Project update – Santa Clara County Retrofit Project

December 2011
Milestones achieved

- Upgraded data archiving system
- Collected 351 data points at 1 – 5 min intervals for ~2.5 years
- Developed SEE IT tool that combines display of measured and simulated performance data
- Completed EnergyPlus (baseline) simulation model (geometry and HVAC systems)
- Reviewed measured performance data in CEE243 (lead by graduate research assistant Tobias Maile) and developed list of performance problems
- Proposed initial set of 33 possible energy efficiency retrofit measures to Santa Clara County (SCC)
- SCC has almost completed the retro-commissioning effort

Focus of this presentation

- Data archiving problems → retro-commissioning
- Overview of EnergyPlus model and its adjustment
- Overview of performance problems found in CEE243
Data archiving problems

- Data for 10 months with 206 data points and 24 months with 351 data points
- Inconsistent documentation
  - as-built drawings did not represent as-built conditions
- Faulty and uncertain data
- Reliability problems with the bigger dataset

→ Thus need for retro-commissioning
Retro-commissioning

- SCC is working with PG&E (incentive funding)
- Contractor: Newcomb Anderson McCormick (SF-based engineering firm)
- Started in August 2011 (one year after initial decision to undertake retro-commissioning)
- Based on CEE243 class findings the contractor is eliminating problems with sensors, archiving, and controls
- Anticipated completion at the end of December 2011
- Simulation of proposed energy efficiency retrofit measures is pending completion of retro-commissioning and collection of building energy performance data post retro-commissioning
SCC – E+ model overview

• High level of detail for high flexibility for possible retrofit options

• Geometry model:
  • 13 floors (including mezzanine levels)
  • 437 thermal zones
  • 2468 spaces
  • 46160 space boundaries

• HVAC model:
  • 39 Air loops
  • 3 Water loops
  • about 600 HVAC components

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<th>Key tasks for EnergyPlus model development</th>
<th>FTE months</th>
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<td>Creation of HVAC systems and controls for EnergyPlus model - complete</td>
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SCC – Adjustment of E+ Model to measurements

• E+ model compared and adjusted to 301 data points
  – Difficulties in comparing such a detailed model with less detailed and faulty data
  – Level of detail provides large number of possible adjustments → large number of simulations (>100)
  – Faulty controls difficult to model in EnergyPlus (e.g., heating increase with hotter outside temperatures)
  – Comparison of simulated and actual performance done on a floor basis
  – Floor-based models combined into one large model
  – Compared to Y2E2, the SCC E+ model is 5 – 10 times larger (more square footage, more HVAC systems)
Problems found in CEE243

Examples:
- Cooling/heating coil position fluctuates very often
- Supply and space temperatures outside of set point range
- Coil valve position is constant (over 14 months)
- Supply air temperature and heating coil inlet temperature seem reverse

→ Facility has a significant number of control problems
→ These problems increase our effort and indicate overall state of the facility
An example of a specific control problem

Supply air temperature of Air Handler 02 shows:

- correlation with intended control strategy (green)
- a control problem if outside air temperature is below 50 F or above 75 F (red)