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>
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</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
SUMMARY
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