



IDEA2021

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2,000-ton Electric Chiller Significantly Reduced RED Rochester's Carbon Footprint

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RED Rochester – Full Service Utility Provider

Steam

- 1,700 klbs/hour Capacity
- Site Wide Distribution & Condensate Return
- 260, 140/135, 10/5 PSIG

Electric

- 117 MW Gen Capacity
- 41MW Interconnect

Other

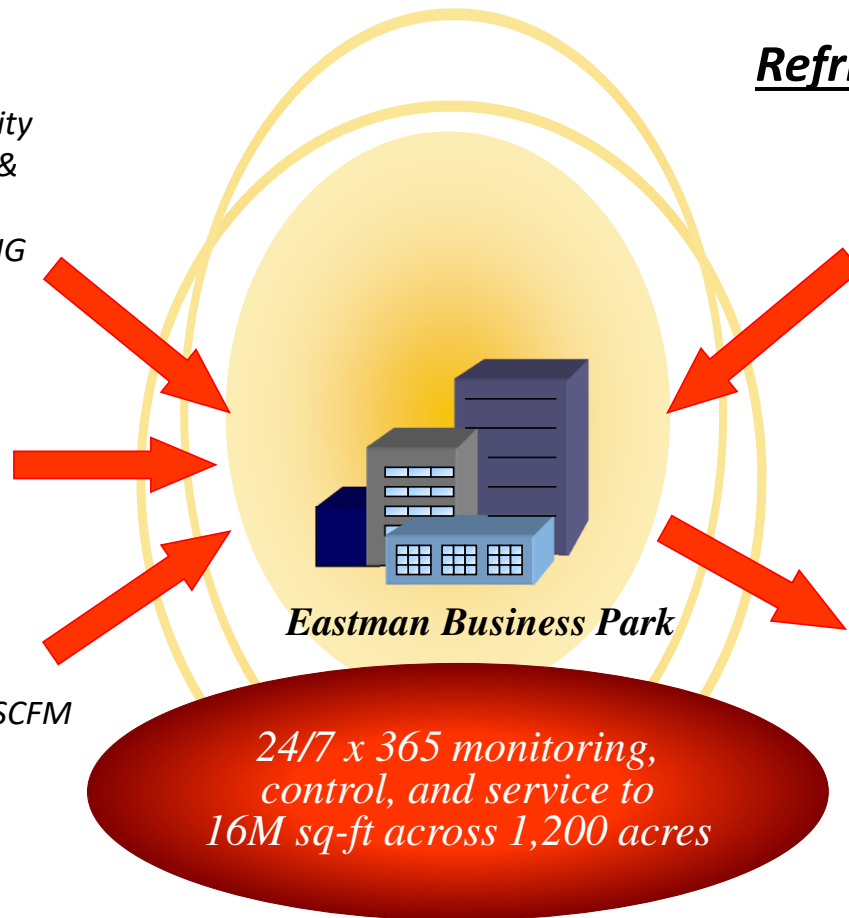
- Nitrogen – 140k SCFH
- Natural Gas
- Compressed Air – 40k SCFM
- Service Metering

Refrigeration & Water

- **Chilled Water – 5x Distribution Systems totaling 50k Tons**
- 9°F, -95°F Brine
- Lake Water Treatment – 54 MGD
- Industrial Water
- Potable Water
- Fire Protection Water
- High Purified Water – 400 GPM

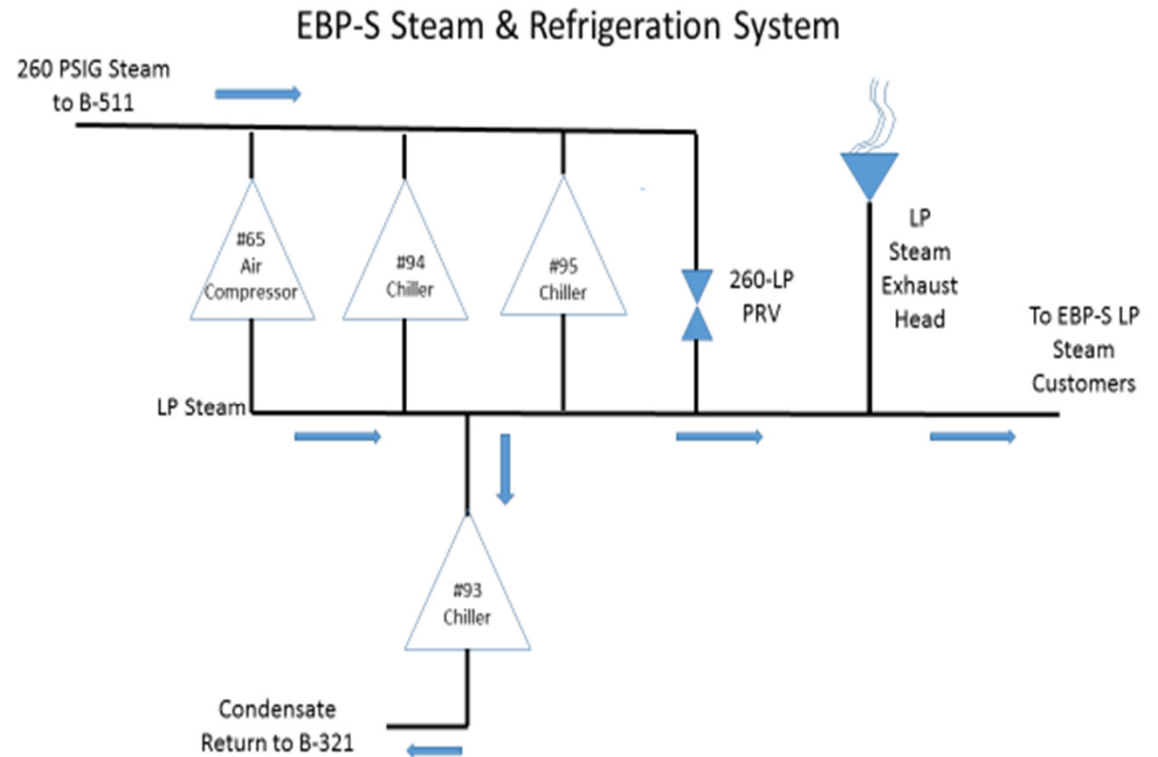
Waste Water

- Industrial Sewage Treatment – 54 MGD
- Hazardous Waste Permitted Multiple Hearth Incinerator
- Precious Metals Recovery Capability



EBP-South B511 Refrigeration Plant

- 7000 Tons Capacity @ 43F
- 93CH- 2300 Tons, Condensing steam turbine drive
- 94CH – 2300 Tons, Backpressure steam turbine drive
- 95CH – 2400 Tons, Backpressure steam turbine drive



Identifying the Opportunity

- RED contracted with CHA through NYSERDA's On-Site Energy Manager Program
 - Provided CHA Energy Engineers to identify, evaluate and develop energy efficiency projects
- B511 Chiller Plant infrastructure 1960's vintage
- Robust systems designed for larger capacities
- Large steam turbine driven centrifugal chillers performed poorly in part-load condition
- False loading through hot gas bypass
- Constant Speed chilled water & condenser water pumping
- Poor system ΔT caused excess pumping power and impeded chiller performance
- Steam load imbalance forced excessive LP venting (avg. 20kLb/hr)



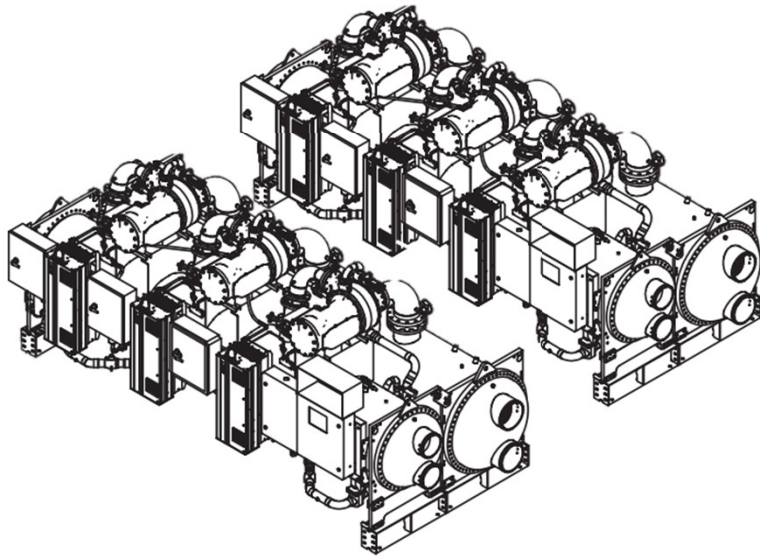
Developing the Solution

- Reviewed options based on efficiency and maintenance requirements.
- Electrification with Magnetic Bearing Chiller
 - Oil-free eliminates the install and maintenance with a lubricated system
 - Magnetic bearings that create a magnetic field which allows the motor shaft to rotate without the need for lubrication
 - Staging compressors to cycle on and off as needed and handle full and part loads more effectively than steam-turbine chillers.
- VFD Pumping
 - Both chilled water and condenser
- Chiller Plant Controls

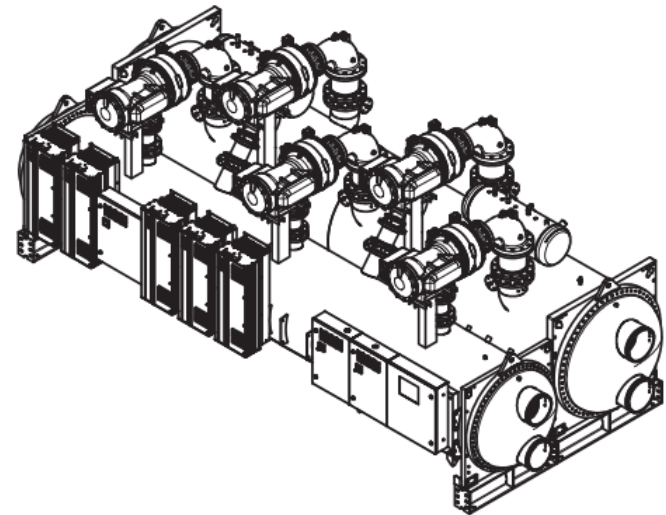
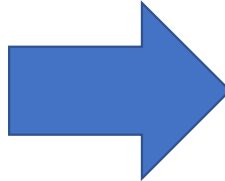


RFP Process

- Original scope called for two chillers
 - 2x chilled water pumps
 - 2x condenser water pumps
- H&V Sales provided alternate bid for a single Smardt chiller
- Multiple compressors = integrated redundancy
- Resulted in significant construction cost savings

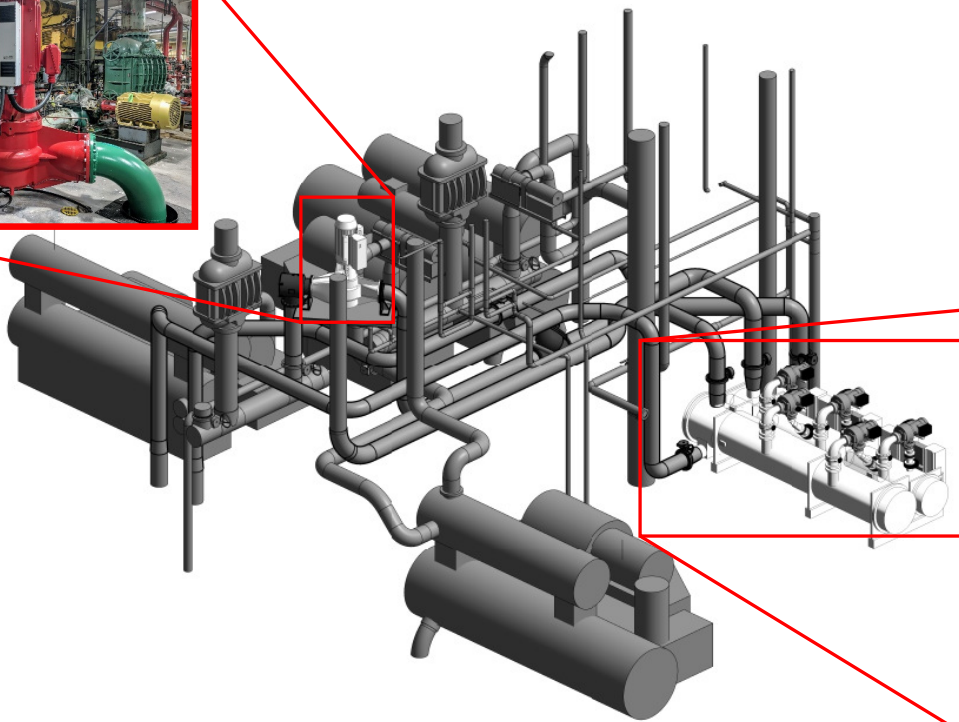
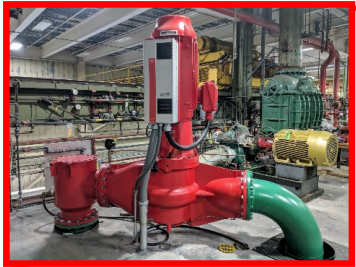


1,000 Tons + 1,000 Tons



2,000 Tons

Design & REVIT Modeling

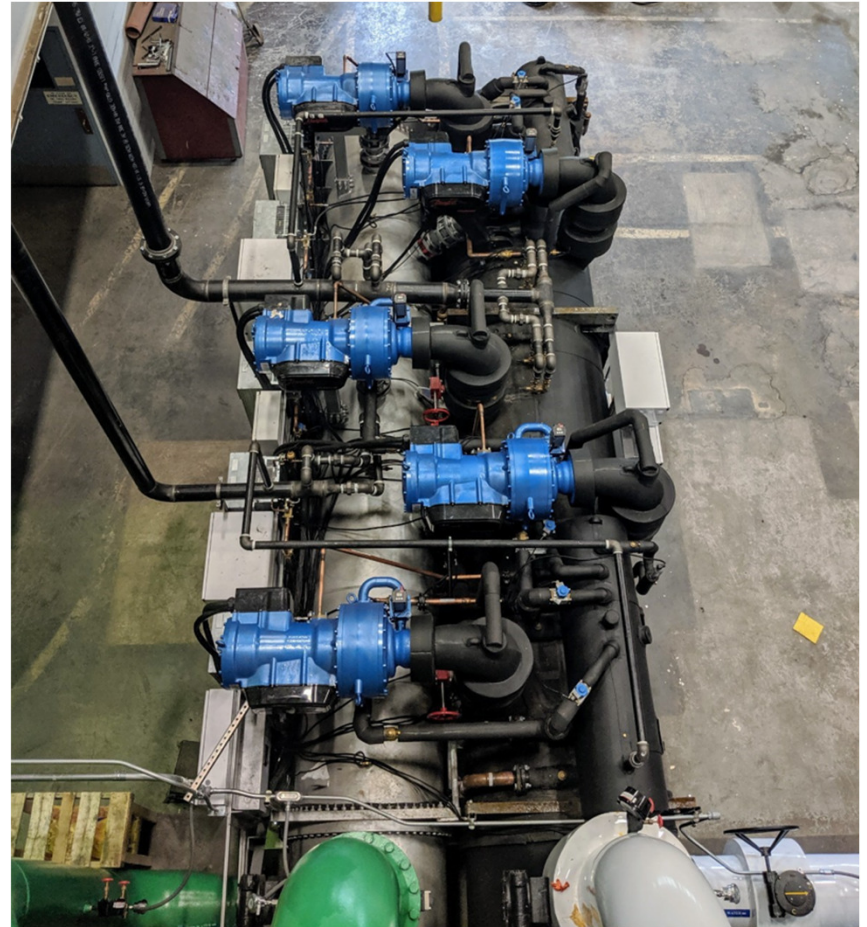


- 3D Scan and REVIT made easier coordination across multiple floors.



Installed System

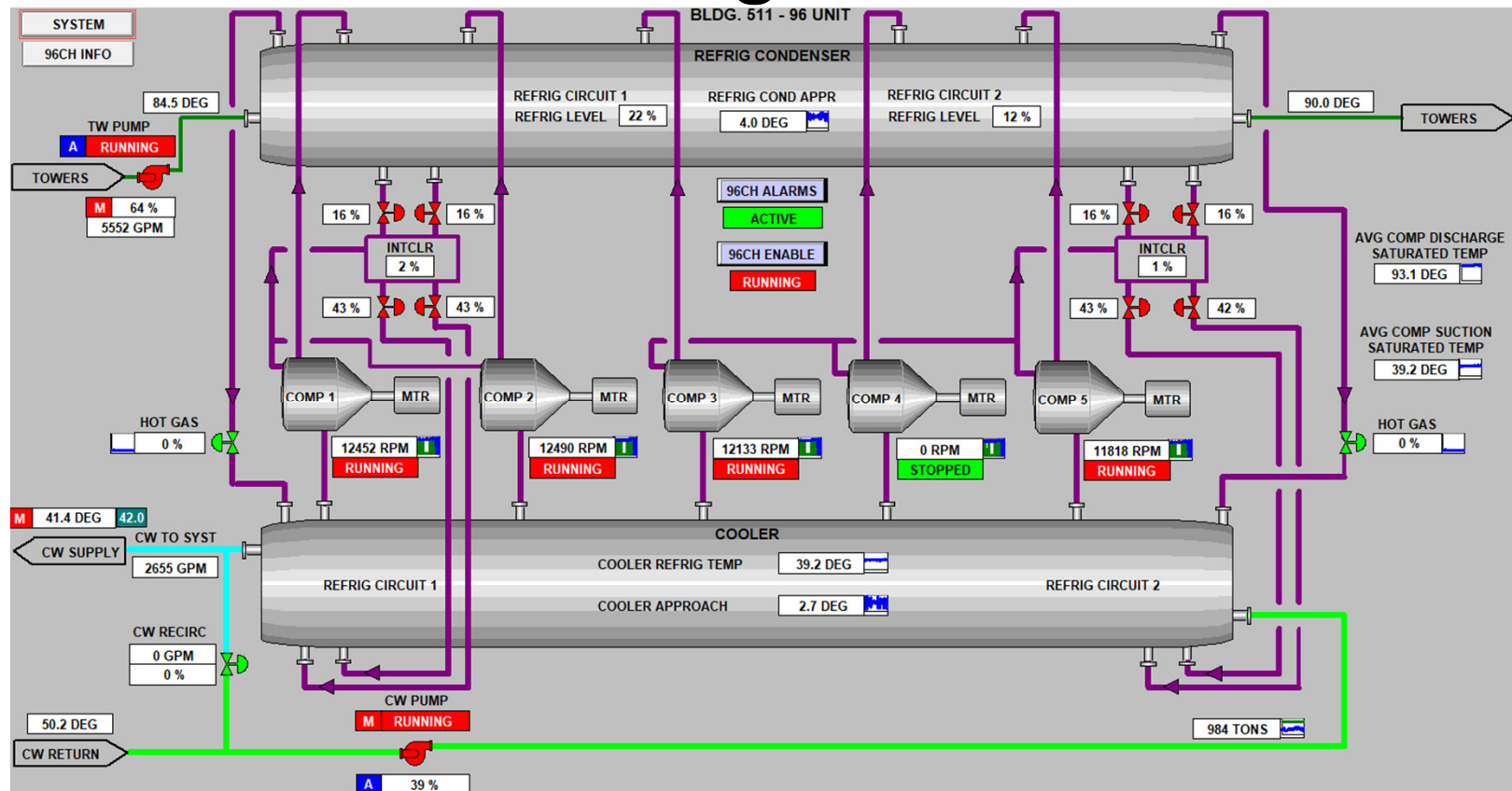
- 2000 Ton Mag Bearing Chiller by Smardt w/ 2x Refrigerant Circuits & 5x Turbocor Compressors
- 300HP Variable Speed, Vertical Inline CHW Pump by Armstrong w/ factory mounted VFD
- 250HP Variable Speed, Vertical Inline Condenser Water Pump by Armstrong w/ factory mounted VFD
- 125HP Variable Speed Cooling Tower Fan w/ Premium Efficiency Motor
- 57x Thermostatically Controlled Distribution System Recirculation Valves
- 93 Steam Chiller Remote Start/Stop Automation and Pump Soft Starts.



Performance Optimization

- All equipment integrated into RED's Emerson Ovation Distributed Control System & OSIsoft PI Data Historian
- Fully variable system
- Smardt Chiller utilizes factory Kiltech controller, field tuned to optimize compressor staging and loading
- Chilled water pump speed controlled to maintain distribution system differential pressure setpoint
- Condenser water pump speed controlled to maintain ΔT setpoint across chiller condenser
- Cooling tower fan speed controlled to supply tower water based on approach setpoint with outdoor wet bulb temperature.
- Condenser water supply temperatures down to 45F
- Continuous monitoring, M&V and system tuning to optimize operational performance and efficiency

Continuous Monitoring & Control

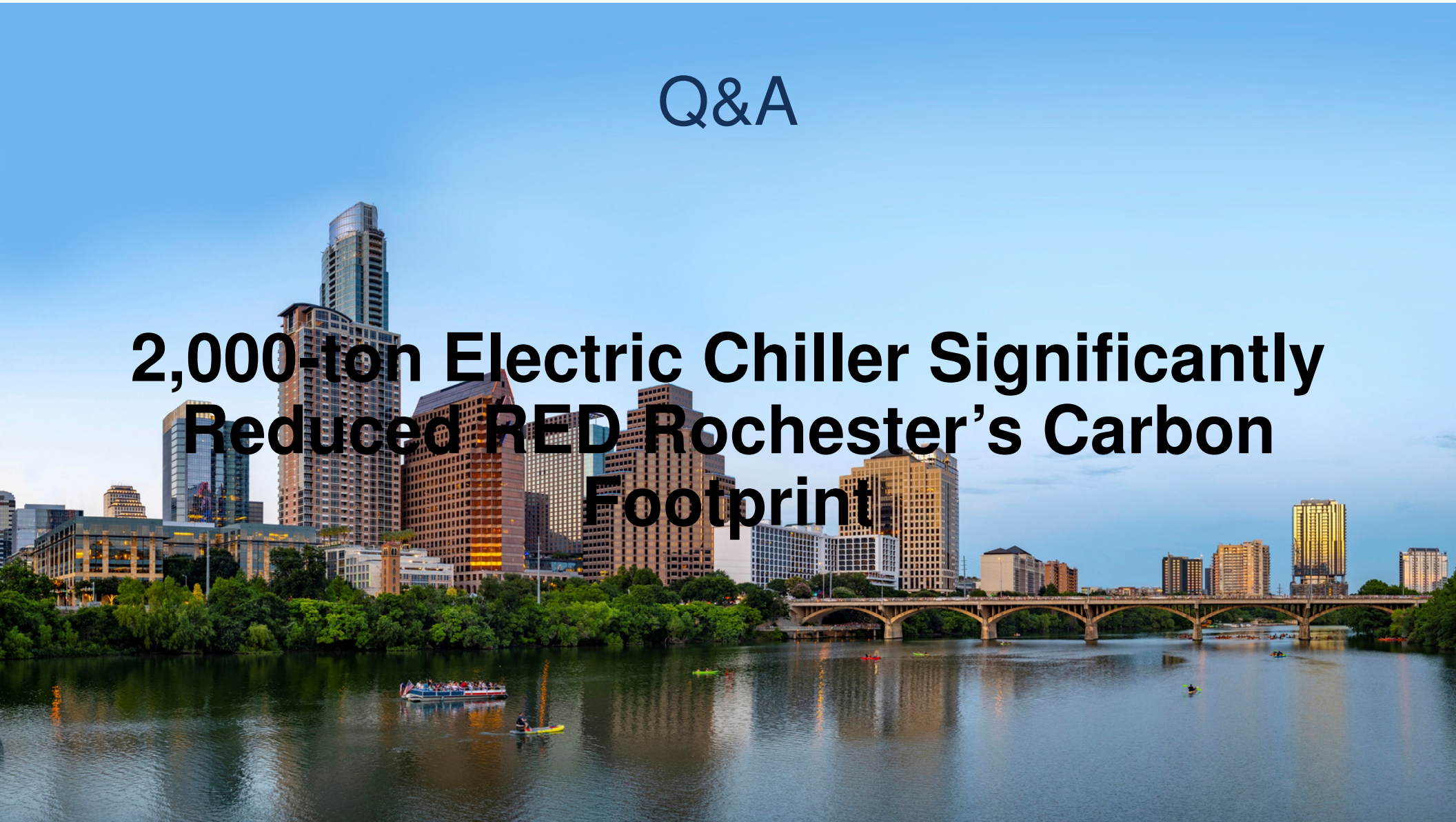


Project Results & Economics

- World Class Chiller Efficiency as low as 0.15 kW/Ton (COP \approx 25)
- Avg Annual Chiller Effic – 0.35kW/Ton
- B511 Steam Vent Reduced by 72% to 5.7kLbs/hr
- System Distribution Flow Reduced by 1500 GPM
- Reduced Annual CO2 Emissions by > 23,300 Metric Tons
- Annual Utility Cost Savings - \$880k
- Project Cost - \$1.9M
- State & Local Utility Incentives - \$775k
- **Simple Payback – 1.3 Years**

Q&A

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Thank You!

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