Cold Climate Chiller Plant
SOUTH DAKOTA STATE UNIVERSITY

March 8, 2018
Agenda

01 Evaluation
02 Construction
03 Energy Use
04 Lessons Learned
Evaluation

Results from 2005 Campus Master plan for 2025.
Evaluation

Utilities Master Plan

Plant Study

Design and Construction
Evaluation

• Northwest Part of Campus
• Research Centers which were utilizing air cooled condensers provide base loading
Construction

• Football Stadium construction moved up. Changed Distribution System installed Day 1.

• New Precision Ag Building announced the week prior to factory testing the chillers. Plant went from N+1 to N-all most meet peak.
Plant Design

- WATER TREATMENT
- FREE COOLING HX
- 3 X 750-TON CHILLERS
- CHILLED WATER AND CONDENSER WATER PUMPS
- FUTURE CHILLERS
- GLYCOL STORAGE
- ELECTRICAL ROOM
- FUTURE BOILERS
Construction
Construction PPT
Piping
Construction

Most of the piping was fabricated at the factory to minimize the on site fusion welding.
Construction

Equipment connections at chillers and pumps were steel.
Construction
Extensive filtration to maintain water quality
Free Cooling Heat Exchanger

Cooling Tower Drain Down Tank

Construction
Comparison

Cooling Degree Days

- 2015 – 526
- 2016 – 591
- 2017 – 501

Electrical (Consumption and Demand)

Water Use

- Air cooled chillers were sprayed with water to increase capacity.

Sewer Use

- New Plant does not pay sewer charge for evaporated tower water (Make-up minus blowdown).
Electrical - Consumption

- North Chiller Plant
- Northern Plains Biostress
- Animal Resource Wing
- Animal Disease Research
- Animal Science Complex
Electrical - Demand

- North Chiller Plant
- Northern Plains Biostress
- Animal Resource Wing
- Animal Disease Research
- Animal Science Complex

KW

2015
2016
2017

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000

2015
2016
2017

North Chiller Plant
Northern Plains Biostress
Animal Resource Wing
Animal Disease Research
Animal Science Complex
<table>
<thead>
<tr>
<th><strong>Savings Summary</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Annual Total Savings</strong></td>
</tr>
<tr>
<td>$169,310</td>
</tr>
<tr>
<td><strong>Electrical Consumption</strong> – 16.7%</td>
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<tr>
<td><strong>Electrical Demand</strong> – 16.7%</td>
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<tr>
<td><strong>Water Use</strong> – 2%</td>
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<tr>
<td><strong>Sewer Use</strong> – 32.9%</td>
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</tbody>
</table>
### Total Plant Energy Use

<table>
<thead>
<tr>
<th></th>
<th>kWh</th>
<th>Btu</th>
<th>ton-hour</th>
<th>kW/ton</th>
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<tbody>
<tr>
<td>January</td>
<td>12,726</td>
<td>4,999,936</td>
<td>417</td>
<td>30.543</td>
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<tr>
<td>February</td>
<td>24,910</td>
<td>104,000,000</td>
<td>8,667</td>
<td>2.874</td>
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<td>March</td>
<td>19,549</td>
<td>134,000,128</td>
<td>11,167</td>
<td>1.751</td>
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<tr>
<td>April</td>
<td>41,656</td>
<td>489,999,872</td>
<td>40,833</td>
<td>1.020</td>
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<tr>
<td>May</td>
<td>100,701</td>
<td>1,332,000,000</td>
<td>111,000</td>
<td>0.907</td>
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<tr>
<td>June</td>
<td>204,360</td>
<td>3,103,000,064</td>
<td>258,583</td>
<td>0.790</td>
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<tr>
<td>July</td>
<td>345,016</td>
<td>5,542,579,840</td>
<td>461,882</td>
<td>0.747</td>
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<tr>
<td>August</td>
<td>259,728</td>
<td>4,388,170,176</td>
<td>365,681</td>
<td>0.710</td>
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<td>September</td>
<td>219,962</td>
<td>3,430,939,584</td>
<td>285,912</td>
<td>0.769</td>
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<tr>
<td>October</td>
<td>54,493</td>
<td>785,000,448</td>
<td>65,417</td>
<td>0.833</td>
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<tr>
<td>November</td>
<td>10,680</td>
<td>48,000,000</td>
<td>4,000</td>
<td>2.670</td>
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<tr>
<td>December</td>
<td>9,669</td>
<td>9,999,360</td>
<td>833</td>
<td>11.604</td>
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<tr>
<td>Total</td>
<td>1,303,450</td>
<td>19,372,689,408</td>
<td>1,614,391</td>
<td>0.807</td>
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</tbody>
</table>

**Peak load – 1,050 Tons instantaneous**  
**Sustained Peak - ~800 Ton**
Questions