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Learning Objectives

1. You will identify the criteria that exemplify new construction best practices in HVAC design and retrofitting.
2. The learner will identify the technologies useful for HVAC efficiency including indirect/direct evaporative cooling, a heat pipe heat recovery loop to dehumidify air in high-density areas, solar thermal installations, and the modification of exhaust stack height and discharge velocity.
3. You will compare and contrast the range of strategies and technologies to energy savings.

Sustainability Best Practices for HVAC Design
Student Rec Center Renovation
Cal Poly State University, San Luis Obispo

Presented to the California Higher Ed Sustainability Conference

June 22, 2010

Presented by

Dennis K. Elliot, PE, CEM
Assistant Director, Energy, Utilities and Sustainability
Facility Services

Monica Amalfitano, PE, LEED AP
Mechanical Engineer, P2S Engineering

CAL POLY

Rec Center HVAC Design

Cal Poly at a glance:

- Founded 1901
- Over 300 Buildings
- 5.8M gsf
- 19,000 Students
- 6,200 Residents
- 2,200 Faculty & Staff
- 10,000 acres
- “Learn by doing”

Rec Center HVAC Design

Student Recreation Center

- Student fee funded
- Completed 1993
- 90,300 gsf
- 5 court gym/event center
- Aerobics/dance room
- Weight training/cardio
- Wrestling/martial arts
- Lap pool
- Racquetball courts
- Sand volleyball courts

Rec Center Expansion Project

- Funded by student fee referendum
- New features and spaces:
  - Additional 2 court gymnasium and Multi Activity Center
  - Separate leisure pool and Wellness Center
  - Indoor running track and additional fitness space
- Adding 85,000 gsf, $71M budget, completion Winter 2012
- Architect: Cannon Design Engineer: P2S Contractor: Sundt Cx: Digital Energy

Rec Center HVAC Design

Project Goals:

- Add air conditioning !?!#
- Students want “Green Design”
- Significantly exceed Title 24
- Achieve LEED Certification
- Evaluate new technologies where appropriate
- Highly controllable and user friendly
- Interactive design process
- High level of student involvement
- Advance the “campus standard”

Facilities Input and Campus Standards:

- Serve from campus central plant
- Push back against AC - try to minimize air conditioning demand
- Consider IDEC – Indirect/Direct Evaporative Cooling for gyms
- Cooling ***is*** needed for concerts and commencement ceremonies
- Field trip to CSU Sonoma to evaluate IDEC
- Use Siemens Apogee building automation for IDEC units
- Evaluate solar thermal for pool heating
- Make decisions based on life cycle cost
- Design for long life and maintainability

Student Input and Participation:

- Student Fee referendum and LEED vote
  - 75% voted to fund building expansion
  - 87% voted to require LEED certification!!
  - “LEED the Way” marketing campaign and YouTube video by Green Campus Program
- Students from ASI involved in project programming and goal setting
- Green Campus Internships for academic credit:
  - Architecture students working on LEED docs
  - ASHRAE club students assisting with Cx

green campus
AN ALLIANCE TO SAVE ENERGY PROGRAM
EMPOWERING TOMORROW'S ENERGY EFFICIENCY LEADERS

Mechanical System Design

Design Challenges

- Increased air changes
- Increased Energy consumption
- LEED Silver

San Luis Obispo OSA BIN Data review

- 0.5% ASHRAE Design Day, 87F DB/64F WB
- 400 hours/year DB temperatures > 78F
- 100 hours/year DB temperatures > 85-90F
- 30 hours/year WB temperatures > 65 F

Payback Analysis

Conventional CHW v. IDEC/DEC

- BIN Data analysis
- First Costs (AHU and extended underground piping)
- Annual utility charges of CHW/HHW to ASI
- Annual additional maintenance costs of IDEC/DEC
- Dolphin System vs. chemical treatment
- IDEC DX vs. IDEC CHW final stage cooling
- Annual additional water and sewer charges
- Annual energy savings

Savings

- 160,000 kwH/year
- Less than 10 year payback

Rec Center HVAC Design

2 Stage Indirect/Direct Evaporative Cooling – 10 AHU

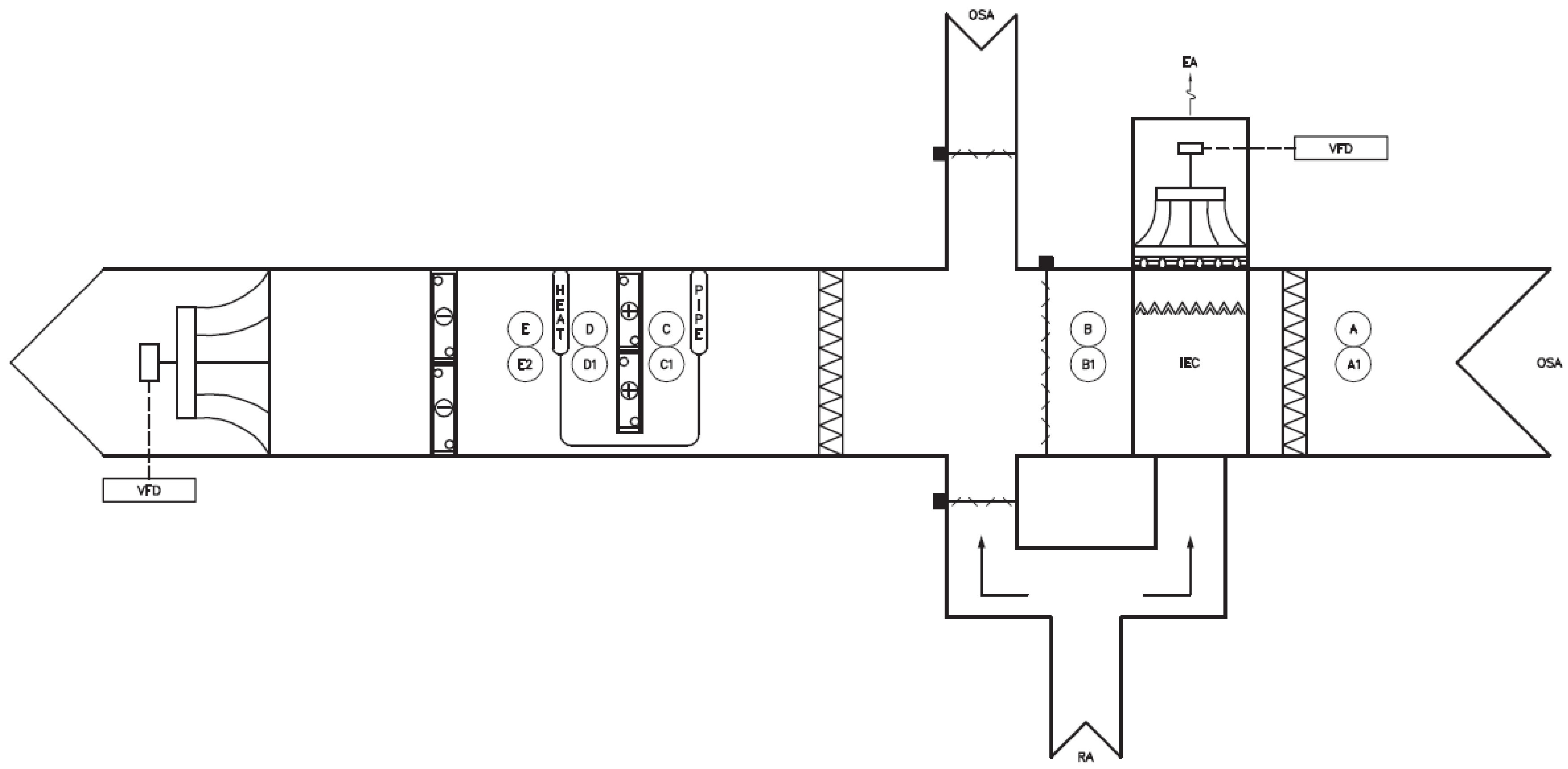
- 8 utilized IDEC/DEC
- 2 utilized IDEC with Heat Pipe technology

Design Benefits

- Maximizes moderate/drier OSA climate
- 100% OSA
- Cooling Media is water, consumes 25% less than cooling towers
- Peak tonnage is 380 tons. Only 50 tons of supplemental cooling required from campus central plant when OSA conditions are higher than ideal (will occur only 20% out of the year).
- VAV application
  - Reduction of fan energy
  - Turn down increases indirect evaporative cooling effectiveness (IEE) of heat pipe and direct evaporative cooling.
- 160,000 kwH/year savings (HVAC only)
- Payback is less than 10 years
- PG&E Incentives

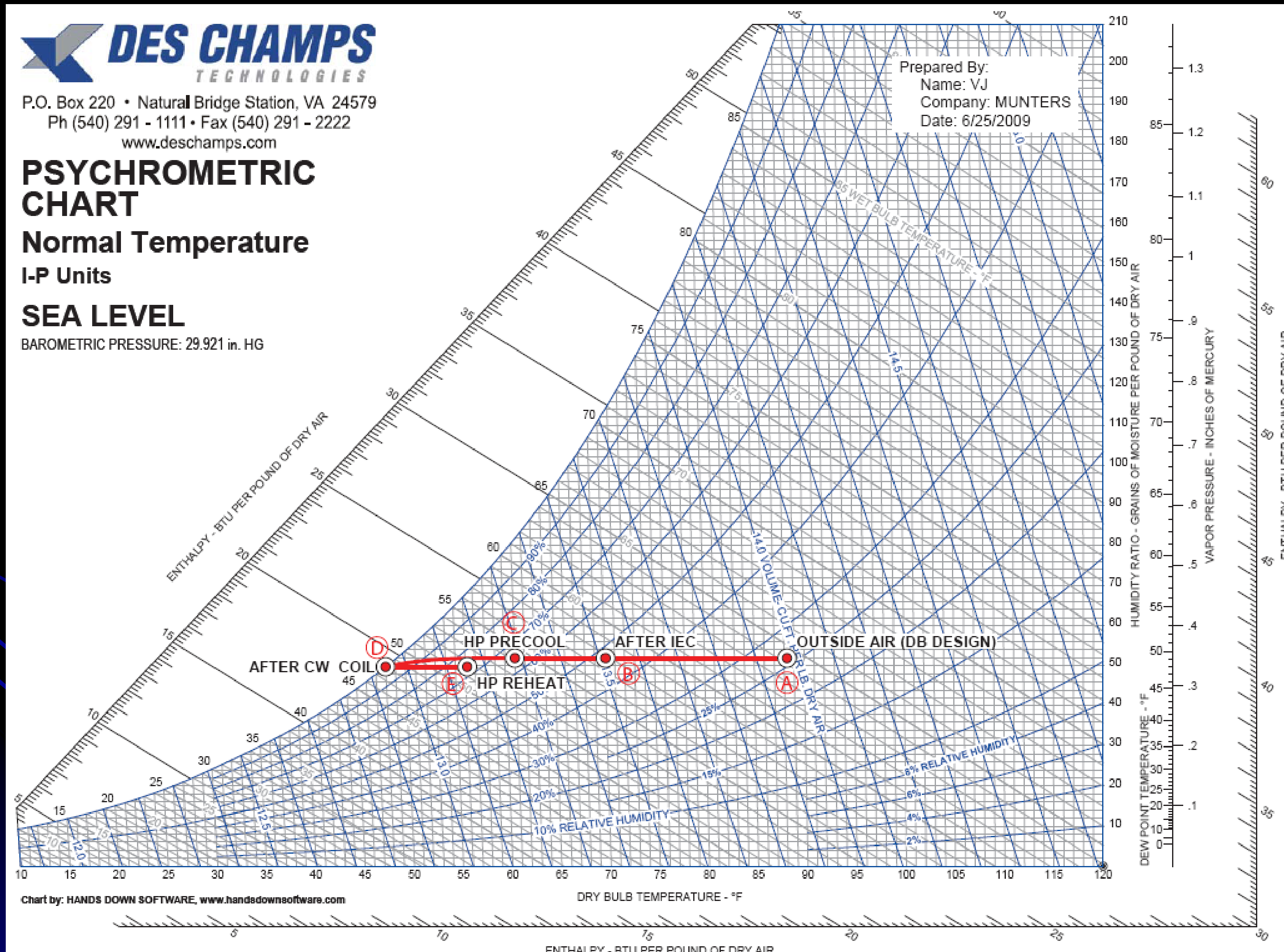
Rec Center HVAC Design

AHU-10 Schematic



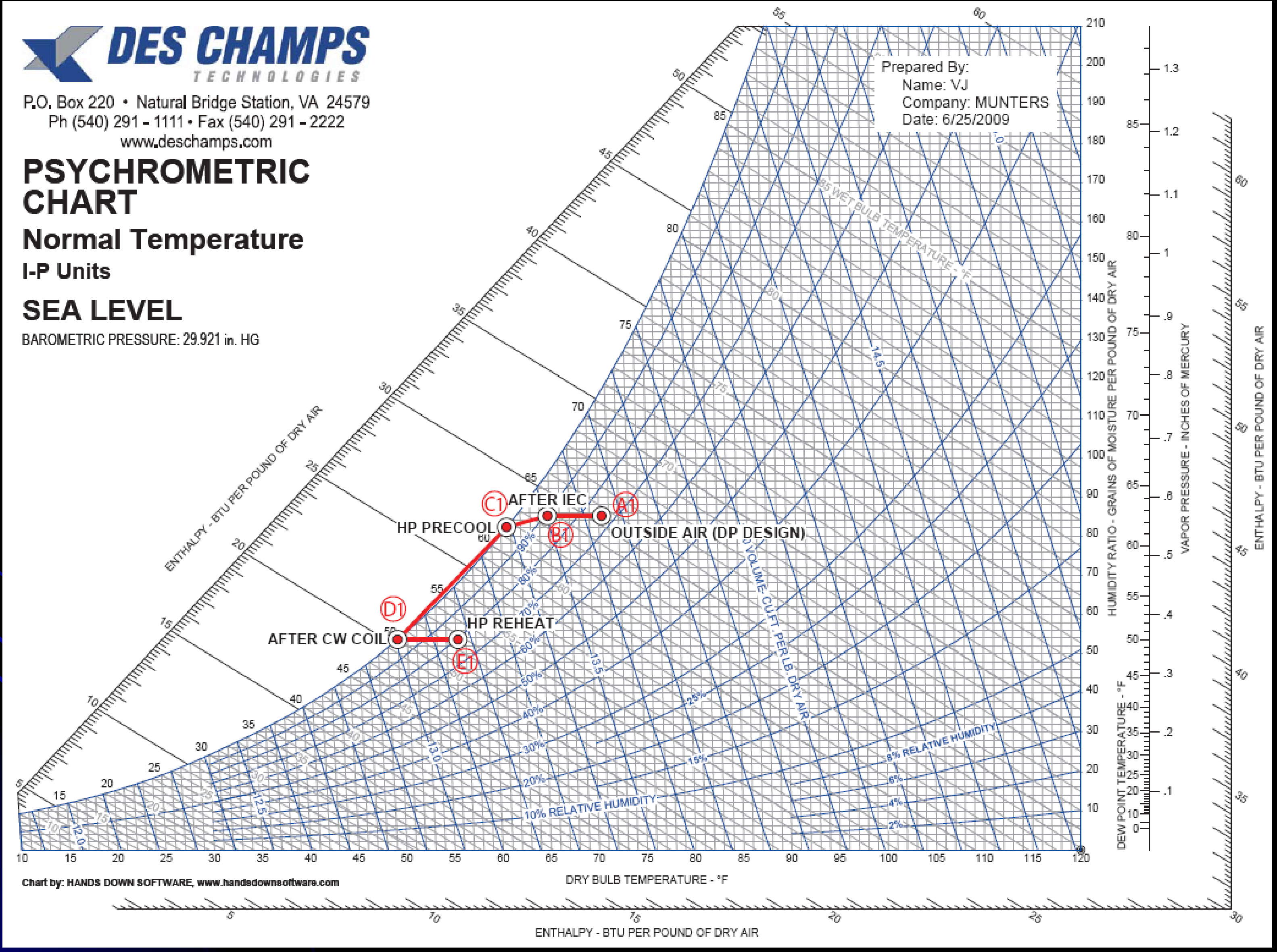
Rec Center HVAC Design

AHU – 10
ASHRAE
Design Day



Rec Center HVAC Design

AHU – 10
Higher WB
Lower DB

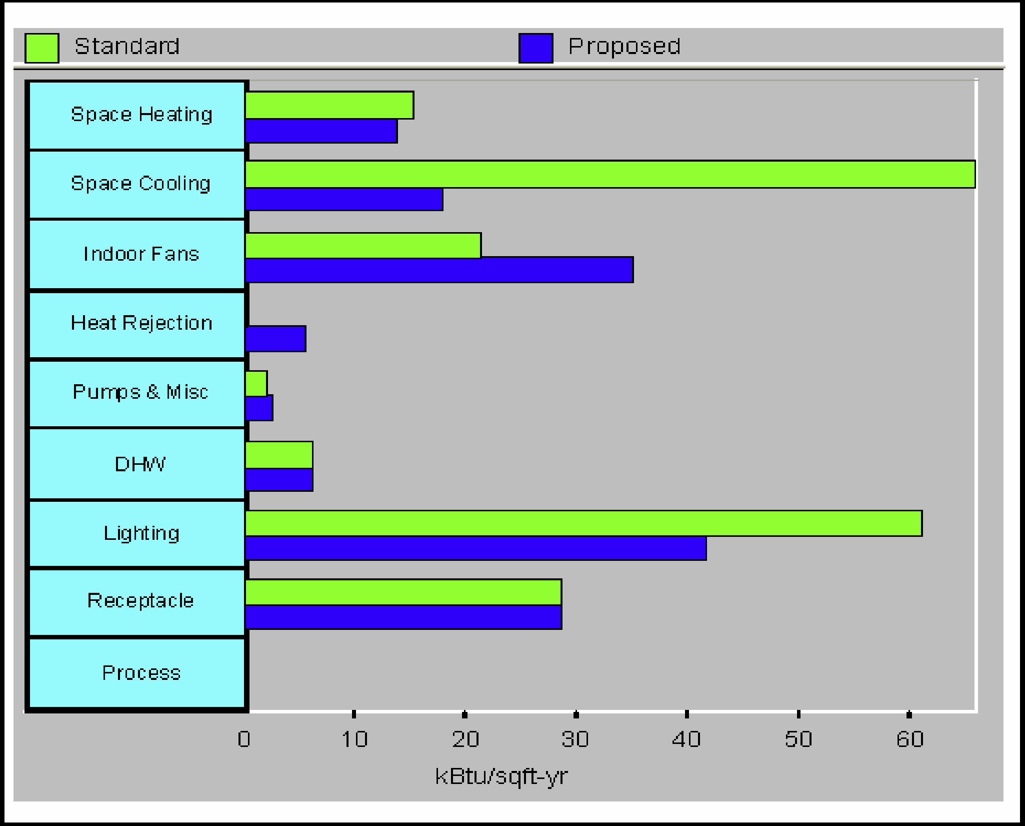


Building Energy Performance

- Building exceeds T24 by 24.7%
- Overall building considerations
  - HVAC design
  - High efficiency lighting and daylighting/dimming control
  - Envelope design
    - R-35 Roof
    - Low E glass
- Over $200,000 in incentives
  - 220 Peak KW savings
  - 452,000 kWh savings
  - 27,000 therm savings
- Meets requirements of Cal Poly “Green Design” and LEED Silver

Expected Performance:

- Title 24 calculations
  - Annual TDV energy use (Performance Method)
    - Baseline: 61.07 kBtu/ft^2 - yr
    - Design: 41.59 kBtu/ft^2 - yr
    - Compliance margin: 19.5%



Contact info and references:

Dennis Elliot, PE, CEM
Assistant Director of Energy, Utilities, and Sustainability
Cal Poly Facility Services
delliot@calpoly.edu

Monica Amalfitano, PE, LEED AP
Mechanical Engineer
P2S Engineering
monica.amalfitano@p2seng.com

www.sustainability.calpoly.edu
www.greencampus.calpoly.edu
www.asi.calpoly.edu/rec_center_project
www.p2seng.com
www.munters.us/en/us/Division-start-pages/Munters-DH-Division/Indirect-Heating--Cooling2/

QUESTIONS??

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