

Lessons Learned - SMUD's East Campus Operations Center

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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 mi², 2331 km² 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



Light rail impacts movement



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 Project Complete - June 2014



East Campus Operations Center Site Layout Design

A Collection of Systems Designed for a New Era

1.1MW Tracking Solar PV

Landscape Reclaimed Water

Bioswale Rainwater Collect / Filter

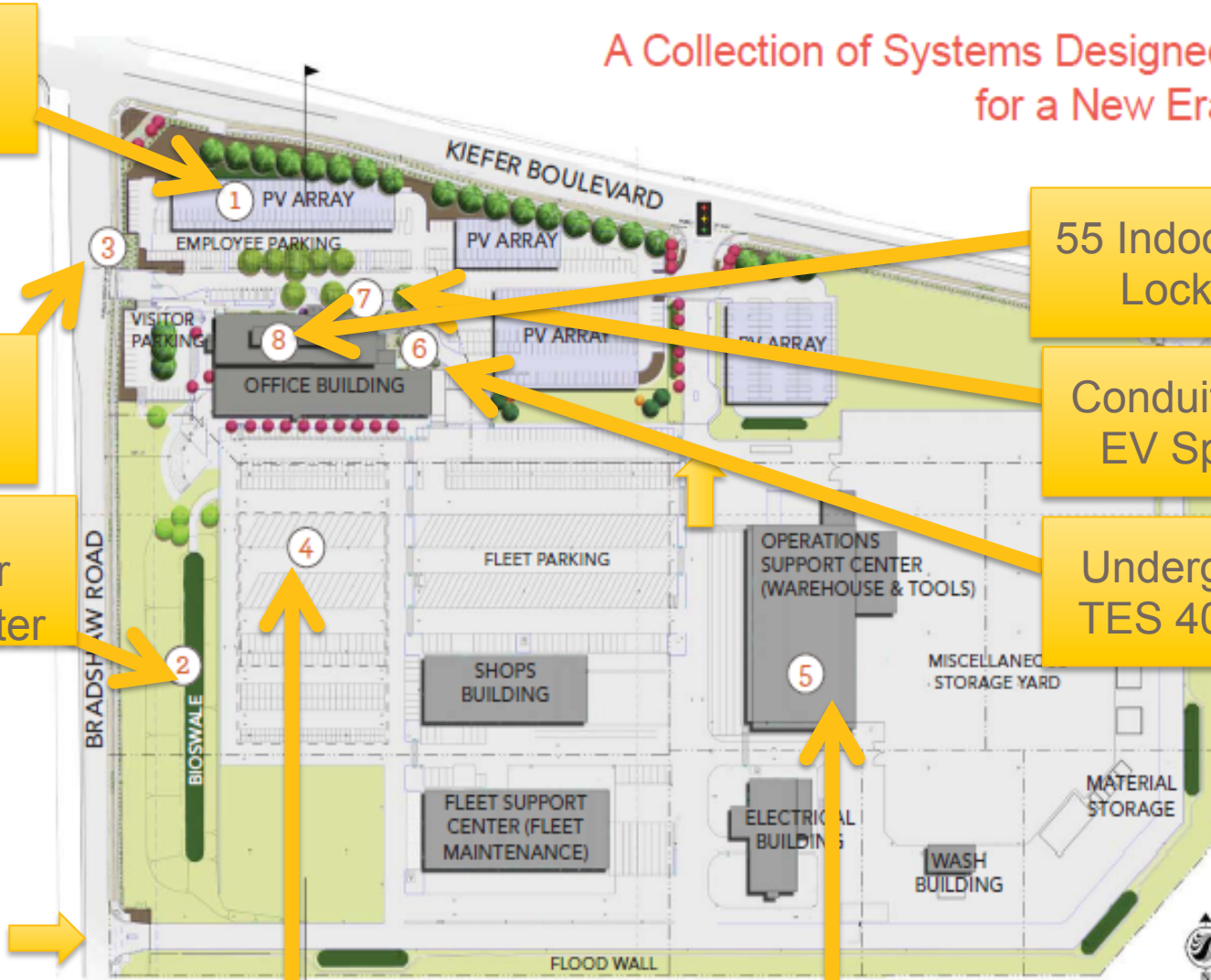
5 Acre Geothermal Field 14' Underground

1 of 4 locations Solar hot water

55 Indoor Bike Lockers

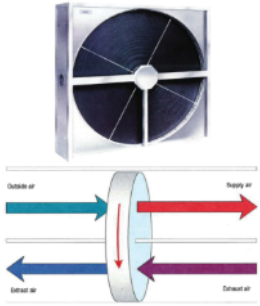
Conduit for 60 EV Spaces

Underground TES 40k Gal.

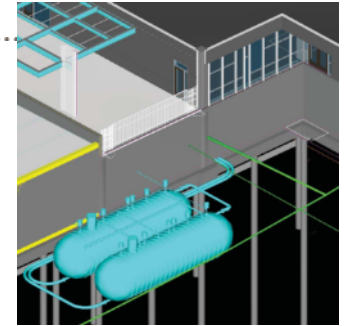
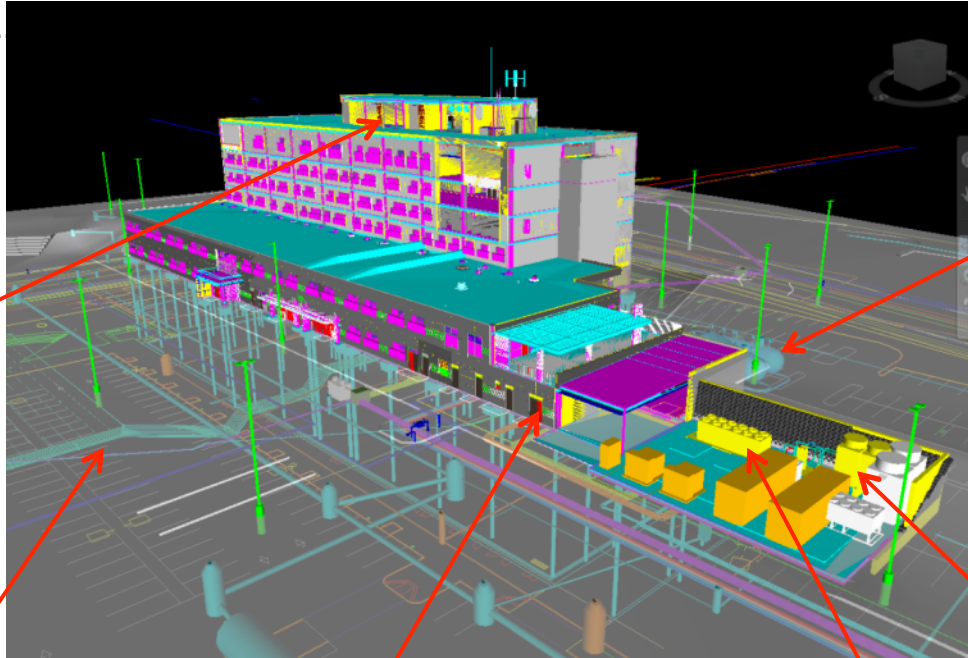




Mechanical System



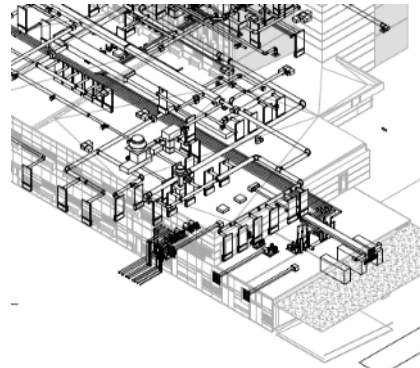
Heat Recovery Wheel



TES Tank



Geo-Exchange Field



CUP w/ Chillers

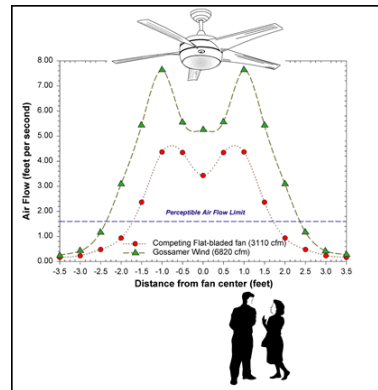
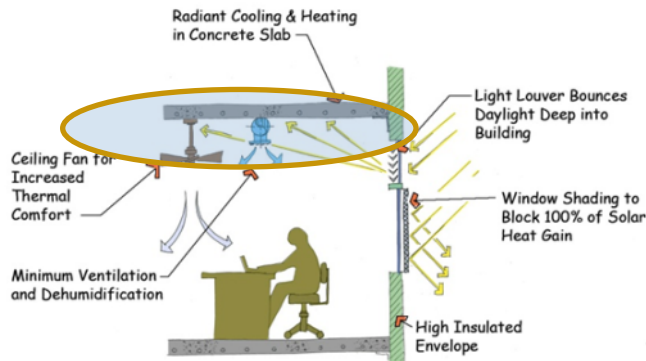


Air Source Heat Pump

Cooling Towers

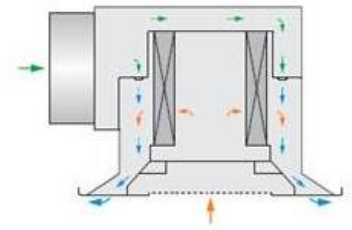


Space Conditioning



Ceiling Fans

Radiant System



Chilled Beams





Plug Load Reduction



VOIP Phones
2 Watts

Standard Phones
24 watts

Ceiling Fans
56 Watts

Typical Ceiling Fans
180 watts

Workstation Load – 55 W
Laptop, Docking Station &
2 Monitors

Desk Fans
Low 9 Watts
High 14 Watts

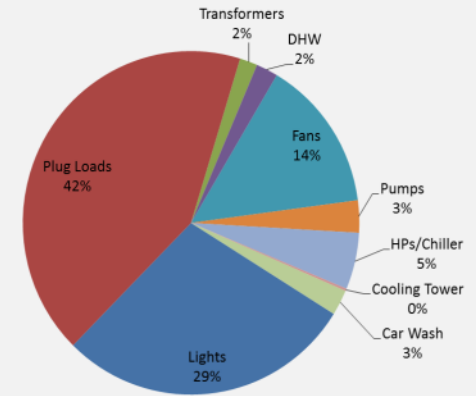
**18" LCD Energy
Efficient Monitors**
12 Watts

**Typical 19"-24"
Monitors**
30-50 Watts

Multi-Function Devices 160 Watts
(Continuous)

Removing desktop printer
save ~ 460 watts/printer

SMUD - Annual Energy Enduse Breakdown



UPS – High Efficiency

No Space Heater - Saves 1500 Watts

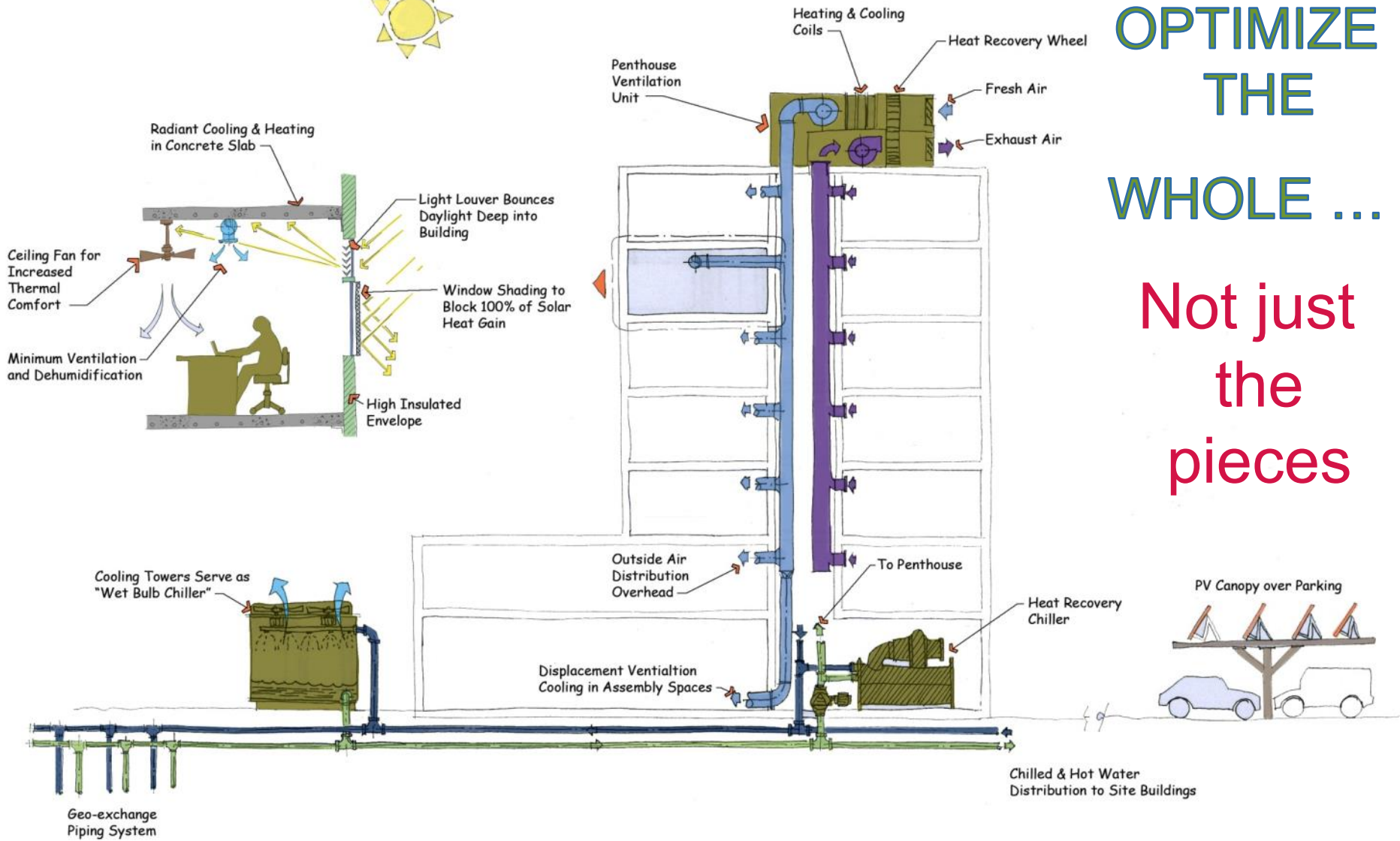
Laptop
30 Watts

**Desktop Computer
(Energy Star)**
300 Watts

**LED Task lights – 6
Watts**

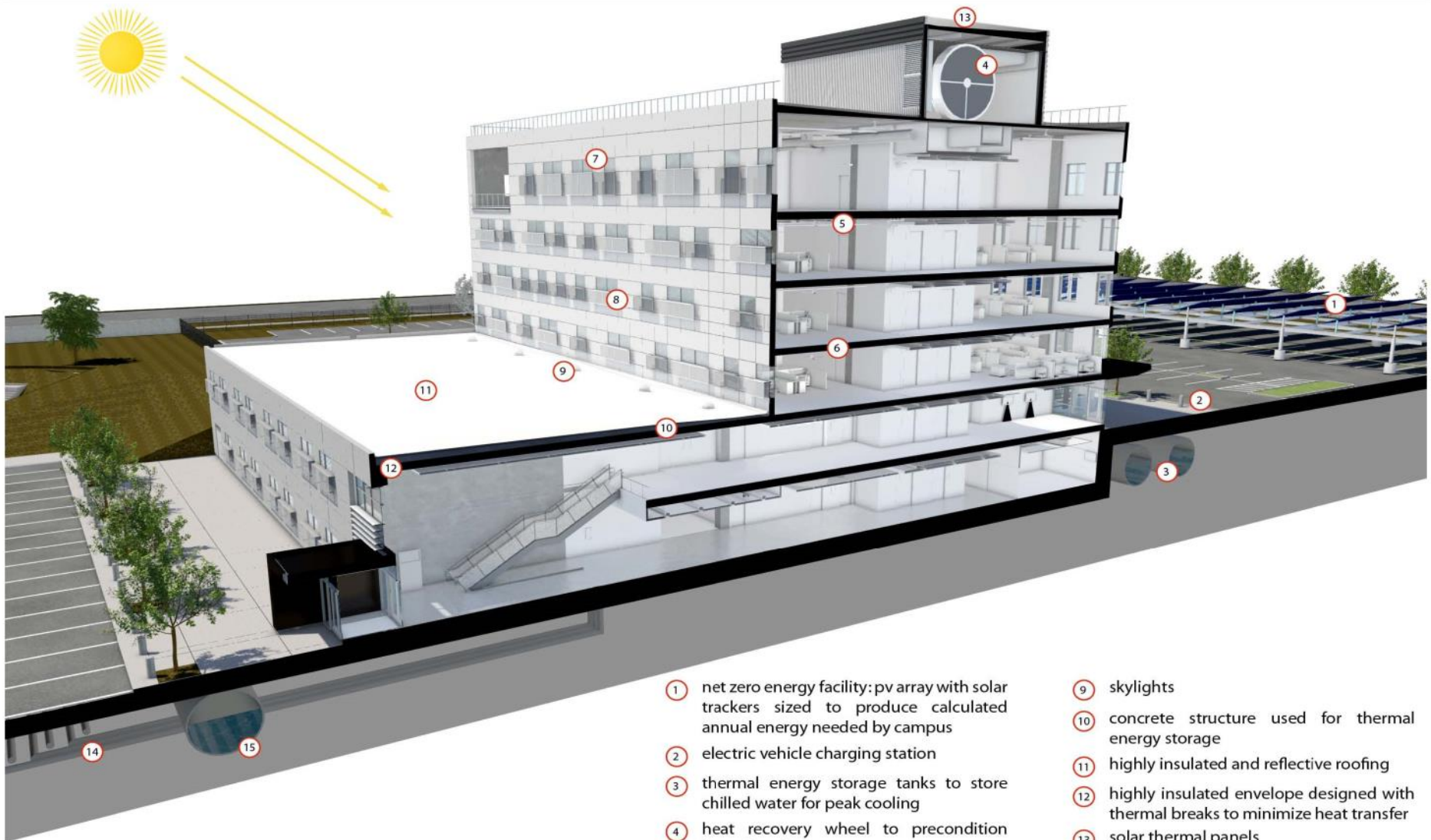
**Fluorescent Task
Lights 35 Watts**

East Campus Operations Center Integrated Solutions



OPTIMIZE
THE
WHOLE ...

Not just
the
pieces



- ① net zero energy facility: pv array with solar trackers 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

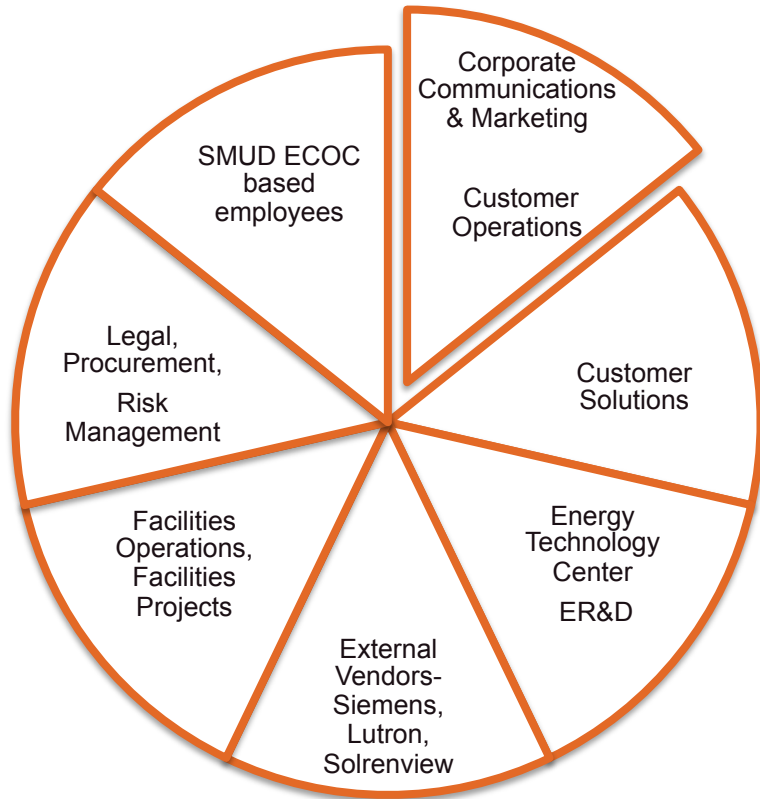
East Campus Operations Center Occupancy

Energy Consumption

- Energy use higher than expected
- Team was put together to determine why

East Campus Operations Center Zero Net Challenge Task Force

January 2015



**picking a darn
good team!**



SMUD 3.0 — FUTURE READY

Robust - Nimble - Innovative

East Campus Operations Center Zero Net Challenge Task Force Energy Data Governance

– Challenges

- Multiple systems
- Lack of central ownership
- Labor intensive
- Irregular reporting

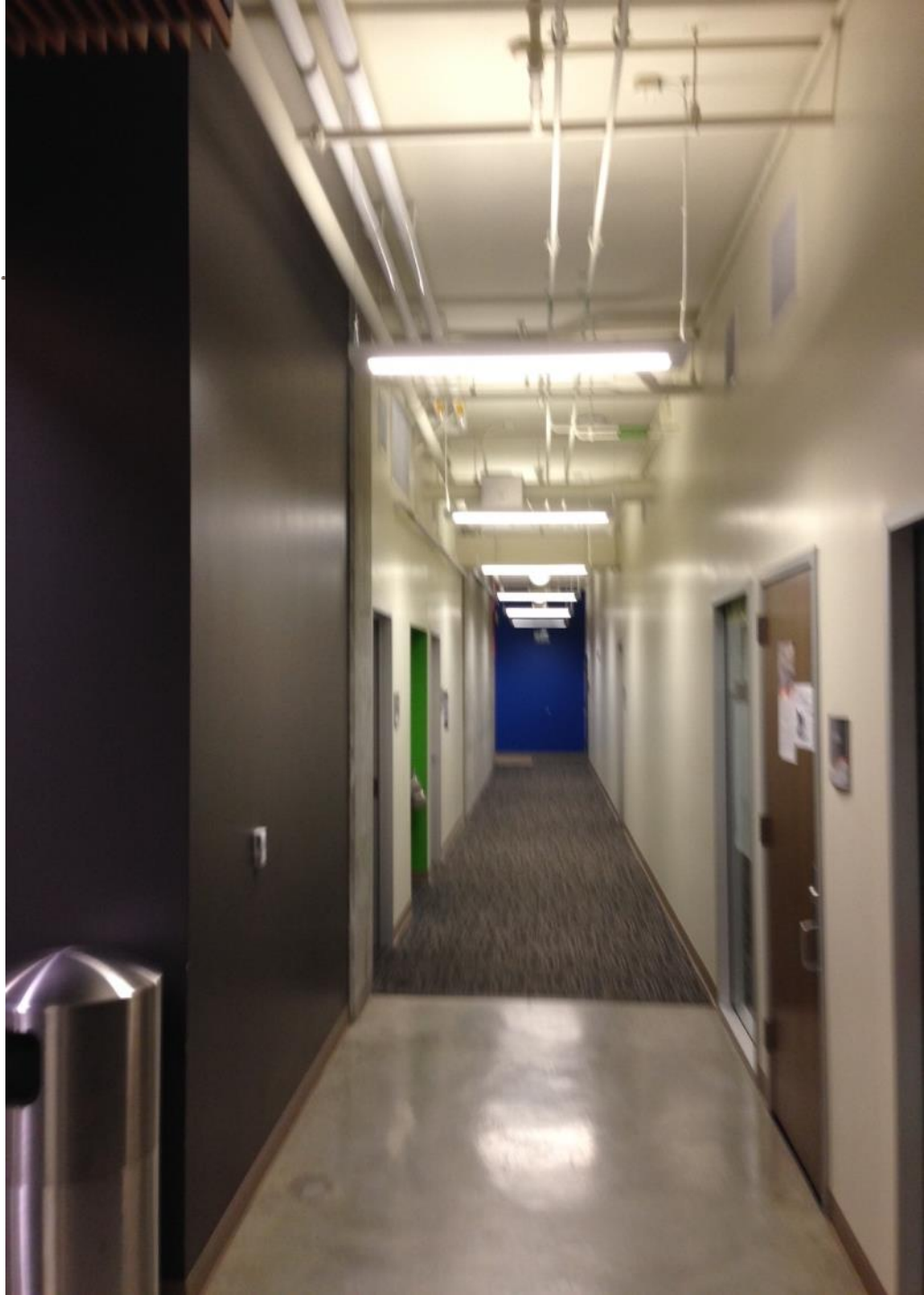


East Campus Operations Center Zero Net Challenge Task Force

Interior Lighting & Controls

- 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









East Campus Operations Center Zero Net Challenge Task Force Exterior Lighting & Controls

- 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



East Campus Operations Center 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

East Campus Operations Center Zero Net Challenge Task Force

Next Steps



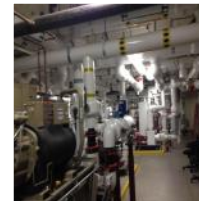
ECOC Interior/
Exterior Lighting
Completion

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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