Lessons Learned - SMUD's East Campus Operations Center

Jim Parks

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

Powering forward. Together.

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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

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East Campus Operations Center

Project Drivers

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

-   Perform Master Plan

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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

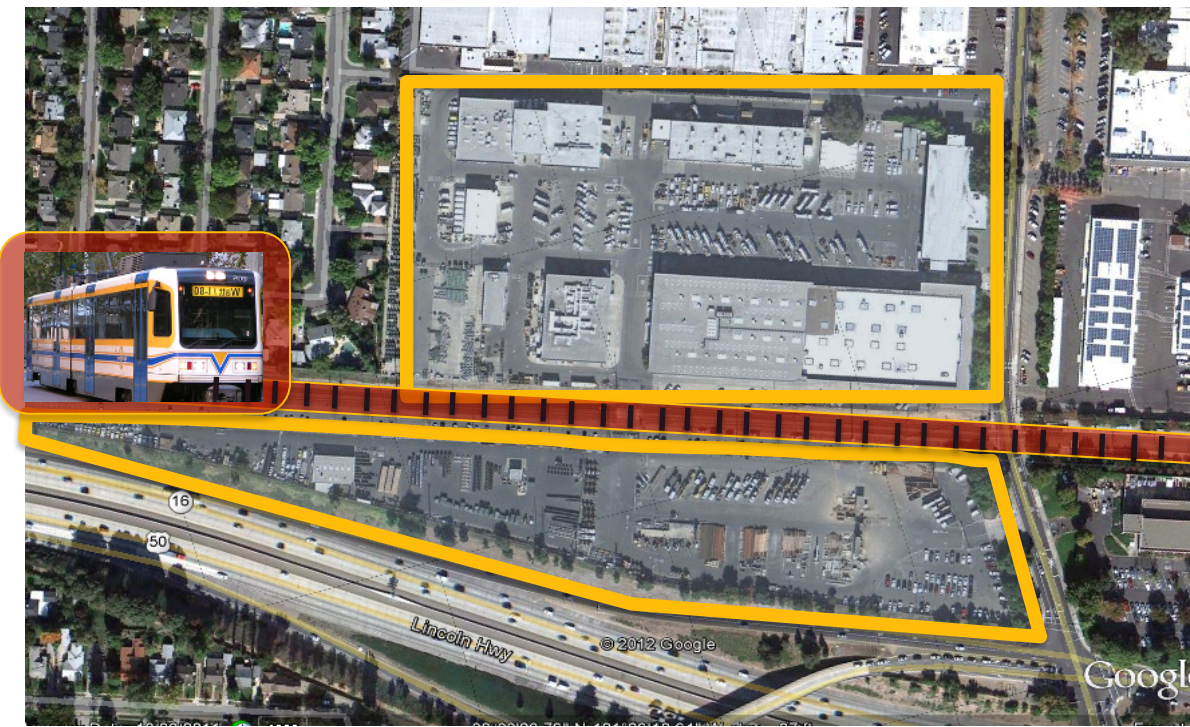

Largest vehicles currently serviced outdoors

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

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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

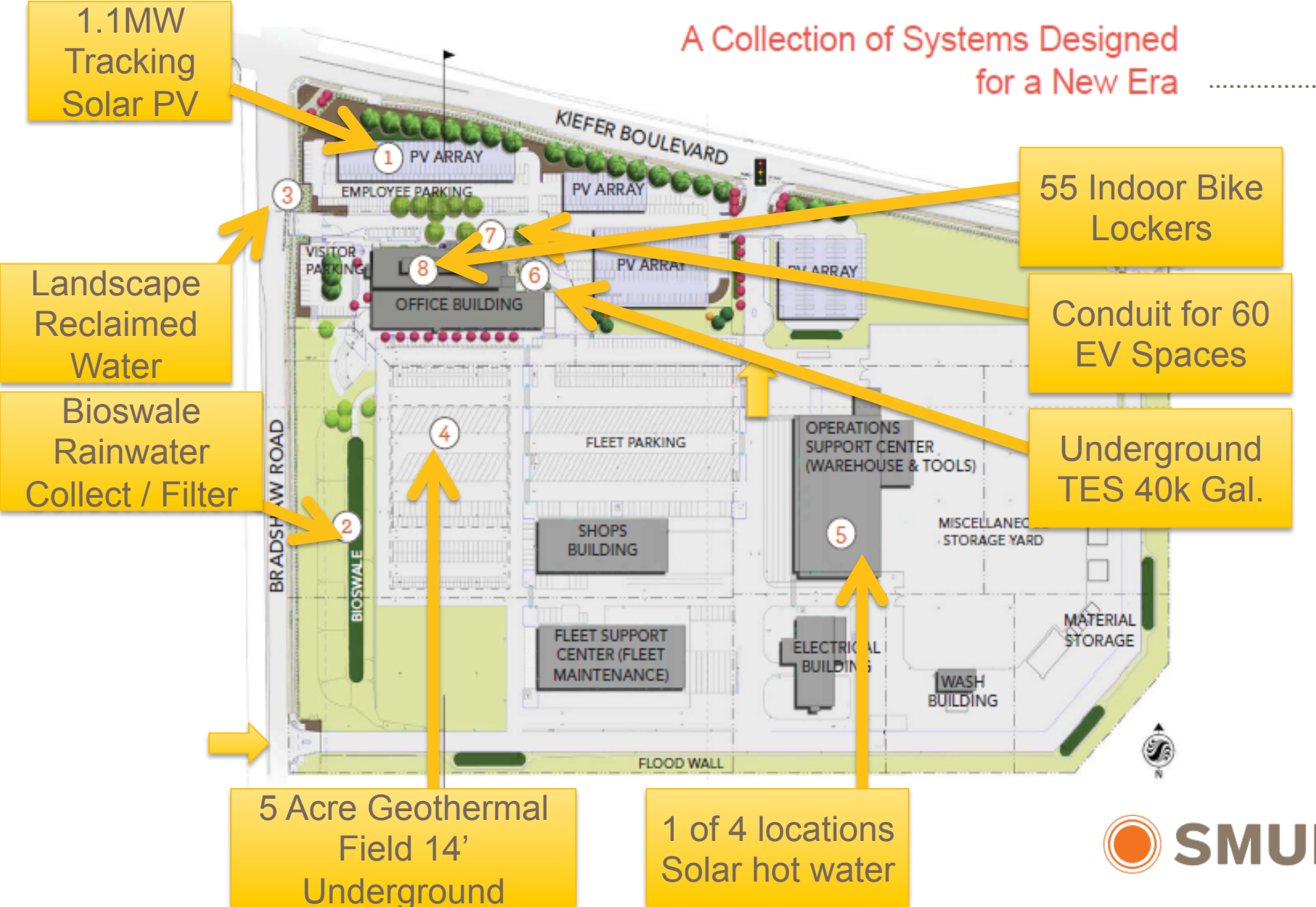# East Campus Operations Center Site Under Construction

East Campus Operations Center
Under Construction

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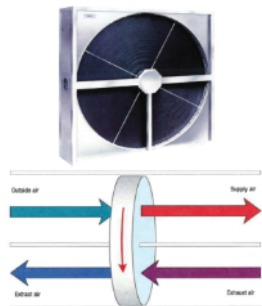
East Campus Operations Center
Project Complete - June 2014

East Campus Operations Center Site Layout Design

1.1MW Tracking Solar PV

A Collection of Systems Designed for a New Era

55 Indoor Bike Lockers

Landscape Reclaimed Water

Bioswale Rainwater Collect / Filter

Conduit for 60 EV Spaces

Underground TES 40k Gal.

5 Acre Geothermal Field 14' Underground

1 of 4 locations Solar hot water

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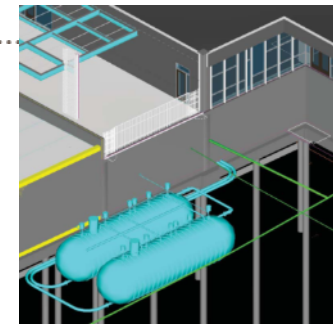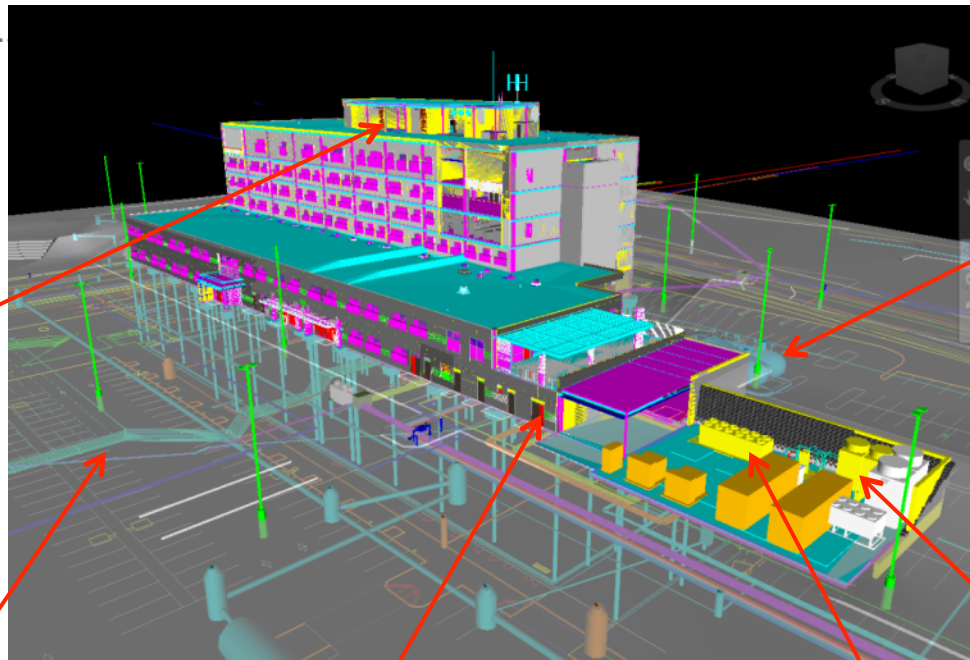# Mechanical System
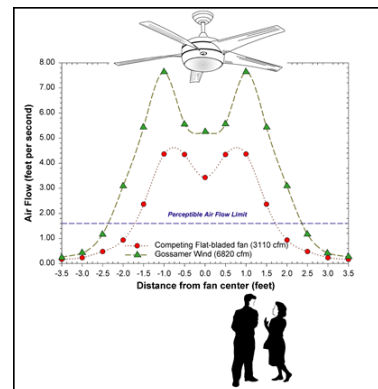

Heat Recovery Wheel

Geo-Exchange Field

CUP w/ Chillers

TES Tank
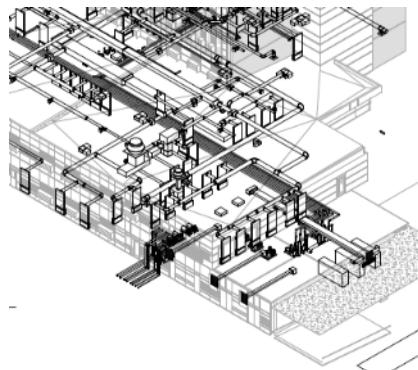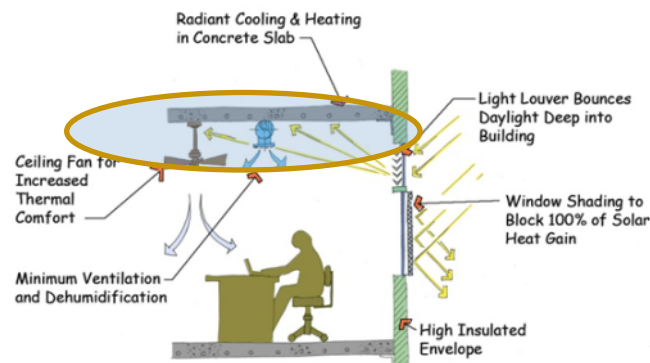
Cooling Towers
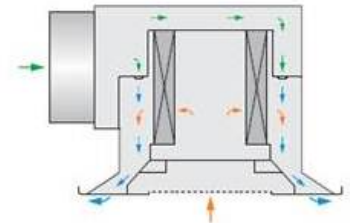
Air Source Heat Pump

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Space Conditioning

Radiant System

Chilled Beams

Ceiling Fans

Plug Load Reduction

VOIP Phones 2 Watts

Standard Phones 24 watts

Ceiling Fans 56 Watts

Typical Ceiling Fans 180 watts

SMUD - Annual Energy Enduse Breakdown

- Transformers 2%
- DHW 2%
- Fans 14%
- Pumps 3%
- HPs/Chiller 5%
- Cooling Tower 0%
- Car Wash 3%
- Lights 29%
- Plug Loads 42%

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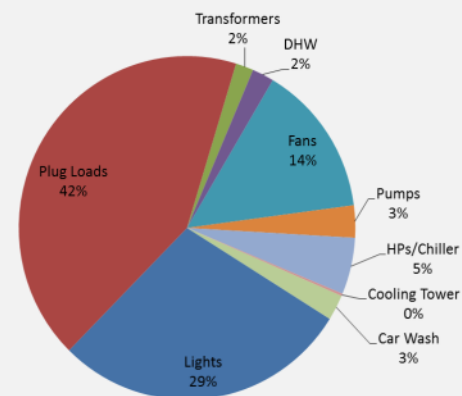
UPS – High Efficiency

No Space Heater - Saves 1500 Watts

Desk Fans Low 9 Watts High 14 Watts

Laptop 30 Watts

Desktop Computer (Energy Star) 300 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

LED Task lights – 6 Watts

Fluorescent Task Lights 35 Watts

East Campus Operations Center
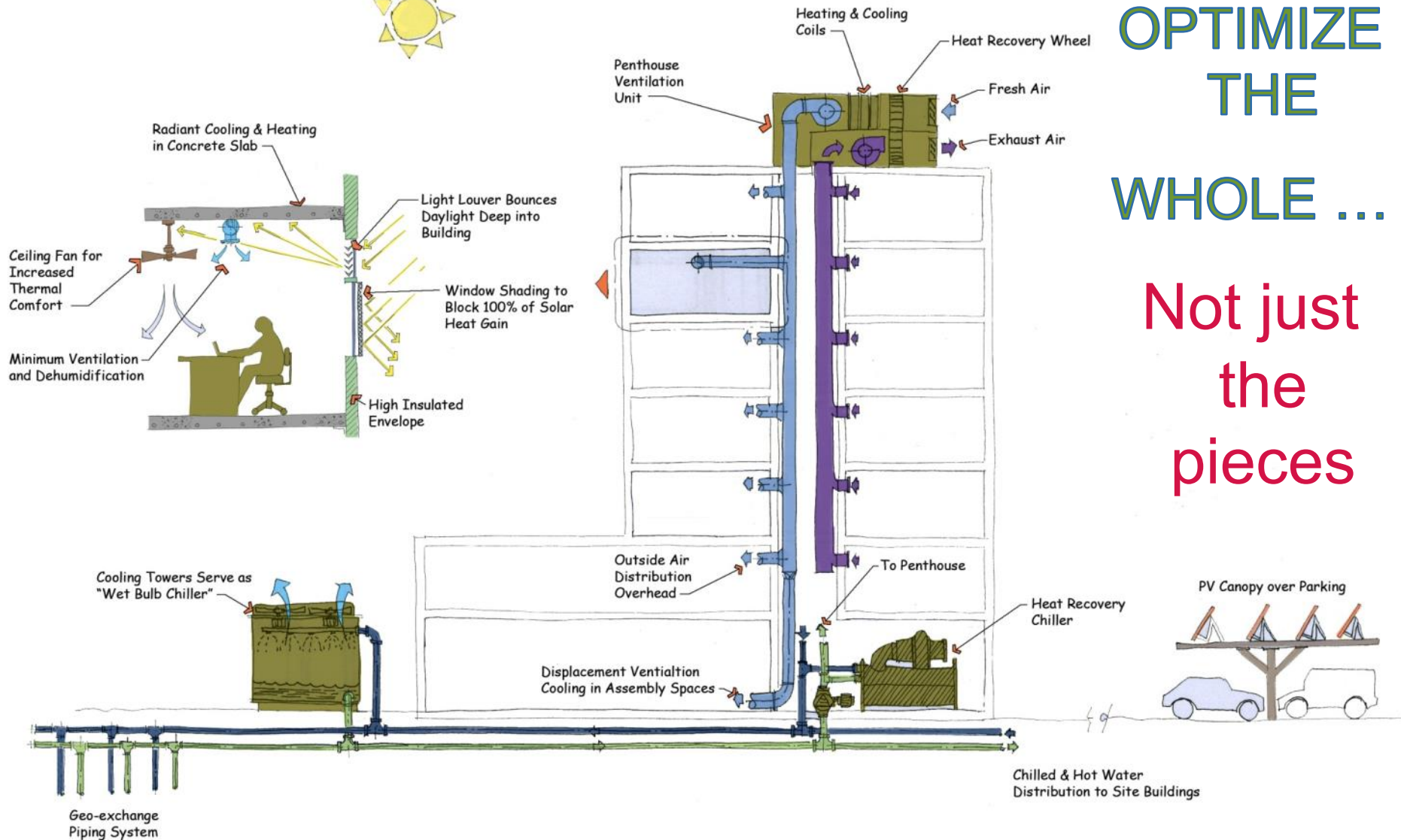## Integrated Solutions

OPTIMIZE THE WHOLE …

Not just the pieces

Sun

Heating & Cooling Coils

Heat Recovery Wheel

Penthouse Ventilation Unit

Fresh Air

Exhaust Air

Radiant Cooling & Heating in Concrete Slab

Light Louver Bounces Daylight Deep into Building

Ceiling Fan for Increased Thermal Comfort

Window Shading to Block 100% of Solar Heat Gain

Minimum Ventilation and Dehumidification

High Insulated Envelope

Cooling Towers Serve as "Wet Bulb Chiller"

Outside Air Distribution Overhead

To Penthouse

Heat Recovery Chiller

PV Canopy over Parking

Displacement Ventialtion Cooling in Assembly Spaces

Chilled & Hot Water Distribution to Site Buildings

Geo-exchange Piping System

Sustainable Features

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
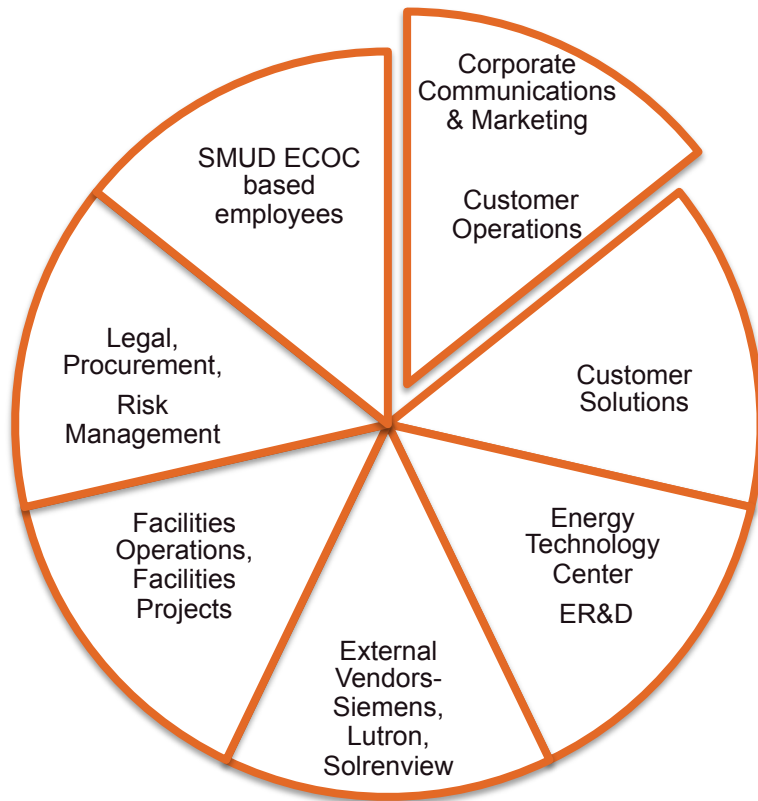
East Campus Operations Center Occupancy

Energy Consumption

- Energy use higher than expected

- Team was put together to determine why

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East Campus Operations Center
Zero Net Challenge Task Force
January 2015

Corporate Communications & Marketing

Customer Operations

SMUD ECOC based employees

Customer Solutions

Legal, Procurement, Risk Management

Energy Technology Center ER&D

Facilities Operations, Facilities Projects

External Vendors- Siemens, Lutron, Solrenview

picking a darn good team!

Facilities Operations

+

Employee Engagement

=

Sustainability

SMUD 3.0 — FUTURE READY

Robust - Nimble - Innovative

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Zero Net Challenge Task Force
Energy Data Governance

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

THE PROBLEM: Connecting the dots...

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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

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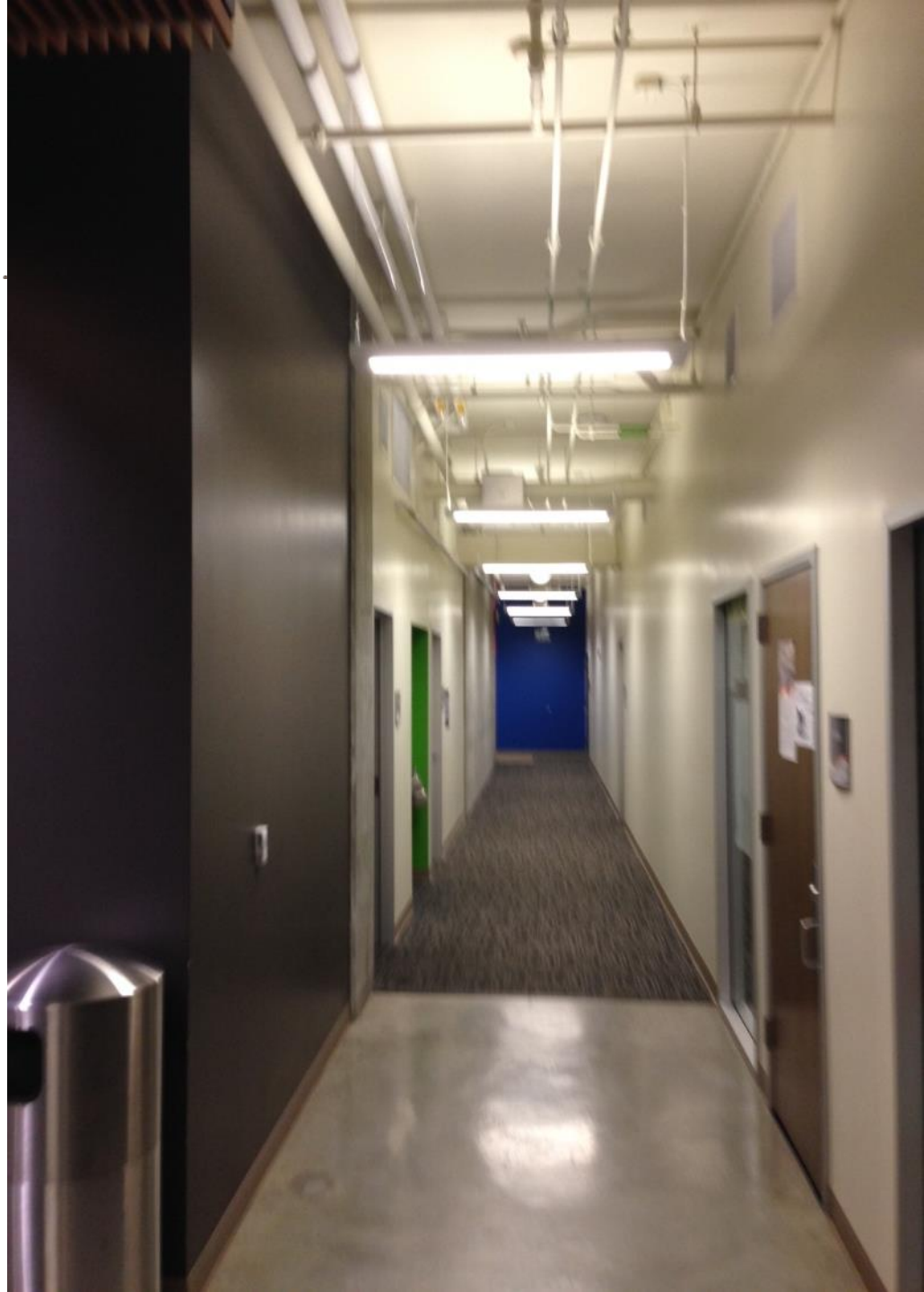
East Campus Operations Center
Zero Net Challenge Task Force
Exterior Lighting & Controls

- Many areas were overlit:
  - Wire cutting canopy
  - Building overhang areas
  - Amphitheater

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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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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

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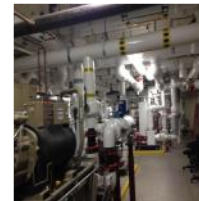# Zero Net Challenge Task Force

Next Steps

ECOC Interior/ Exterior Lighting Completion

Plug Load Assessment

Admin building

PV Optimization

HVAC/Central Plant Optimization

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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

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Discussion and Questions

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