Utilities Production and Distribution Master Plan
University of Illinois at Urbana-Champaign

REVIEW OF DRAFT REPORT WITH STAKEHOLDERS
KENT REIFSTECK - DIRECTOR OF UTILITIES & ENERGY SERVICES

F&S ENERGY SERVICES - POWERING THE FUTURE
Utility Planning & Recent History

- Last Major Review late 1990s
- Capital Improvements early 2000s
  - COPS “Borrow” ~ $145M
    - Central Chilled Water System
    - Abbott - 2 Gas Turbines Comb Cycle
    - Electric Distribution – New Sub
  - ~$200M Remaining Debt Service
- Continuous Improvements (e.g. Thermal Energy Storage tank)
- Conservation alleviated additional Supply Infrastructure
General Process
- Affiliated Engineers, Inc. (AEI)
- Started 2012
- Projecting to 2049
- Stakeholder Engagement

Goals and Objectives
1. Existing Services
2. Improvement Options
3. Recommended Plan
Existing Services

- Campus loads, projected growth, and demands
- Condition & remaining service life of utilities infrastructure
- EPA Air Permit
- Operations & maintenance
- Purchase and import of utilities
- Compare capacity versus loads
Existing Utility Systems

Distribution Systems
Abbott Power Plant (APP)

Co-Gen (CHP) Advantage

CO2 pounds per kilowatt-hour

- Abbott Power Plant: 0.87 lb/kWh
- Illinois electric grid: 1.60 lb/kWh

Utilities & Energy Services
April 9, 2015
Projected “Growth”

Accurate space GSF projections are vital for accurate future peak load projections.

Three Growth Scenarios

- **Zero Growth Strategy:** constant of 22,173,000 GSF
- **Low Growth Projection:** build 75,000 GSF per year
- **High Growth Projection:** build 150,000 GSF per year
- **NOT Projected Historical Growth:** built 300,000 GSF per year
## Campus Peak Load Projections

- **Required Infrastructure** dependent on accurate load estimate
  - Campus Future Space Plan – Commit to what is planned
  - Energy Conservation Commitment – Charts presented include this
  - Super Computers – 2049 Elec Peak + 30 MW w/ cont’d data center

<table>
<thead>
<tr>
<th></th>
<th>2014 Peak</th>
<th>2049 Peak</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>600 kpph</td>
<td>701 kpph</td>
<td>17%</td>
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<tr>
<td>Chilled Water *</td>
<td>30,948 tons</td>
<td>49,474 tons</td>
<td>60%</td>
</tr>
<tr>
<td>Electric</td>
<td>78,437 kW</td>
<td>110,100 kW</td>
<td>40%</td>
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<tr>
<td>Gross Square Feet **</td>
<td>22,173,000</td>
<td>27,573,000</td>
<td>24%</td>
</tr>
</tbody>
</table>

* Chilled Water projection includes 8,108 tons of building conversions
** Gross Square Feet (GSF) projected to increase at 150,000 GSF per year
CHILLED WATER CAPACITY VS FUTURE LOAD

BAU

- FUTURE CHW LOAD, 150K GSF/YR
- N+1 FIRM CAPACITY (NO VET MED)
- FUTURE CHILLED WATER LOAD, 75K GSF/YR
- FUTURE CHILLED WATER LOAD, 0 GSF/YR
- DATA CENTER CAPACITY

VET MED, 4,700 TO 5,250 TON
NCCP 9,400 TO 16,400 TON
ANIMAL SCIENCE 2,000 TON
CHEM LIFE 3,630 TON
OAK ST CHILLER PLANT (ELEC), 17,630 TON
OAK ST CHILLER PLANT (STM), 10,000 TON
LIBRARY A/C CENTER, 4,340 TON
TES, 5000 TON
EXISTING IMPORT CAPACITY
60 MW

CT 1 & 2 (INLET CLG)
13.5 MW EACH

EXISTING CT 1 & 2
11 MW EACH

APP STG BACKPRESSURE
APP STG CONDENSING

APP ELECTRIC PRODUCTION VARI
BASED ON AVAILABLE STEAM

ELECTRIC LOAD VS FUTURE LOAD
BAU WITH CONSERVATION

N+1 FIRM CAPACITY
FUTURE ELECTRIC LOAD, 150K GSF/YR
FUTURE ELECTRIC LOAD, 75K GSF/YR
FUTURE ELECTRIC LOAD, 0 GSF/YR
DATA CENTER IMPACT
Improvement Options

✓ Focused on Providing the Best Overall Option
✓ Focused on Safe, Reliable, Cost Effective, and Sustainable Options
✓ Goal is Utility Services that Meet Campus Energy Needs
Option Analysis

- More than 200 concepts considered and screened
- Technically verified concepts analyzed in detail
- Recommended options identified based on analysis that considered safety, reliability, cost, and sustainability
- Summarized 13 Options (4 Themes) compared to the Base Case
## LIFE CYCLE COST SUMMARY ($ MILLIONS)

<table>
<thead>
<tr>
<th>OPT. NO.</th>
<th>DESCRIPTION</th>
<th>ABBOTT PP</th>
<th>NO CAMPUS GROWTH</th>
<th>150,000 GSF/YEAR GROWTH</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>PV CAPEX</td>
<td>$0 PER TON GHG</td>
<td>$10 PER TON GHG</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>TOTAL PRESENT VALUE</td>
<td>TPV BAU DIFF.</td>
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<tr>
<td><strong>BAU</strong></td>
<td></td>
<td>269</td>
<td>1,704</td>
<td>---</td>
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<tr>
<td>1.1</td>
<td></td>
<td>221</td>
<td>1,638 (66)</td>
<td>1,694 (75)</td>
</tr>
<tr>
<td>1.2</td>
<td></td>
<td>250</td>
<td>1,720 16</td>
<td>1,768 (1)</td>
</tr>
<tr>
<td>1.3</td>
<td></td>
<td>226</td>
<td>1,663 (41)</td>
<td>1,719 (50)</td>
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<tr>
<td>2.1</td>
<td></td>
<td>212</td>
<td>1,820 116</td>
<td>1,902 133</td>
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<tr>
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<td>216</td>
<td>1,826 123</td>
<td>1,908 140</td>
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<tr>
<td>2.3</td>
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<td>454</td>
<td>2,124 421</td>
<td>2,203 435</td>
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<td>3.1</td>
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<td>294</td>
<td>1,726 22</td>
<td>1,779 10</td>
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<tr>
<td>3.2</td>
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<td>266</td>
<td>1,673 (30)</td>
<td>1,729 (39)</td>
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<td>299</td>
<td>1,725 22</td>
<td>1,777 8</td>
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<td>274</td>
<td>1,793 89</td>
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<td>4.1</td>
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<td>265</td>
<td>2,004 300</td>
<td>2,047 278</td>
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<tr>
<td>4.2</td>
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<td>468</td>
<td>1,912 208</td>
<td>1,993 224</td>
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</tbody>
</table>

**NOTES:**
1. CHP - COMBINED HEAT AND POWER
   - BLP - BOILERS
   - CBLP - BUILDING CONDENSING BOILERS
   - HRC - HEAT RECOVERY CHILLERS
   - GHRC - GEOTHERMAL HEAT RECOVERY CHILLERS
2. PHV - PHOTOVOLTAIC SOLAR
   - PV - PRESENT VALUE
   - TPV - TOTAL PRESENT VALUE
   - GHG - GREEN HOUSE GAS
Universal Recommendations

- Limit campus growth to net zero GSF.
- Expand the current energy conservation program in conjunction with Retrocommissioning.
- Provide heat recovery and energy reduction strategies on all new capital projects.
- Increase the electric import capacity.
Option Specific Recommendations

- Enhance best-in-class diversified fuel cogeneration.
- Add variable speed chillers to central system.
- Pursue additional renewable projects/renewable power purchase agreements as opportunity affords.
- Purchase renewable energy credits as needed.
- Apply heat recovery chiller technologies in specific campus regions.
- Continue to evaluate and apply new technologies for energy supply as the industry advances.
Next Steps

- Review plan with key stakeholders
- Finalize Plan
- Obtain approval of plan recommendations through CCRC
- Present plan to campus
- Integrate with other strategic initiatives and implement
- Plan for periodic review and update
  - Typically review every 3-5 years
  - With Strategic Changes or New Initiatives
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QUESTIONS?

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