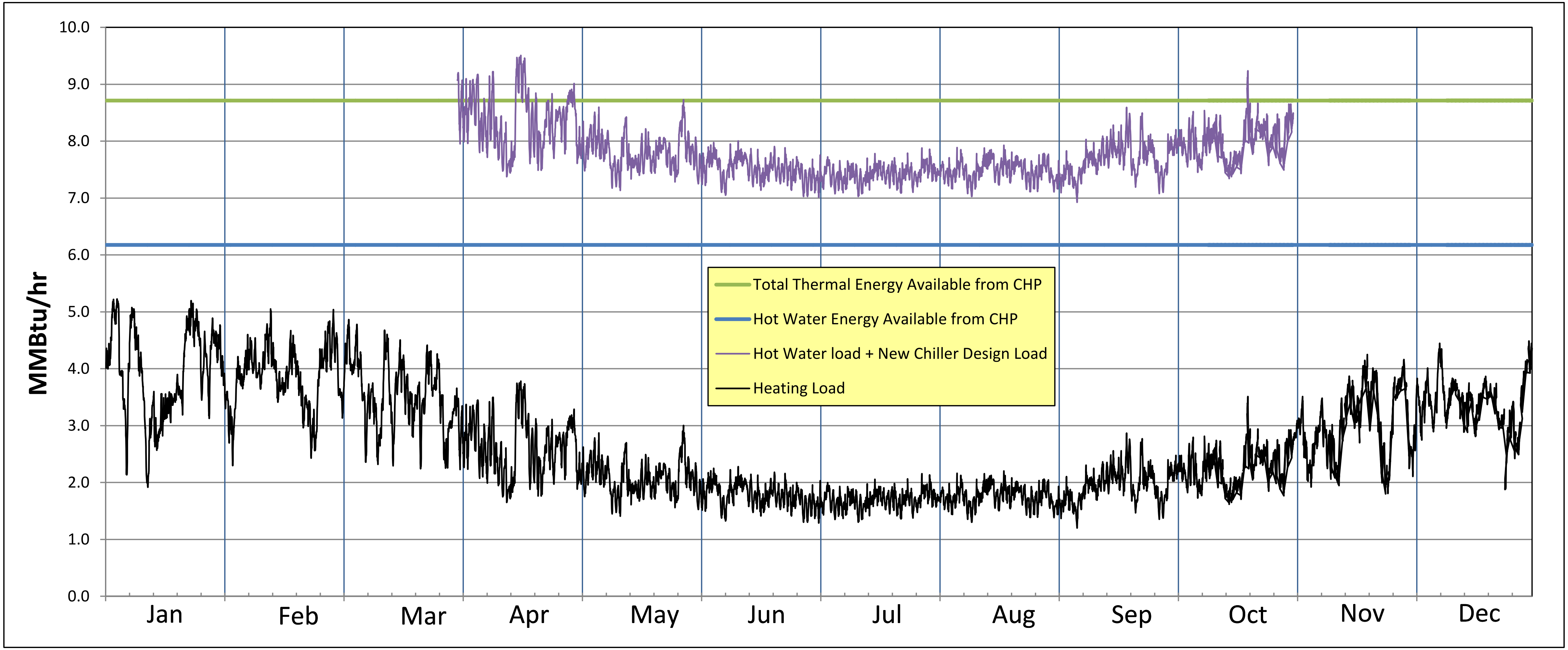
# CCHP Thermal Energy Available

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# Highlights of Design – Electrical


- 13.8 kV switchgear for engine and utility breakers as well as metering, located outside
- MCCs located in existing electrical room for engine and balance of plant equipment
- Engine operates in parallel with the local utility, but can also island from the utility and black start
- DIA.NE engine and auxiliaries control panel located in existing electrical room
- Plant Control System
- Siemens control system for chiller and building heating loops.

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# Challenges / Lessons Learned

- Interfacing with electrical utility provider
- Engagement with natural gas supplier
- Ensuring all stakeholder interests are met
- Construction in a constrained area and operating plant and fitting all of the equipment into the space
- Construction schedule
- Clear understanding of design intent – hot water only or hot water and steam

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# Key Factors of Success

- Performing a detailed feasibility study to get Stakeholder buy-in
- Sufficient schematic design phase allowing details of equipment supply to be determined
- Conducting laser scan of existing plant and preparing an overall 3D model
- Data logging of hospital hot water loads
- Early purchase of major equipment
- Design / Build project execution using Cogeneration Power Technologies
- Incentives available for CHP projects

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# Combined Cooling, Heat and Power Plant

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# Thank you

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