

Sustainability in Motion

SFO Goes to Zero: A Campus-Scale Approach



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ICAO Seminar on Green Airports
Session 2: Stamping Green
November 29, 2017



SFO ZERO Approach

- Buildings: Maximizing High Performance Measures
- Campus: Monitor & Scale
- Community: Transforming Markets

ACRONYMS

B/A	Boarding Area
BHS	Baggage Handling System
CUP	Central Utility Plant
ERF	Emergency Response Facility
GSE	Ground Service Equipment
ITB	International Terminal Building
RCC	Rental Car Center
RON	Remain Overnight
VSR	Vehicle Service Road





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SFO ZERO Approach

2014

2015

2016

2021

Airport Council
International's
"EONS"

Big Hairy
Audacious
Goals

5 Year Strategic Plan Objectives

Economic
Viability

Industry
Leadership

Operational
Efficiency

Technology
Transport

Intermodal
Transportation

Natural
Resource
Conservation

Get 2 Zero

Zero Net
Energy

Zero
Waste

Zero
Carbon

Water
Balanced

Social
Responsibility

Safeguard &
Protect

Healthy
Buildings





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ZERO Buildings

- Buildings: Maximizing High Performance Measures
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Buildings: Prescriptive Path

Mandatory Requirements

Expanded Requirements

- 14 SFO
- 51 CALGreen Tiers 1 & 2



ENERGY & ATMOSPHERE

Greenhouse Gas
Emission Reduction

Energy Optimization

Energy Systems
Commissioning

On-Site Renewable &
Alternative Energy

Refrigerant
Management & Ozone
Protection

Criteria Pollutants &
Air Toxics

HEALTH

Indoor Air Quality

Chemicals of Concern

Green Cleaning

COMFORT

Thermal Comfort

Acoustic Comfort

Daylight Access

Ventilation

WATER & WASTEWATER

Storm Water Runoff
Management

Water Efficiency &
Conservation

Water Quality
Management

SITE & HABITAT

Habitat & Open
Spaces

Transportation

Heat Islands

Climate Change
Adaptation

Site & Building
Orientation

MATERIALS & RESOURCES

Material &
Resource
Conservation

Regional Sourcing

Life Cycle Based
Analysis & Selection

Zero Waste

EQUITY & AESTHETICS

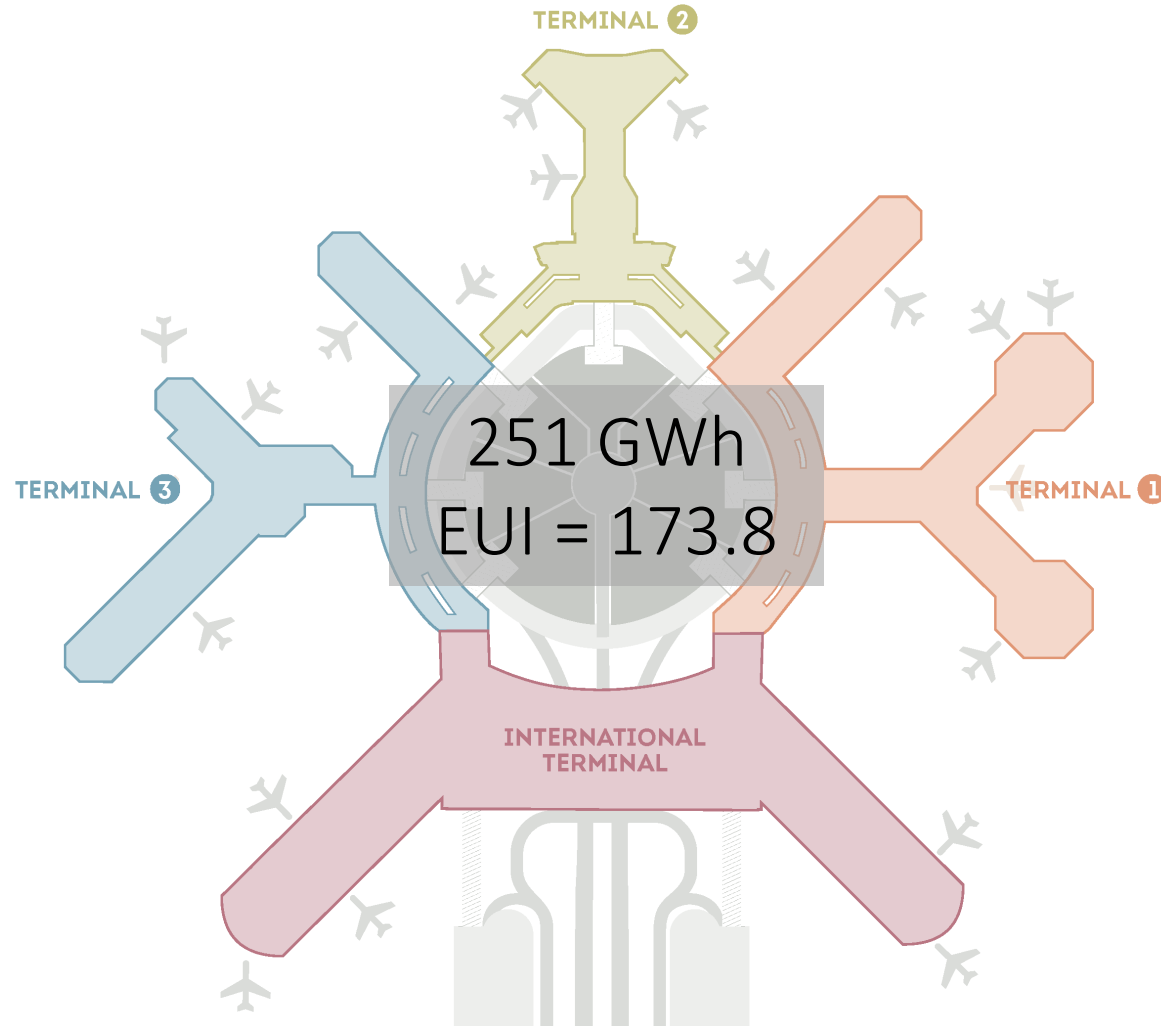
Fair Labor Practices

Universal Design

Aesthetics

Community
Engagement

Buildings: Prescriptive Path



Buildings: Performance Path



Sustainable Design Strategies

- Heat Recovery & Vertical Transportation Energy-Ready
- Radiant Cooling & Heating
- Dynamic Glazing
- Solar PV Infrastructure
- Digital Controls: Preconditioned Air, 400Hz, GSE Charging

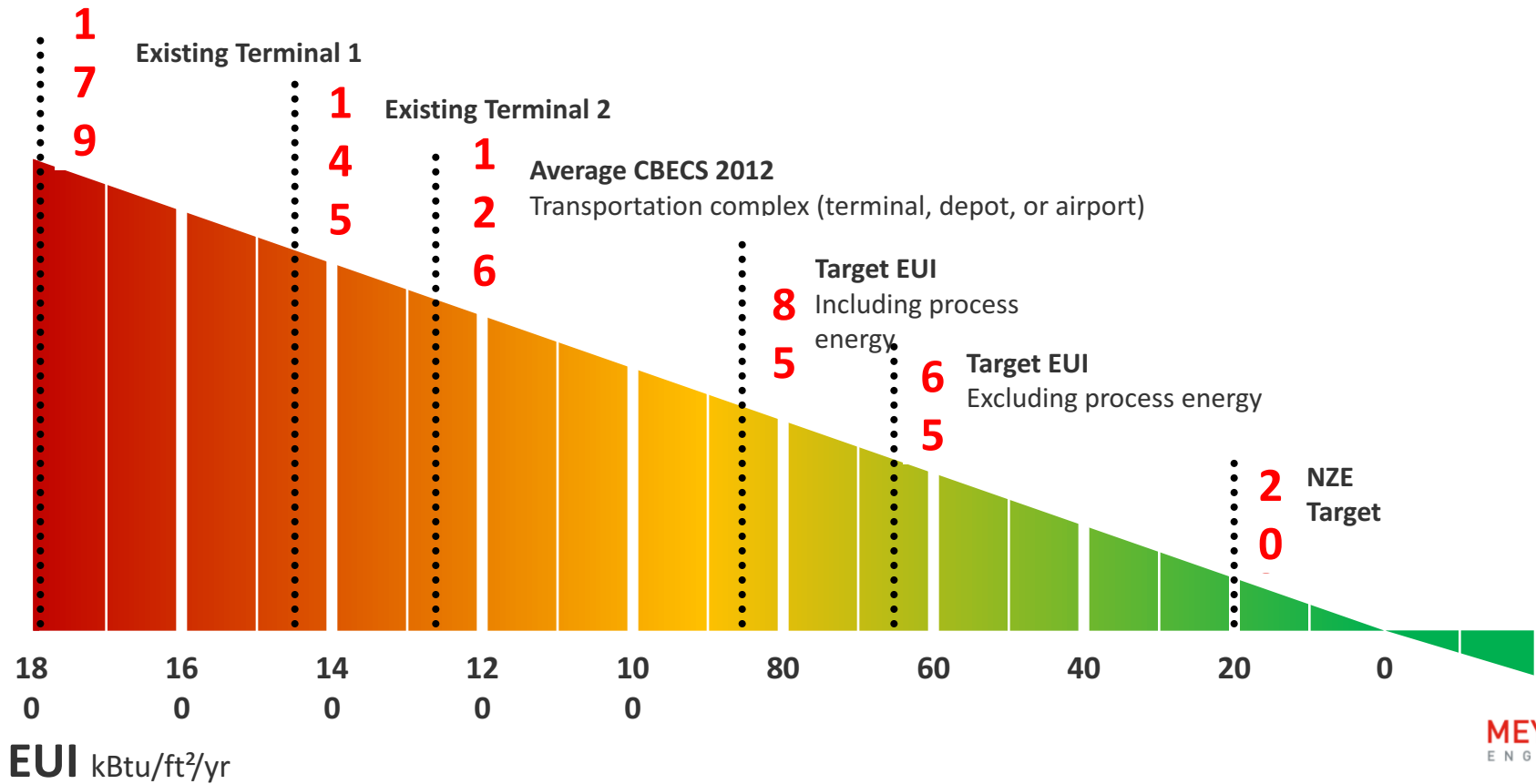
Energy Performance

- | | |
|---------------------------------|----------------|
| ■ Code EUI w/out NZE | 103 kBtu/sf/yr |
| ■ Modeled EUI w/NZE | 64 kBtu/sf/yr |
| ■ Average Annual Savings | \$4.74M |



Buildings: Performance Path

BENCHMARKING AND GOALS





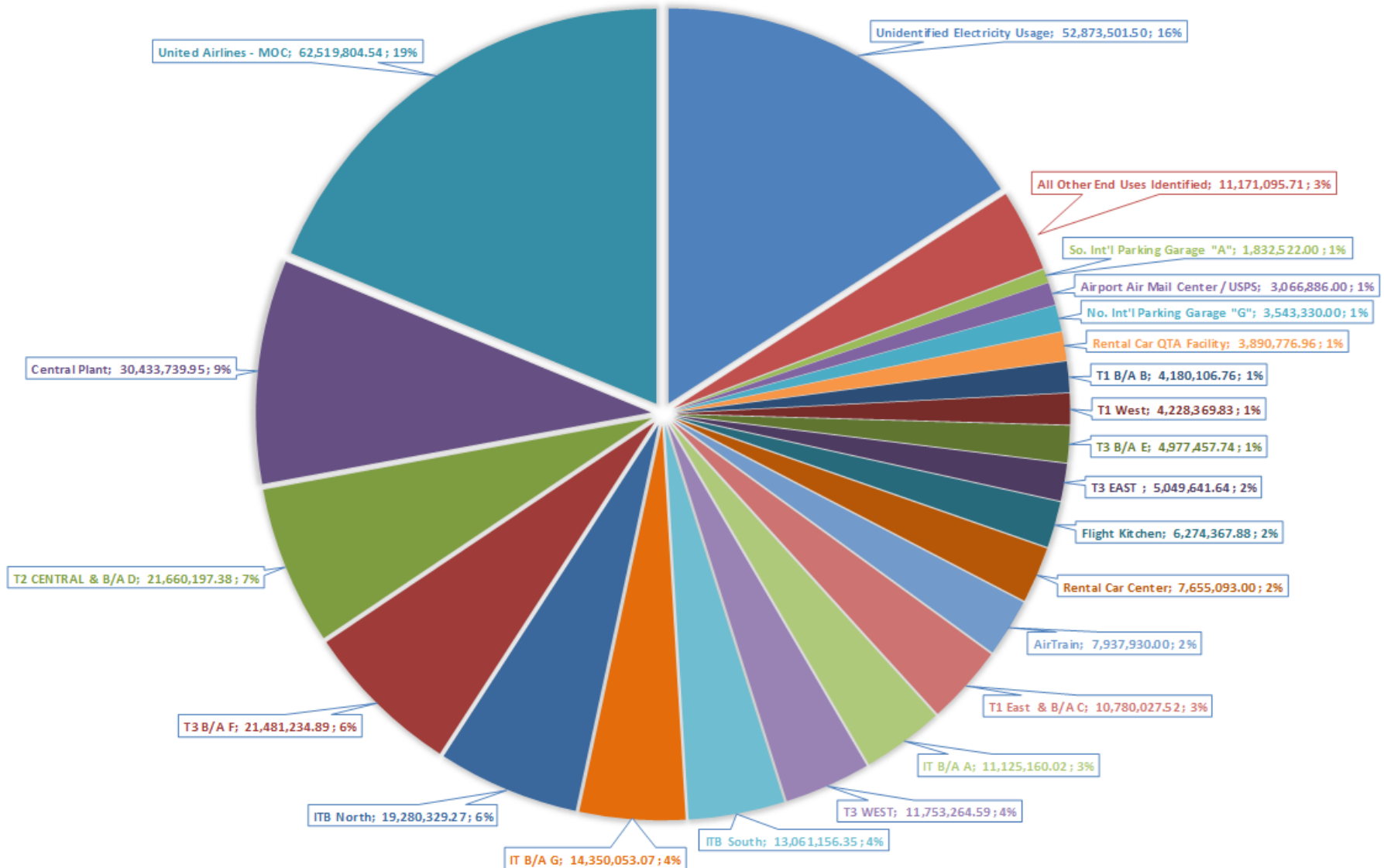
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ZERO Campus

- Buildings: Maximizing High Performance Measures
- **Campus: Monitor & Scale**
- Community: Transforming Markets



Campus: Monitor





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Campus: Monitor



438 GWh



21,400 T



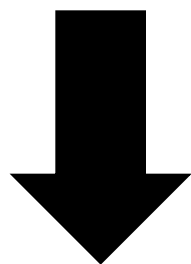
400M



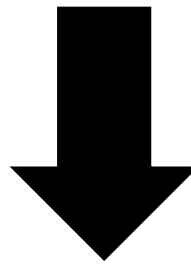
24.4M



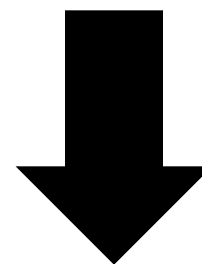
2013



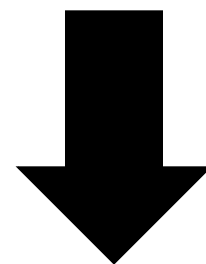
17%



20%



27%



5%



Campus: Scale



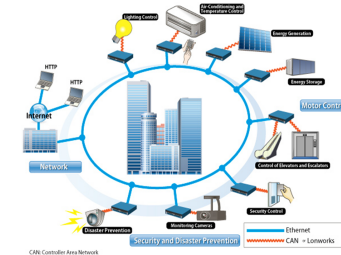
1. Dynamic Glazing



2. Radiant Heating & Cooling
/Celling & Floor Systems



3. Building Enclosure



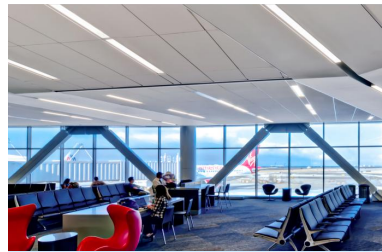
4. IOT – Wireless, Lighting,
Temperature, & Occupancy



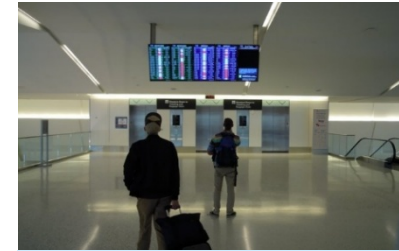
5. Heat Recovery From
Process Loads



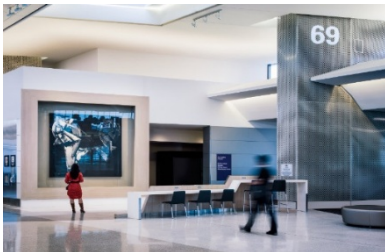
6. High Efficiency BHS (ICS)



7. LED Lighting



8. Efficient Elevators and
Escalators



9. Displacement Ventilation



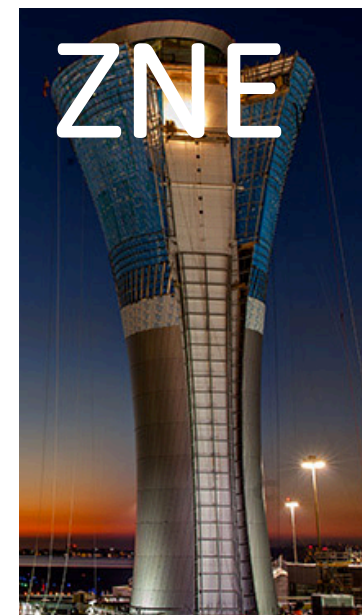
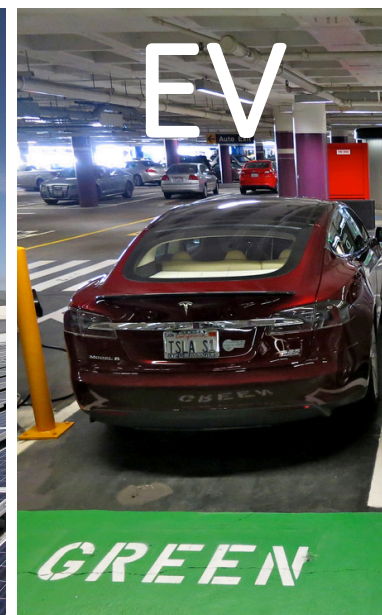
10. Renewable Energy
Generator





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Campus: Scale





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ZERO Community

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Airport Transformation



71% Pax

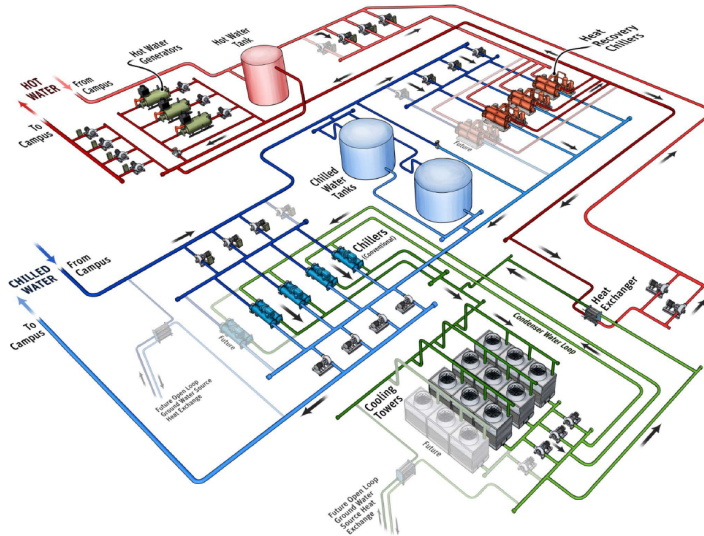
33% GHG





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Industry Transformation



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