Lessons Learned - SMUD’s East Campus Operations Center

7th Annual Statewide Energy Efficiency Forum
Applying Building Technologies to Realize Savings
June 16, 2016

Powering forward. Together.
About SMUD

- SMUD began serving Sacramento in 1946
- 620,000 meters
- 1.46 million population
- $1.47 billion in revenues
- 900 mi$^2$, 2331 km$^2$ service territory
- 7 member, elected Board of Directors
- Not-for-Profit Utility
- 2nd largest muni in California, 6th largest in the US
- 3299 MW peak load
- 2071 employees
East Campus Operations Center
Project Drivers

• Facility Improvement Requests
  – Parking reconfiguration
  – Conference and meeting space
  – Storage
  – Repair aging infrastructure

• Perform Master Plan
Master Plan Findings

Layout is 65+ years old
- Storage & parking
- Layout is inefficient; functions scattered
- Crew & conference space lacking
- Renovation will cost 30% more than relocating

Largest vehicles currently serviced outdoors

Delivery vehicles block exit drive
Existing Yard Situation

- Buildings 50+ years old
- Land locked-20ac
- Light Rail & Local traffic
  - Highly congested at peak times
- Safety & Security
- Not compatible with area
Conclusion of Master Plan

To safely and efficiently operate, you need at least 35 acres
Project Overview

- Location: Sacramento County, Bradshaw Rd./Kiefer Blvd.
- Site: 51 Acres
- Office Building: 203,000 sq ft
- Yard Buildings: 150,000 sq ft
  - Warehouse/Tool Issue
  - Fleet Maintenance Garage
  - Shops Building
  - Transformer Services
  - Truck Wash
- $122 Million
- Timeline:
  - Summer 2011 – Site Work
  - June 2014 – Project Completion
Project Goals

• LEED Platinum Certified
• Zero Net Energy site
East Campus Operations Center Site
Under Construction
East Campus Operations Center
Under Construction
East Campus Operations Center
Site Layout Design

1.1MW Tracking Solar PV

A Collection of Systems Designed for a New Era

Landscape Reclaimed Water

Bioswale Rainwater Collect / Filter

5 Acre Geothermal Field 14’ Underground

1 of 4 locations Solar hot water

5 Acre Geothermal Field 14’

Underground TES 40k Gal.

Conduit for 60 EV Spaces

55 Indoor Bike Lockers

SMUD®
Mechanical System

Heat Recovery Wheel

TES Tank

Cooling Towers

Geo-Exchange Field

CUP w/ Chillers

Air Source Heat Pump
Space Conditioning

Radiant System

Chilled Beams

Ceiling Fans
Plug Load Reduction

- VOIP Phones: 2 Watts
- Standard Phones: 24 watts
- Workstation Load – 55 W (Laptop, Docking Station & 2 Monitors)
- 18” LCD Energy Efficient Monitors: 12 Watts
- Typical 19”-24” Monitors: 30-50 Watts
- Ceiling Fans: 56 Watts
- Typical Ceiling Fans: 180 watts
- Desk Fans: Low 9 Watts, High 14 Watts
- Multi-Function Devices: 160 Watts (Continuous)
- Removing desktop printer saves ~ 460 watts/printer
- Laptop: 30 Watts
- UPS – High Efficiency: No Space Heater - Saves 1500 Watts
- Desktop Computer (Energy Star): 300 Watts
- LED Task lights: 6 Watts
- Fluorescent Task Lights: 35 Watts

SMUD - Annual Energy Enduse Breakdown:
- Plug Loads: 42%
- Lights: 29%
- DHW: 2%
- Fans: 14%
- Pumps: 3%
- HPU/Chiller: 5%
- Cooling Tower: 4%
- Car Wash: 3%
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Integrated Solutions

OPTIMIZE THE WHOLE ... Not just the pieces
1. Net zero energy facility: pv array with solar trackers sized to produce calculated annual energy needed by campus
2. Electric vehicle charging station
3. Thermal energy storage tanks to store chilled water for peak cooling
4. Heat recovery wheel to precondition incoming air
5. Ceiling fans for added thermal comfort
6. Radiant heating and cooling with pex tubing embedded in concrete structure
7. Light louvers used to bounce daylight deep into the building
8. Shade screens to prevent direct solar heat gain
9. Skylights
10. Concrete structure used for thermal energy storage
11. Highly insulated and reflective roofing
12. Highly insulated envelope designed with thermal breaks to minimize heat transfer
13. Solar thermal panels
14. Underground horizontal geo-exchange field that uses earth as a source of thermal energy
15. Zero potable water for irrigation: underground cistern used to store reclaimed grey water, rainwater, mechanical equipment blow down and condensate
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Occupancy
Energy Consumption

• Energy use higher than expected

• Team was put together to determine why
– Challenges
  • Multiple systems
  • Lack of central ownership
  • Labor intensive
  • Irregular reporting
Lobbies, hallways, stairways and the cafeteria were overlit and were operating almost all of the time at full intensity.

Existing lighting control zones were too large.

Daylight and occupancy sensors not working properly.

10 large flat screen monitors and 10 large flat screen TVs were operating 24/7/365.
Many areas were overlit:
- Wire cutting canopy
- Building overhang areas
- Amphitheater
East Campus Operations Center
Zero Net Challenge Task Force
Exterior Lighting & Controls

• Opportunities to add or improve controls:
  – Parking lots
  – Amphitheater
  – Wire cutting canopy
  – Pole Yard
  – Truck wash
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Zero Net Challenge Task Force
Lighting & Controls Summary

• Implemented 102 Lighting ECMs (interior & exterior) of 149 identified measures:
  – Cost: $97,975
  – Annual savings: $20,130, 182,998 kWh
  – Simple payback: 5 years

• Remaining 47 ECMs (interior and exterior):
  – Estimated cost: $157,051
  – Annual savings: $13,111, 119,188 kWh
  – Simple payback: 12 years
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Zero Net Challenge Task Force

Next Steps

- ECOC Interior/Exterior Lighting Completion
- Plug Load Assessment
  Admin building
- PV Optimization
- HVAC/Central Plant Optimization
Final Thoughts

• We achieved LEED Platinum based on the design
• Modeling vs. Reality—are there any REAL net zero buildings?
• The campus is extremely efficient, but not net-zero
• Reasons include:
  – Greater number of staff than planned
  – Dust from gravel operation reduces PV production
  – Greater loads than modeled
  – Not as integrated as planned
• Still…it’s an awesome project and we’re proud of it
Discussion and Questions

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