

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





San Francisco
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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

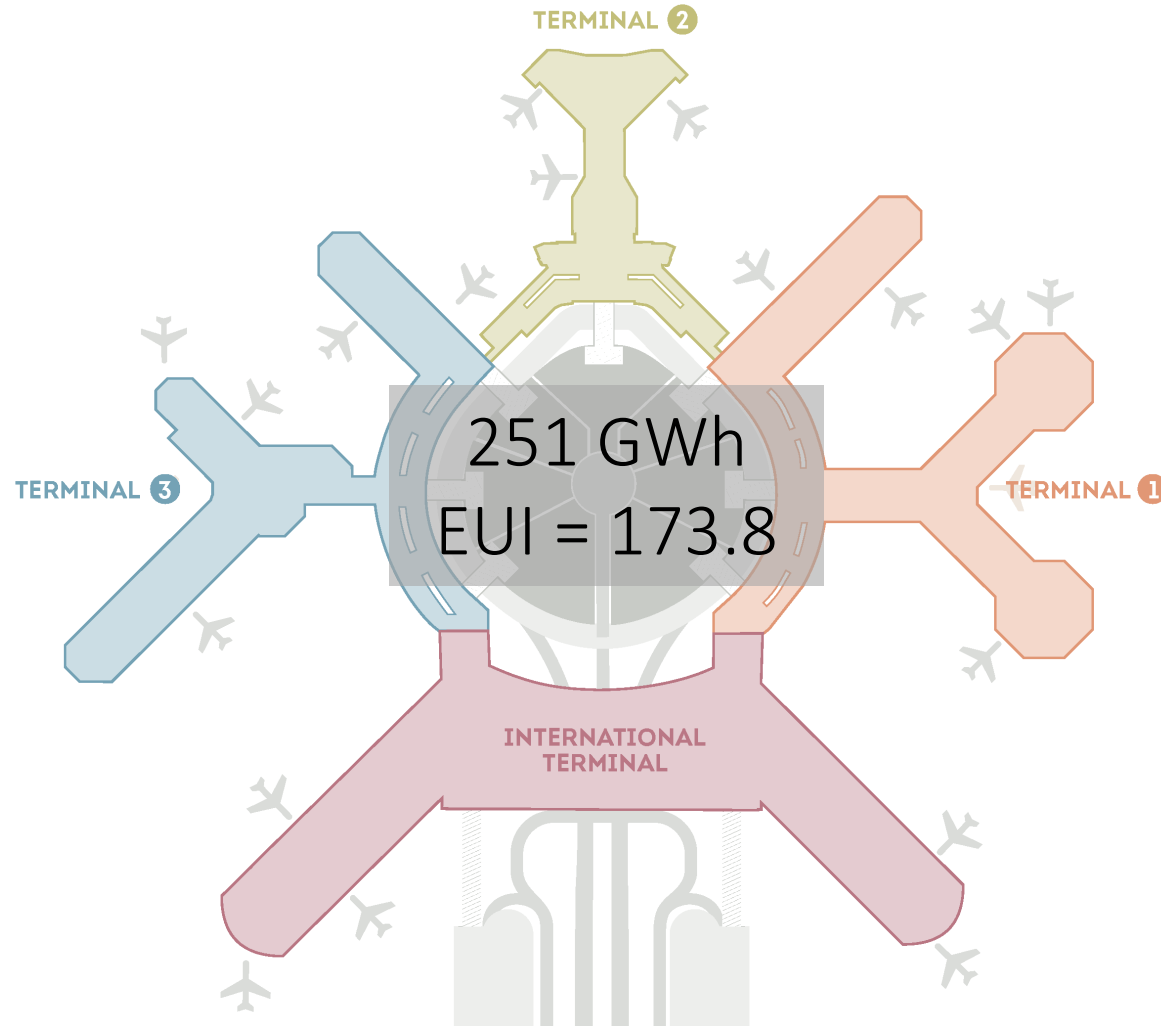
Fair Labor Practices

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

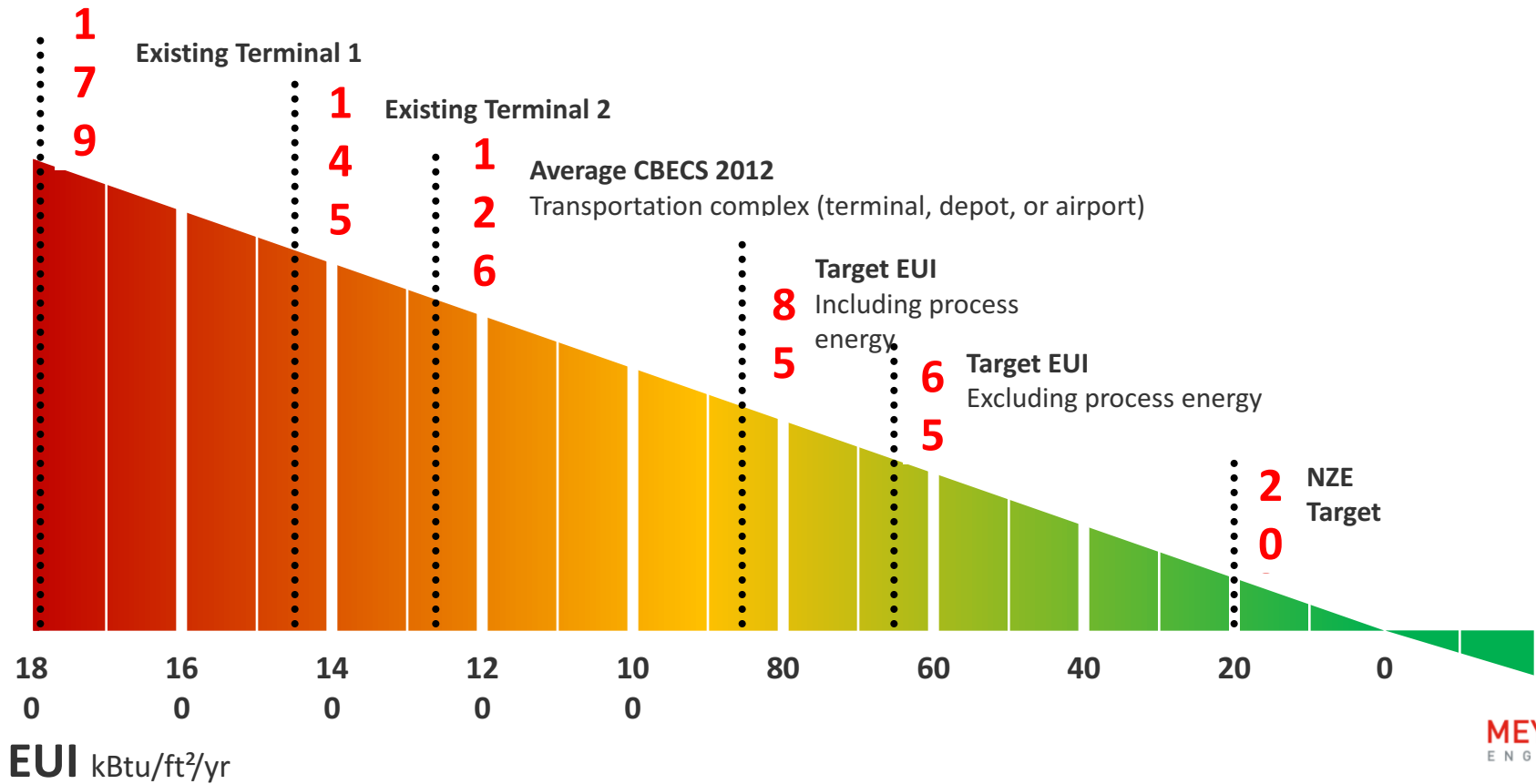
Energy Performance

- | | |
|---------------------------------|----------------|
| ■ 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





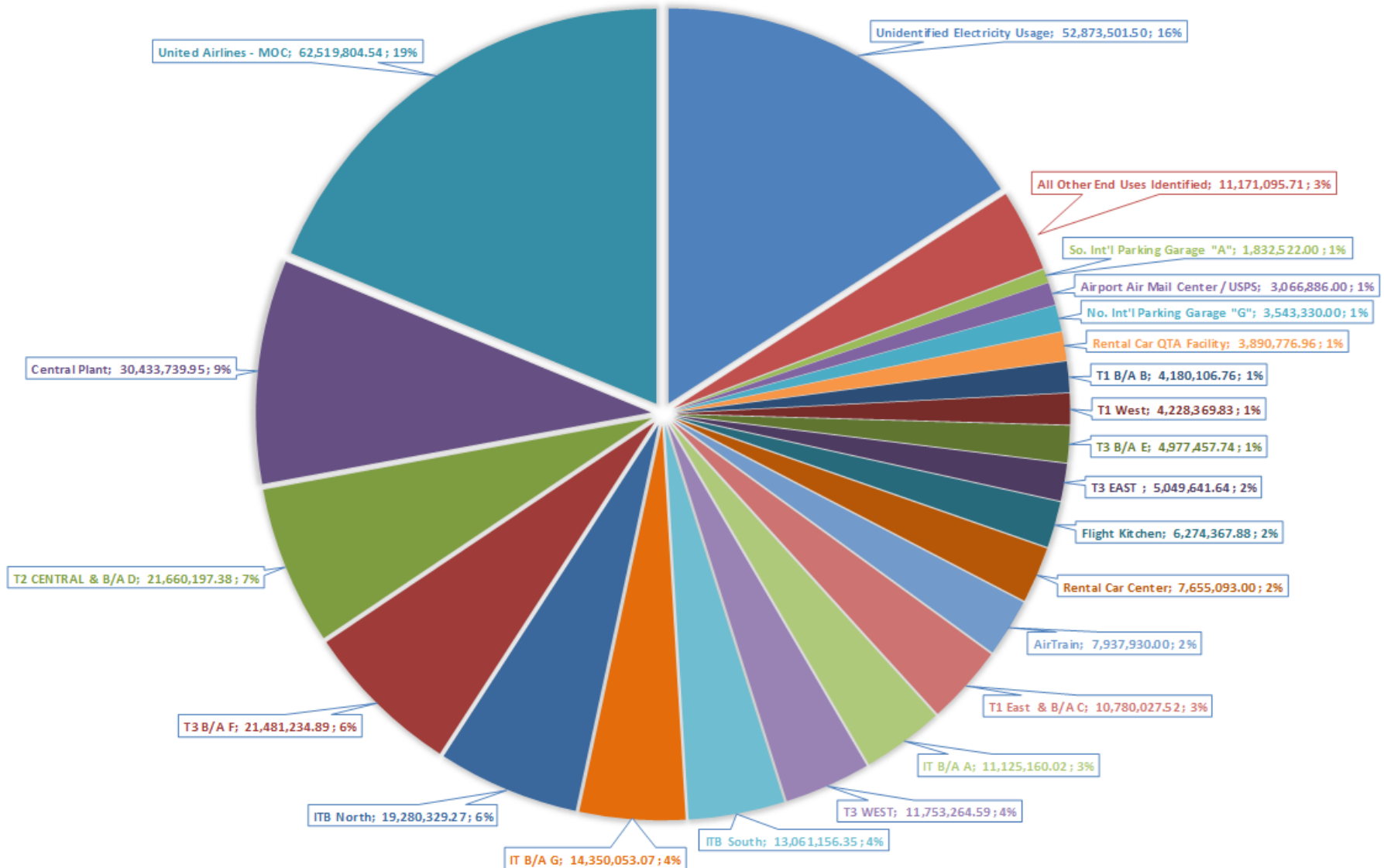
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ZERO Campus

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



Campus: Monitor





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Campus: Monitor



438 GWh



21,400 T



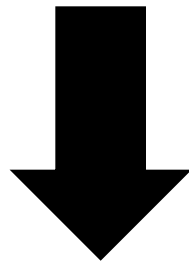
400M



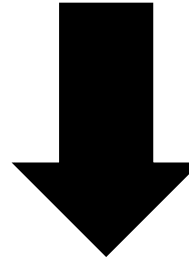
24.4M



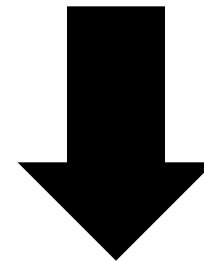
2013



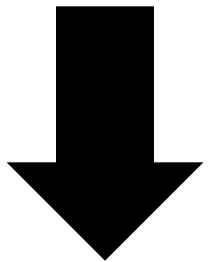
17%



20%



27%



5%



Campus: Scale



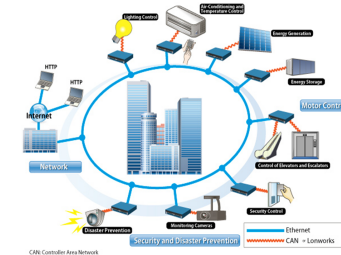
1. Dynamic Glazing



2. Radiant Heating & Cooling
/Celling & Floor Systems



3. Building Enclosure



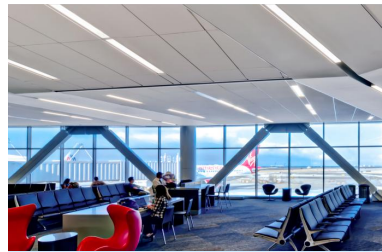
4. IOT – Wireless, Lighting,
Temperature, & Occupancy



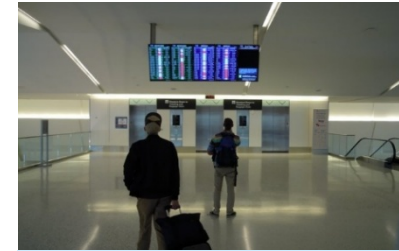
5. Heat Recovery From
Process Loads



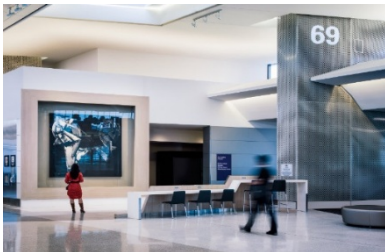
6. High Efficiency BHS (ICS)



7. LED Lighting



8. Efficient Elevators and
Escalators



9. Displacement Ventilation



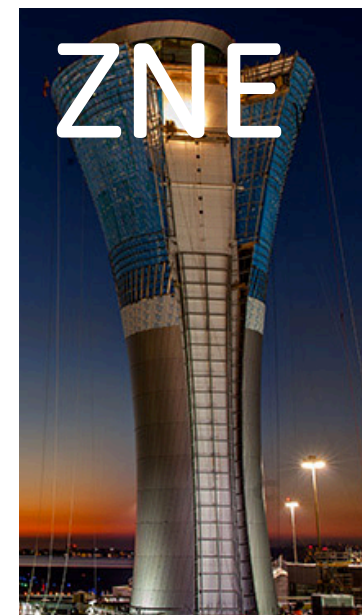
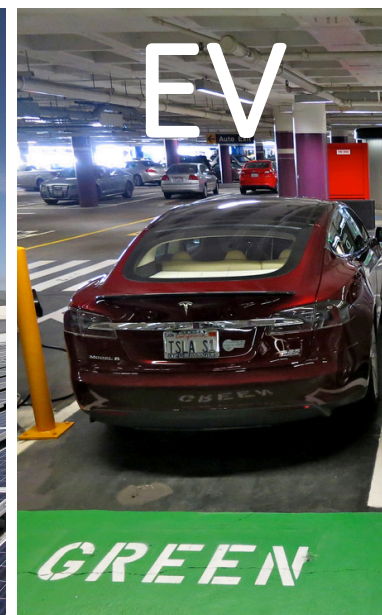
10. Renewable Energy
Generator





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Campus: Scale





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ZERO Community

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Airport Transformation



71% Pax

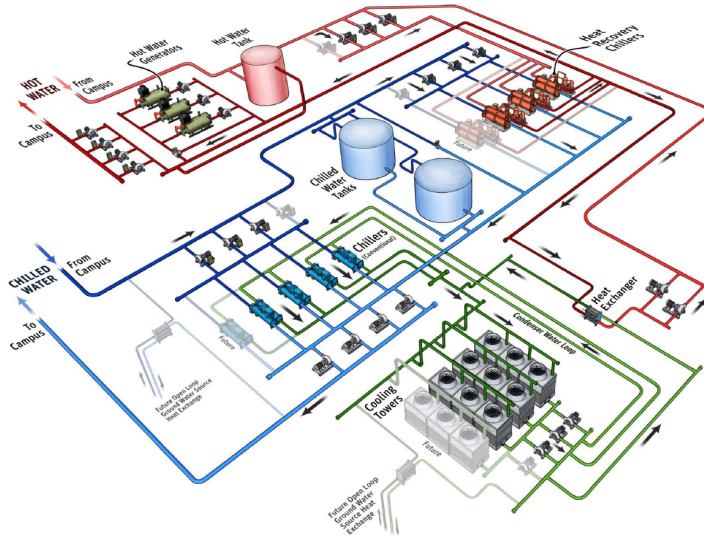
33% GHG





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Industry Transformation



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