

Thermal Networks for Heating and Cooling Downtown Bridgeport IDEA2015



NuPower Thermal



June 30, 2015

NuPower LLC – Renewable Power Development



Plainfield Renewable Energy Project 37.5MW Biomass Power Plant in Plainfield, CT

- **Start of Operation - 12/13**
- **15 year PPA with two CT Utilities**
 - **1,000 tpd waste wood**

City of Bridgeport, CT





City of Bridgeport

- **Area - 19.4 sq. miles**
- **Pop. - 147,216**
- **Density - 7,588/sq. miles**

The Bridgeport Thermal Project



Thermal Customer Profile

Totaling approximately 3.5 million square feet

- **Academic**
 - **University of Bridgeport**
 - **Housatonic Community College**
- **Commercial**
 - **Webster Arena**
 - **Peoples Bank**
- **Government**
 - **City Buildings**
 - **State Buildings**

Potential Heat/Electrical Sources



Wheelabrator WtE Facility
67 MW



United Illuminating Fuel Cell Facility
3 MW



Emera Combined Cycle Facility
520 MW



Bridgeport Thermal Project Progress

- Feasibility Report completed 2013 on Bridgeport opportunity
- CT Legislature awarded NuPower Thermal in 2014 the exclusive thermal energy carrier franchise
- Initiated Phase 1 development - retained Ramboll in July 2014
- Closed CT Green Bank development funding in January 2015

Project Team

Ramboll Group

- District Thermal Engineering Design Firm
- Focus – District Thermal/Building Design/Environmental Engineering

Smith Engineering

- Engineering Consulting Firm
- Focus – Central Energy Plant Optimization, Chiller Equipment Design and Customer Data Analysis

Milone & MacBroom

- Regional Civil Engineering Firm
- Focus – Pipe Route Analysis and Permitting

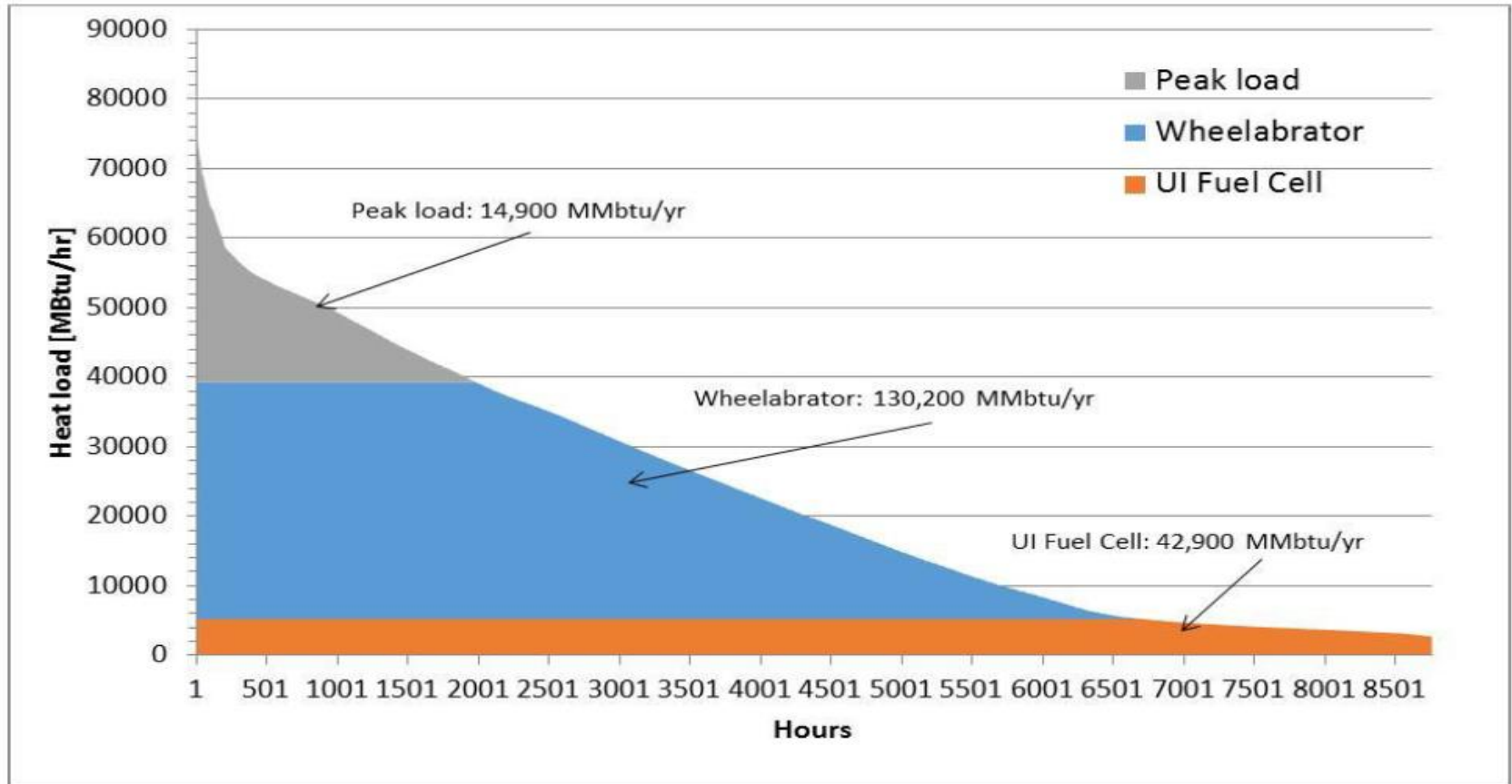
Pullman & Comley

- Contract and Legislative Support

Phase 1 Project Status

- Completed Concept Design Phase
 - Customer site survey and energy usage analysis
 - Housatonic Community College
 - University of Bridgeport
 - CT Judicial System
 - Webster Arena
 - City of Bridgeport
 - Peoples Bank
 - Concept design of heating and chilled water loop
 - Completed heat source design for Wheelabrator WTE and UI fuel cell facilities
 - Final Design Report for Heating and Chilling Systems
 - Negotiating LOI with Anchor Customers

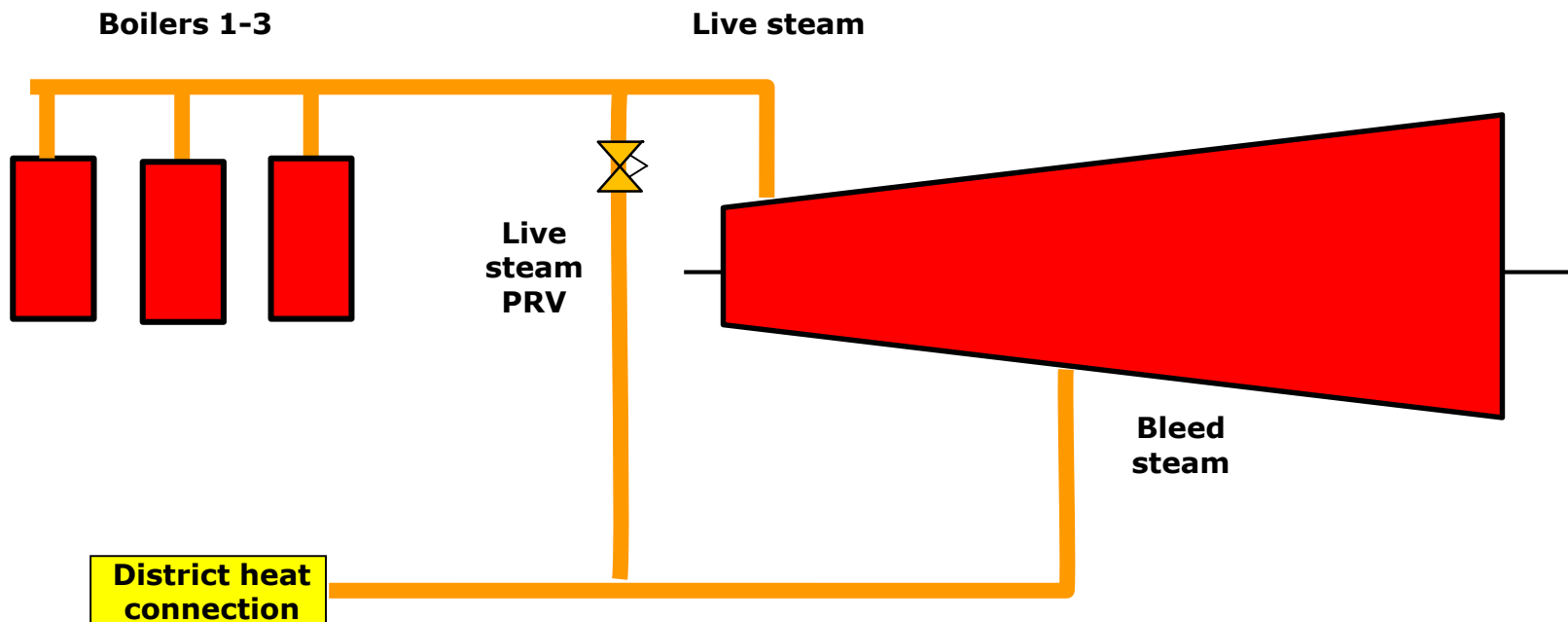
Bridgeport Heat Duration Curve



UI Fuel Cell	42,900	MMBtu/yr	23%
Wheelabrator	130,200	MMBtu/yr	69%
Peak load	14,900	MMBtu/yr	8%
Total	188,000	MMBtu/yr	100%

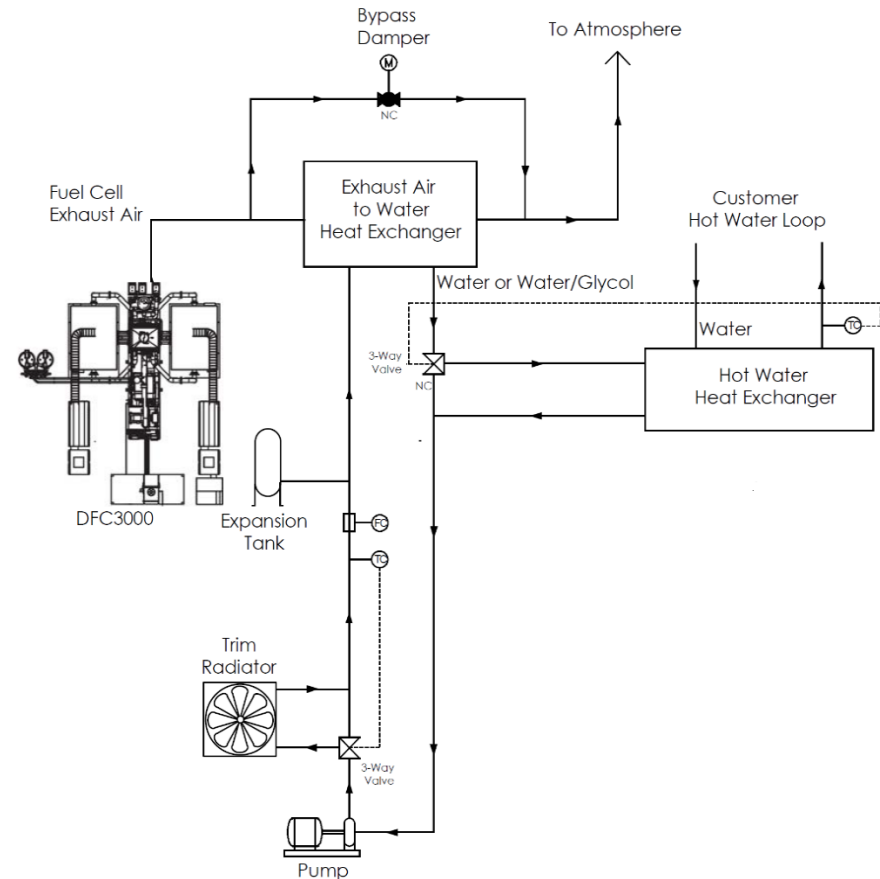
Wheelabrator – Heat Source

- **Bleed steam from turbine up to 34 MMBtu/hr (1:5 Power to Heat Ratio)**
- **High redundancy with 3 individual boilers and 94% historical availability**
- **Additional 68 MMBtu/hr available (1:3 Power to Heat Ratio)**



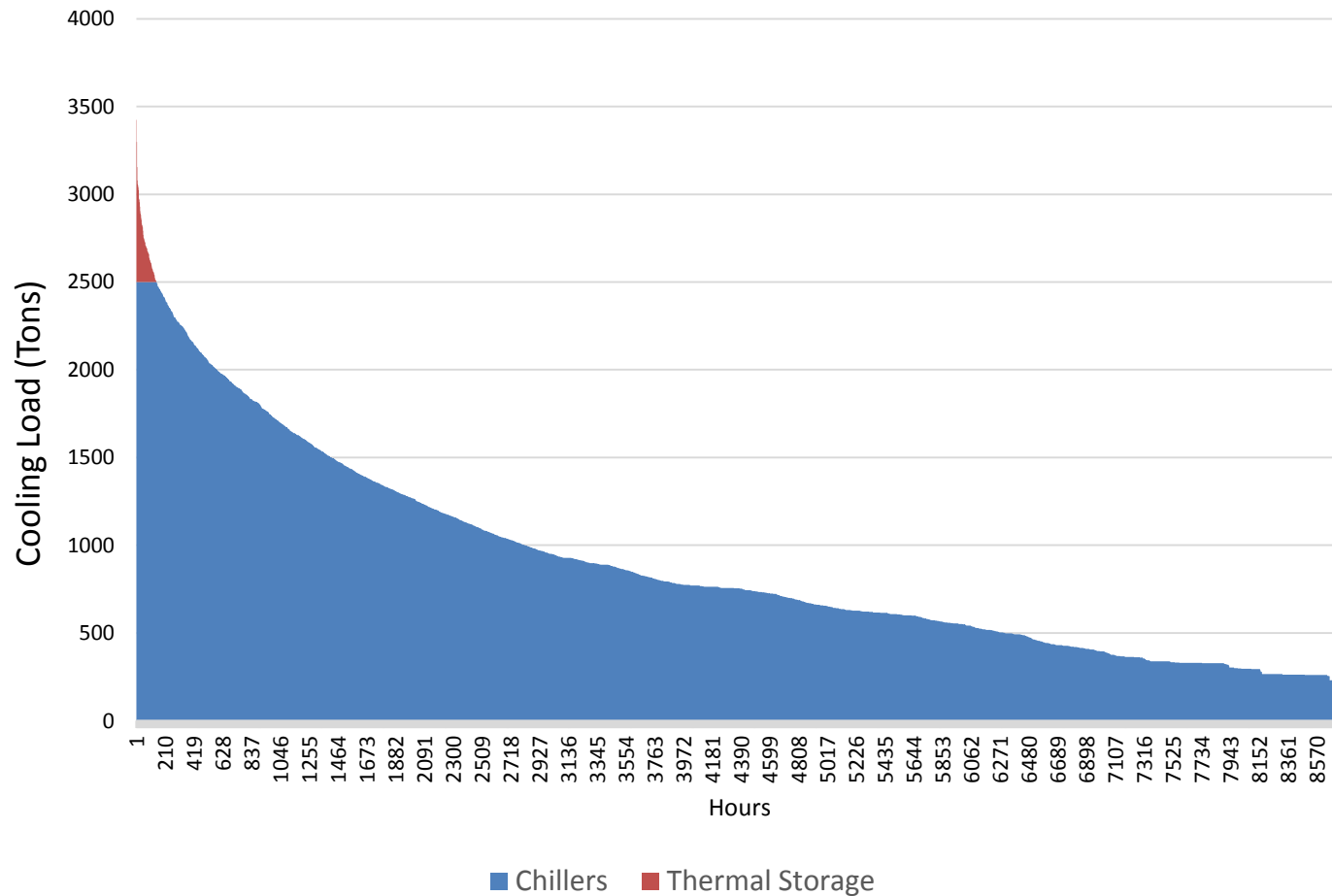
UI Fuel Cell – Heat Source

- Temperature Exhaust Gas
 - 600 °F
- Heat Recovery Potential
 - 5 MMBTU/hr
- Impact
 - Improves System Efficiency

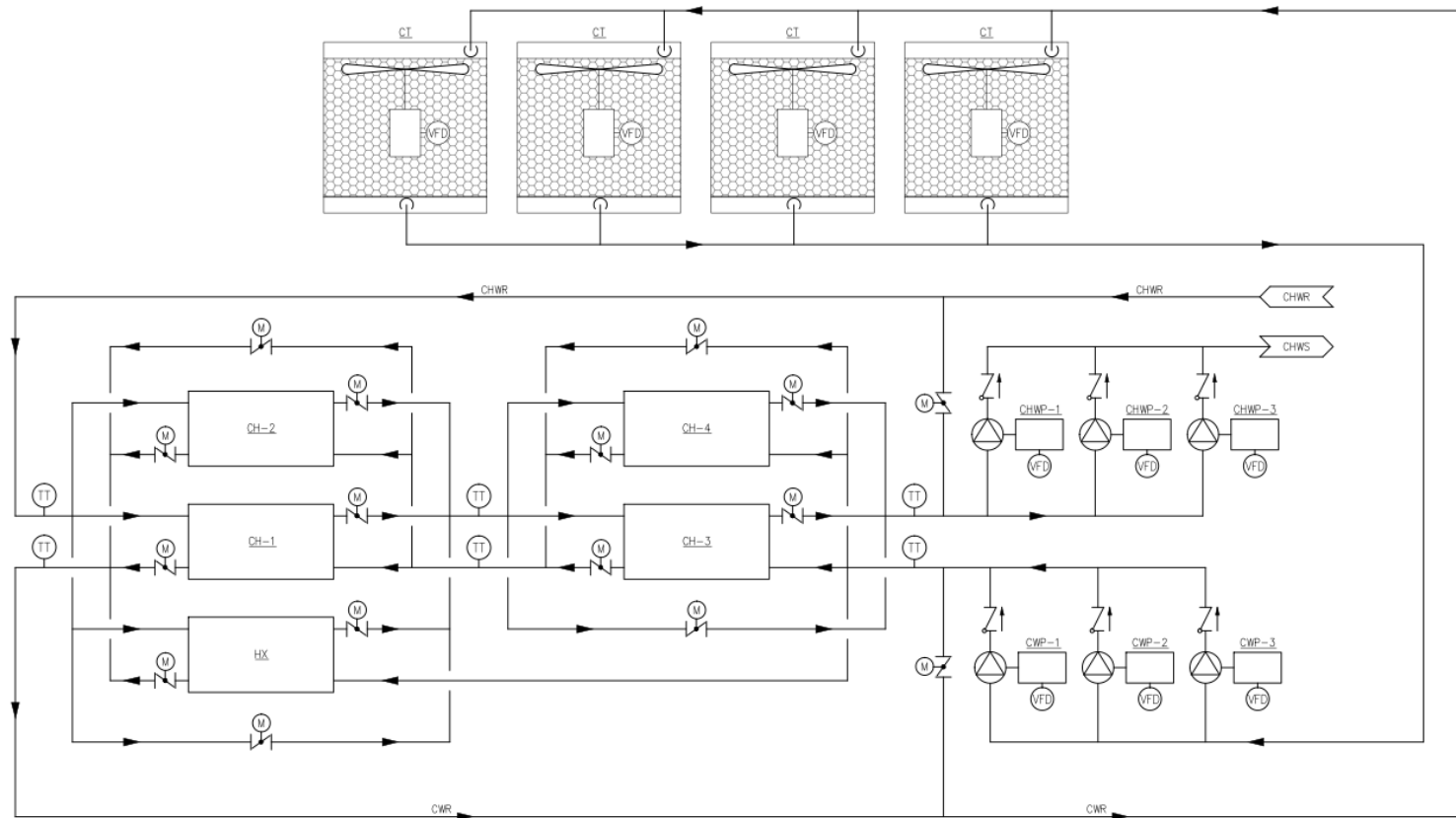


Bridgeport Cooling Duration Curve

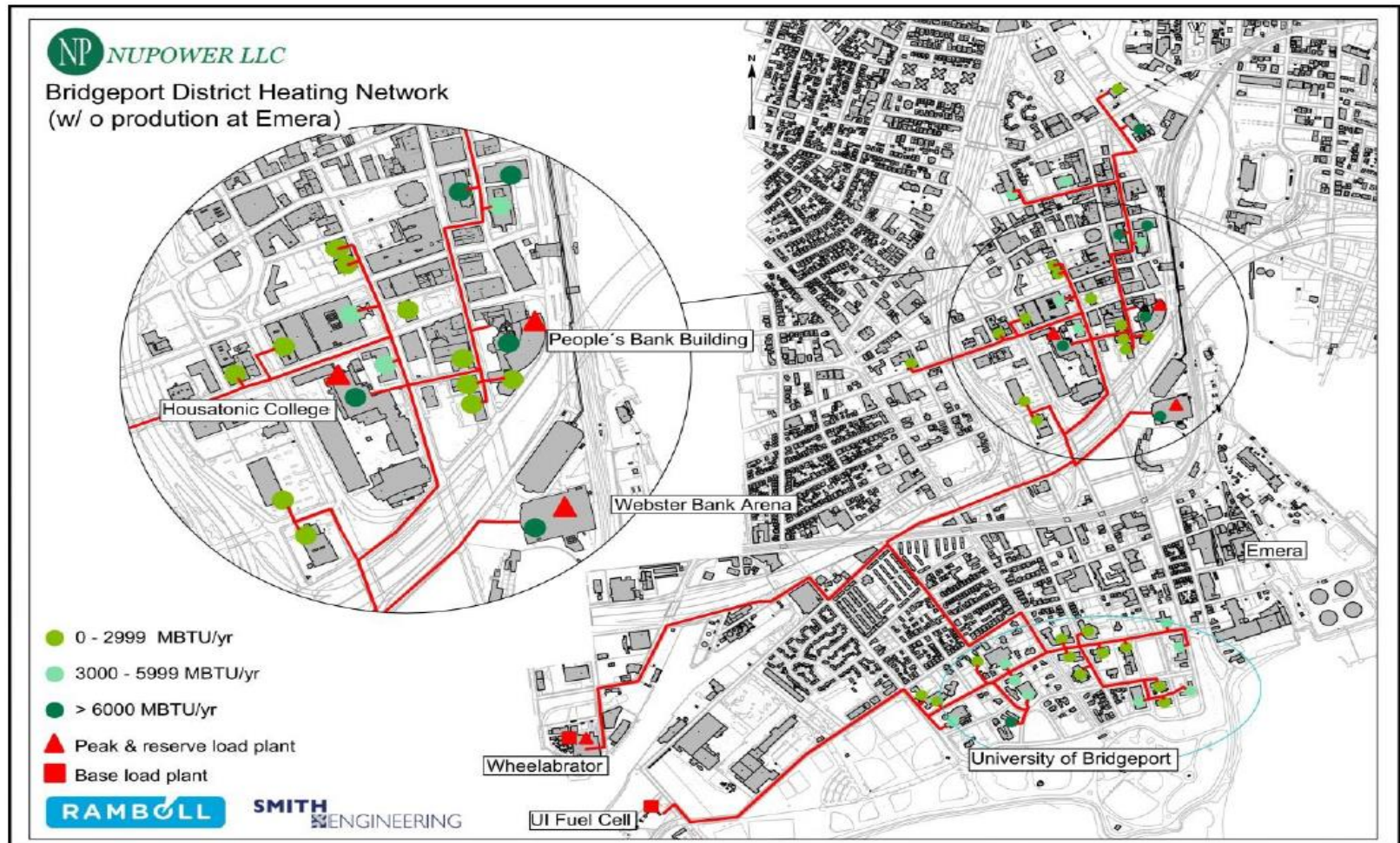
System Cooling Load Duration Curve



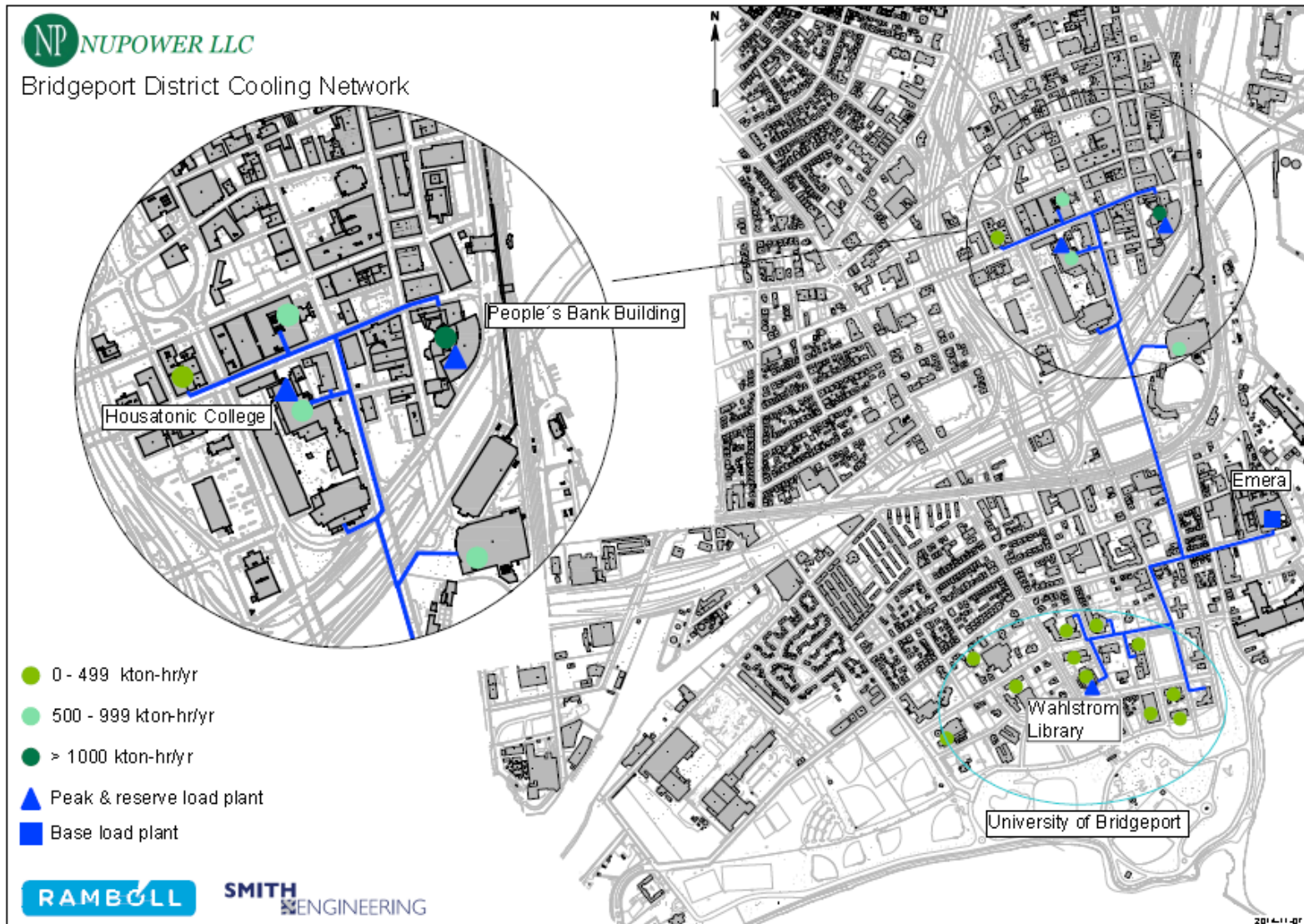
Central Chilled Water Plant at Emera Site



Heating Network



Cooling Network



Legislative Status

- Hot Water Component
 - CT Energy Conservation and Load Management natural gas reduction program
 - Specifically for district heating systems using waste heat
 - Funding based on reduction of customer natural gas consumption over term of offtake contract
- Chilled Water Component
 - PA 15-107
 - Solicitation by CT DEEP of long term contracts up to 20 years
 - energy storage including thermal energy for the direct use of heating or cooling at a later time avoiding electrical usage

Key Project Attributes

- Unregulated utility status as licensed Thermal Energy Carrier
 - access to public ROW
 - exclusive license for City of Bridgeport
- Environmental Permits – no controversial permits. Air permit requirements are minimal
- Legislative Initiatives – natural gas savings and thermal/energy storage programs
- Anchor customers
 - energy usage analysed and site visits completed
 - anchor tenant presentations completed
 - LOIs in process or completed
- Off-Take and Customer Purchase Contracts in process



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