Supporting A Fast Track Mission-Critical Campus Healthcare Expansion

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New Campus Master Plan
5.5 million SF Completed June 2012
New Medical School

Master Plan
Completed April 2013
Phase 1
1 million square feet

Phase 2 - 1,200,000 square feet in 5 to 10 years

Table 2a. Dell Medical School Program
<table>
<thead>
<tr>
<th>PROGRAM ELEMENT</th>
<th>GSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education and Administration Building</td>
<td>75,000</td>
</tr>
<tr>
<td>Research Building and Vivarium</td>
<td>240,000</td>
</tr>
<tr>
<td>MOB Phase 1</td>
<td>200,000</td>
</tr>
<tr>
<td>Parking Structure (1,000 spaces)</td>
<td>325,000</td>
</tr>
<tr>
<td>Intra-Professional Education (IPE)*</td>
<td>+/- 50,000</td>
</tr>
</tbody>
</table>

*Not included in Phase 1 planning budget.

Table 2b. Teaching Hospital and MOB Program
<table>
<thead>
<tr>
<th>PROGRAM ELEMENT</th>
<th>GSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital (220 beds)</td>
<td>480,000</td>
</tr>
</tbody>
</table>
Methodology

Develop Utility Master Plan in 3 months

• Used building type & actual metered energy use per GSF for existing campus buildings
  • Estimate annual & peak energy & water needs
  • Determine plant total capacity & rate impact

• Used Termis chilled water and steam model
  • Size and plan distribution system

• Include build out of 2.2 million SF for Phase 2&3

• Include 1 million more new square feet on the campus
Over Arching Objectives

• New chilling station
  • Capacity & efficiency enough to prevent negative impact to campus
  • Expandable to address subsequent phases of district
  • Continue philosophy of loops & redundant service

• What is impact of other new space?

• Avoid power plant expansion

• Avoid conflict between Peak Steam and Peak Power
Projected Loads

• Main Campus Load Growth
  • 6,000 Tons

• Phase I
  • Dell Medical School;
    • 7,000 Tons, 6 MW, 30,000 lbs/hr

• Hospital
  • 1,700 Tons, 30,000 lbs/hr

• Phase II- Medical School
  • 5,100 Tons, 4MW, 25,000 lbs/hr
Capacity

• Chilled Water System
  • 15,000 tons chilled water
  • 6 -2,500 ton chillers
  • 5°F approach cooling tower
  • Expandable to 20k tons
• 5.5 million gallon TES
• Stratified Water
• Dedicated pumping
• More than 5 MW load shifting capacity
Capacity

• Chilled Water
  • Proven Existing System
  • Tunnel + Direct Buried
  • Station Redundancy

• Heating Water
  • New System
  • Fuel Diversity
  • Geographic Diversity

• Single Points of Failure
  • N+1 pumps and tower cells
  • Looped Piping
  • Main tie main switchgear
Resiliency

• Multiple Water Sources
  • Recovered
  • Reclaimed
  • Irrigation
  • Domestic

• O&M Considerations
  • Bridge crane and monorails
  • Standardize components
  • Catwalks

• PLC Control Systems
  • Programming for failure
Efficiency

• Water
  • Recovered Water System
  • Heat Pump Chiller
    • 17,000,000 gal/year + Chemicals

• Gas
  • Heat Pump Chillers
    • $287,000/ year

• Electricity
  • Optimization
    • Maintain the “Sweet Spot”
    • Pumping in harmony
  • Up to 25,000,000 kWh/year savings vs. conventional plant
CS7 / TES-2 BENEFITS

• Lower campus annual kW/ton
  • 4 years at .64 kW/ton annual average
  • New plant expected at .55 KW/ton

• Offset 6 MW of peak demand
  • Avoids additional CHP capacity need

• Improves campus hydraulics

• Off-loads plants in need of renewal

• Room for expansion
  • 5,000 tons more
  • 1,800 tons / 30 MMBtu with HPC’s
  • 12 MMBtu via boiler