Repowering LAX: District Cooling, TES and CHP Blend

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ARUP

Presentation overview

- Introduction to LAX
- LAX modernization program
- LAX Central Utility Plant (CUP) - overview and challenges
- Getting the energy blend right
- System economics
- Questions

Introduction to LAX

LAX modernization program: 2013-18

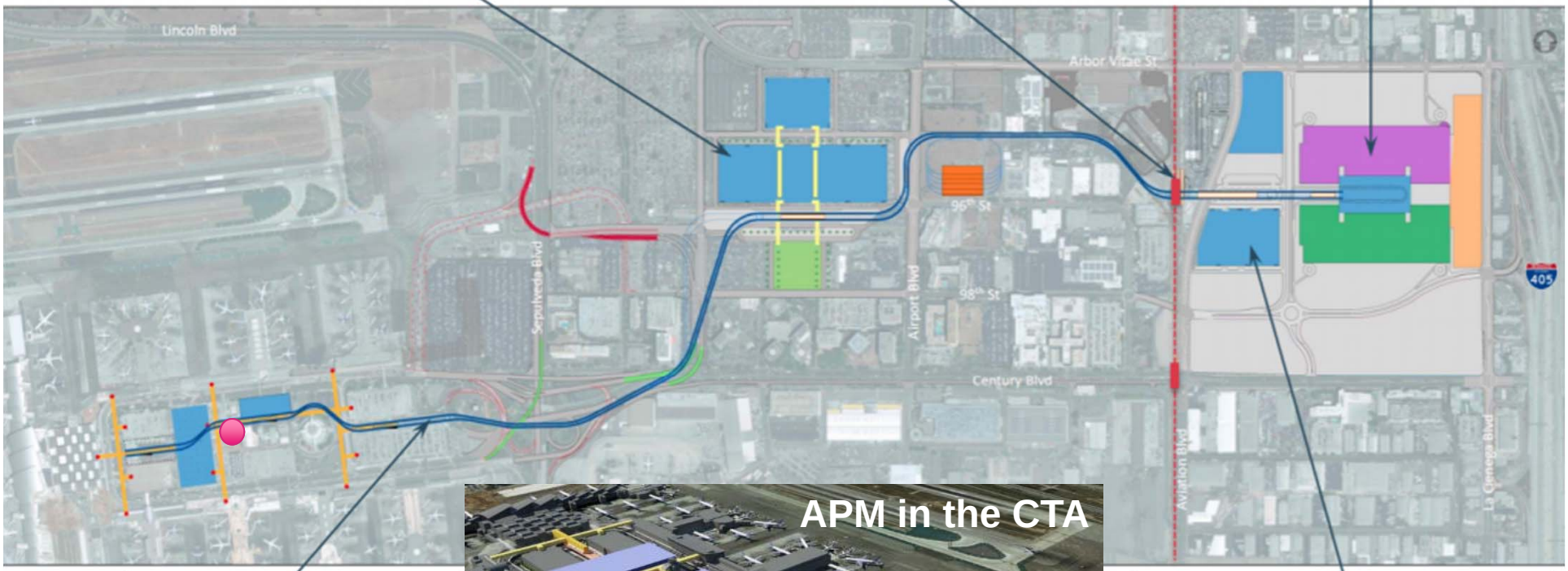
LAX Landside Transportation Program

Los Angeles World Airports

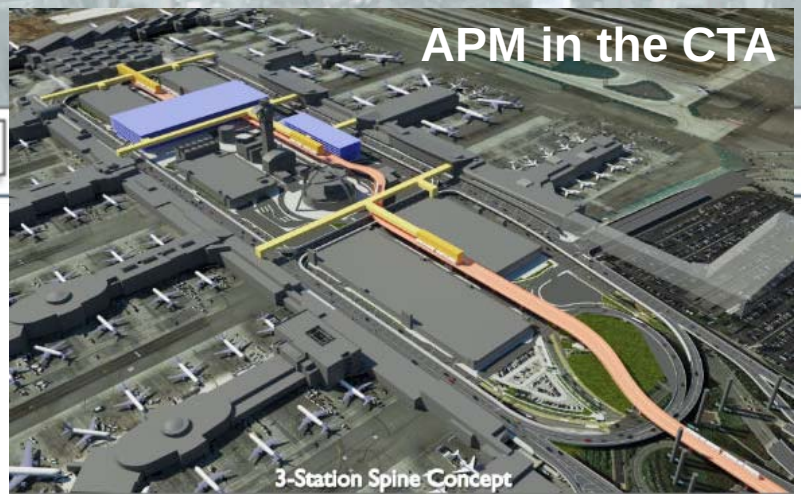
Intermodal Transportation Facility (West)

96th St. Metro Station Connection to LAX

Consolidated Rent-a-Car Center



Automated People Mover System



Intermodal Transportation Facility (East)

ARUP

LAX CUP – Overview and Challenges

Existing CUP

- Existing CUP - 1961 Vintage, Partial Renovation -1983
- Capacity - Load Demand has Grown
- Aged Facility and Equipment
- Inefficient
- Unreliable

New CUP – the facts

- Chilled water system could cool 373,500 homes
- 9 miles of new distribution utilities to service the existing terminals
- Heating hot water system could heat 16,200 homes
- Structural steel moment frame of new CUP has a weight equal to 28 x A320-200 Airbus planes

Project objectives

- Replace the 50 year old central utility plant
- Improve overall building systems efficiency
  - Variable CHW & HW Flow (less pumping power)
  - Improved Delta T (12° F to 16° F ΔT CHW & 29° F to 50° F ΔT HHW)
  - Cogeneration (Cycle efficiency. Natural Gas in lieu of electricity)
- Improve systems reliability
- Control, Monitor, Measurement, Verification, and Optimization of Energy Use
- Incorporate Sustainable Building Design and Practices
- Reduce Air Emissions

CUP project team

Owner

Los Angeles World Airports (LAWA)

Airport Development Group (ADG)

Design-Builder

Clark-McCarthy A Joint Venture

Design

Arup – Engineer of Record & Lead A/E

Gruen – Architect of Record

PID – Cogen Specialist

KSG – Power Systems Consultant

Greenform – LEED Consultant

Build

Murray Co. – Mechanical

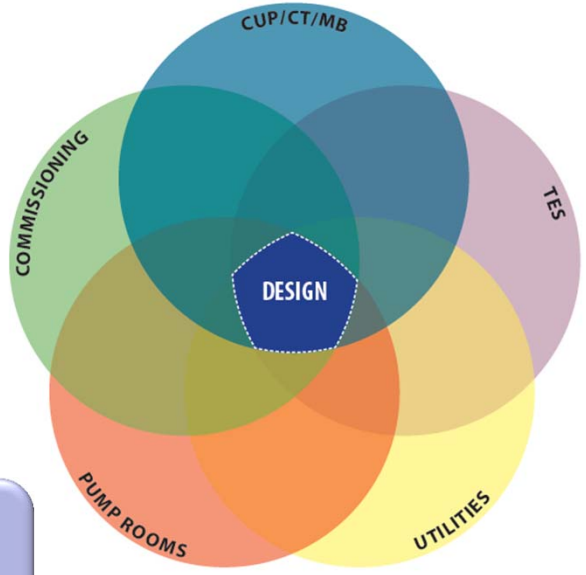
Sasco – Electrical

JCI – Controls

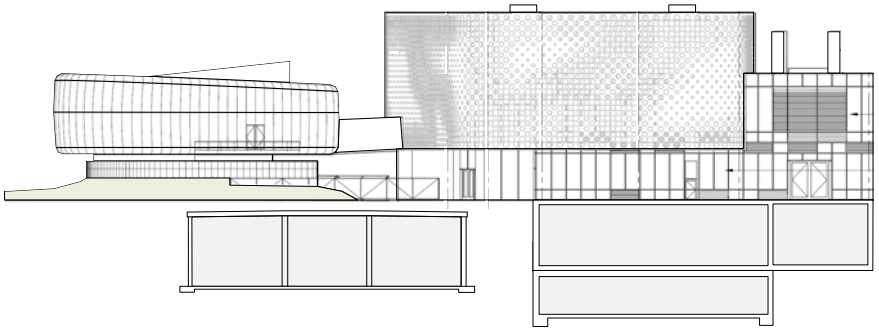
WA Rasic – Civil/Utilities

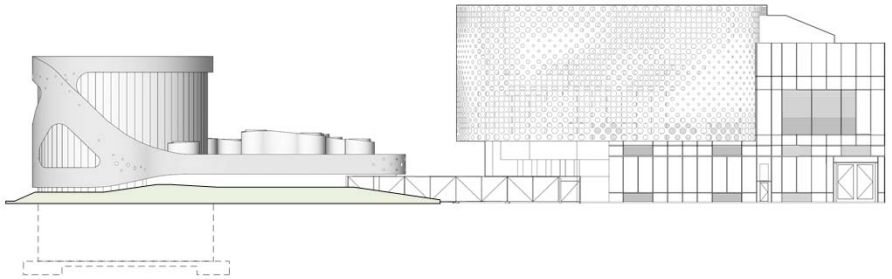
Schuff – Steel

Conco – Concrete

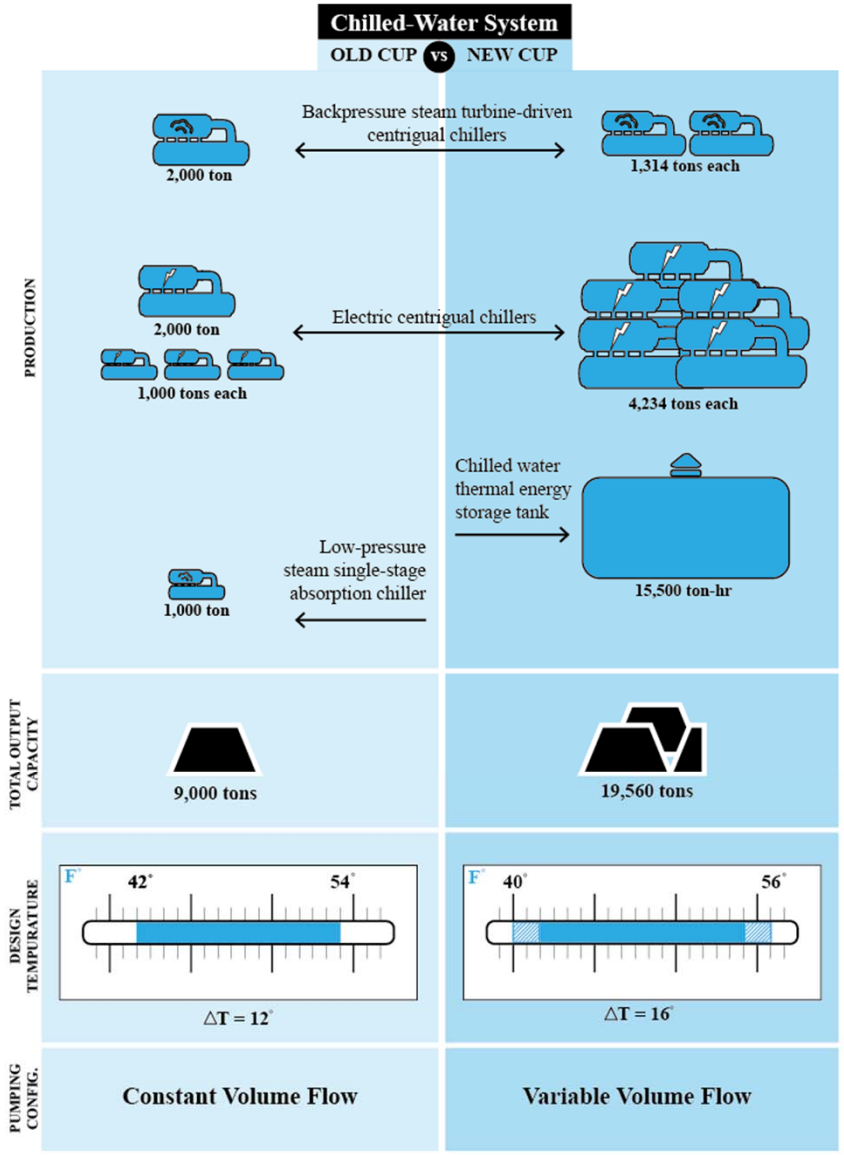


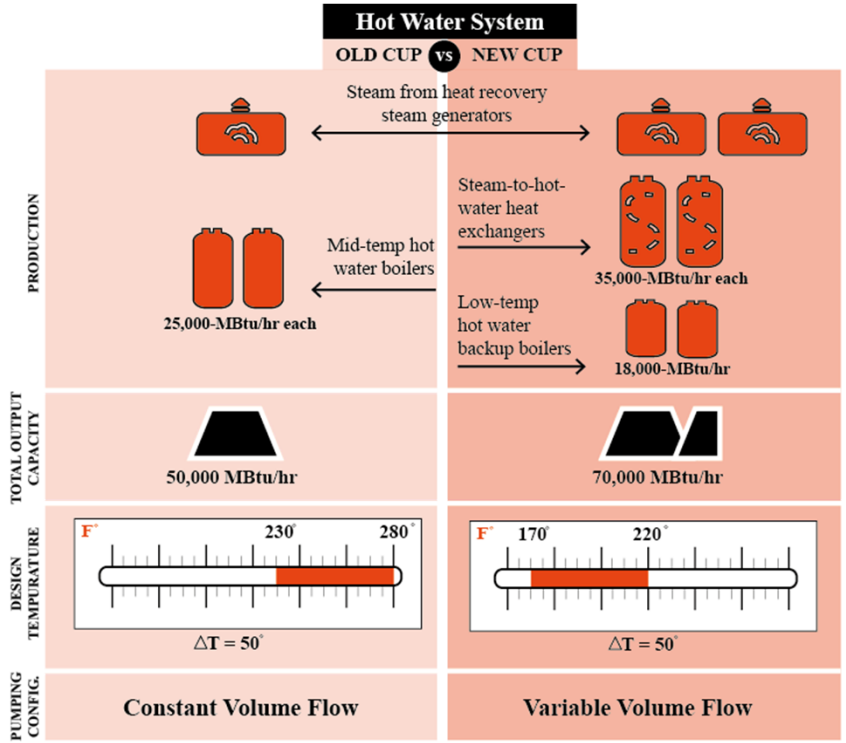
RFP Design vs Reference Design

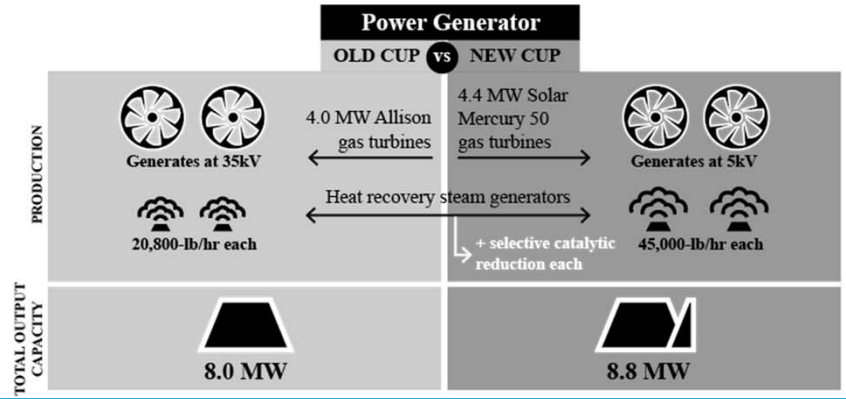




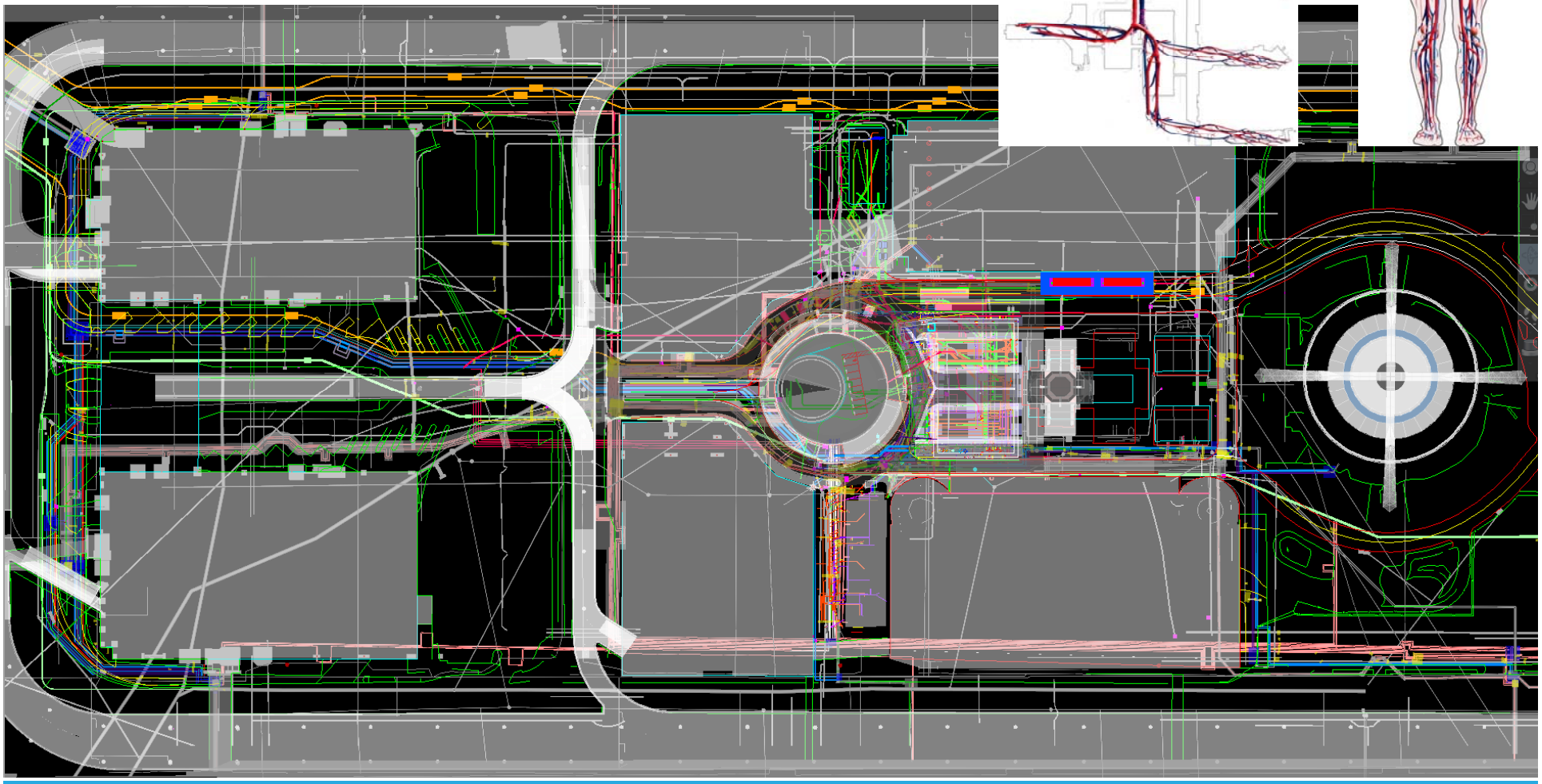
CUP comparisons



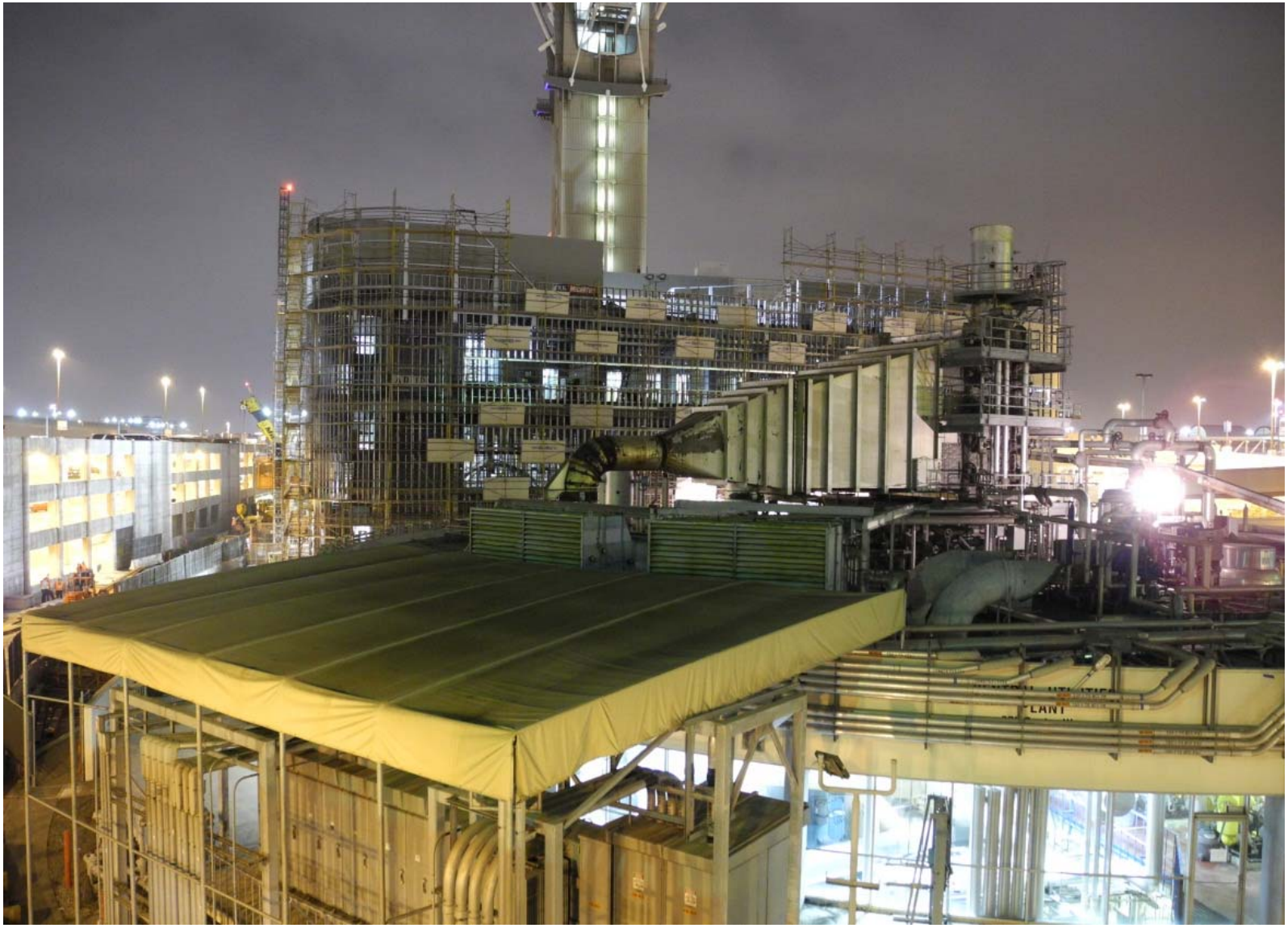




Challenges - site distribution

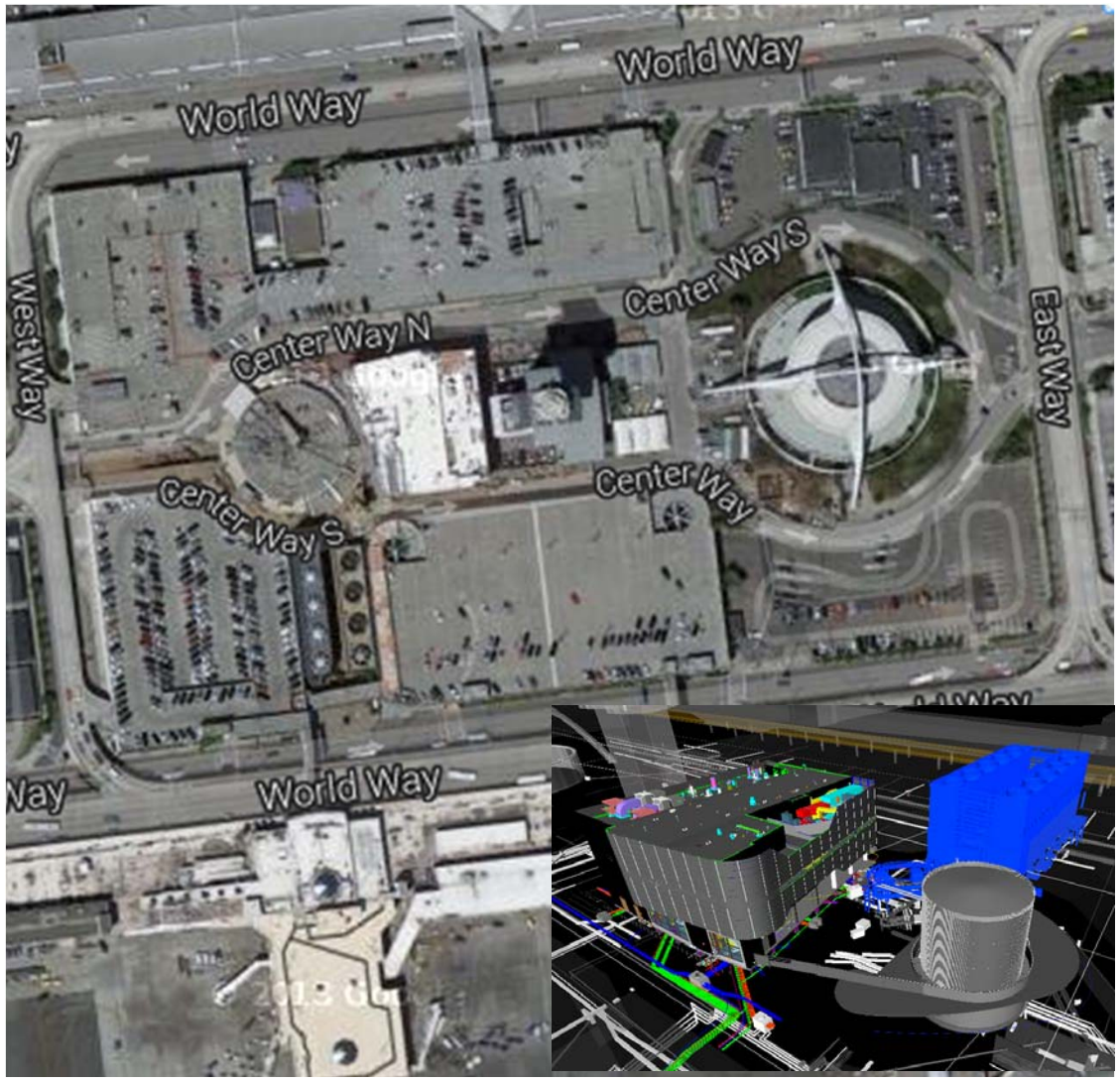


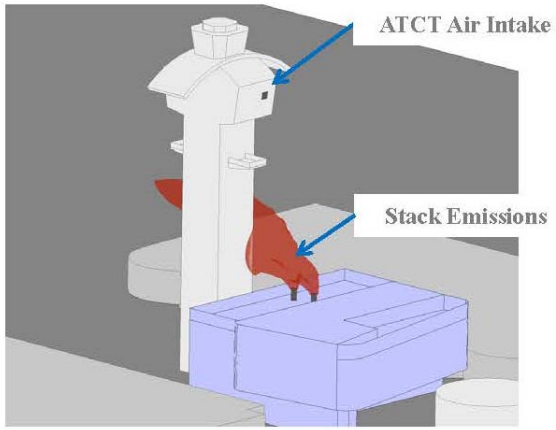
Challenges – proximity to critical facilities

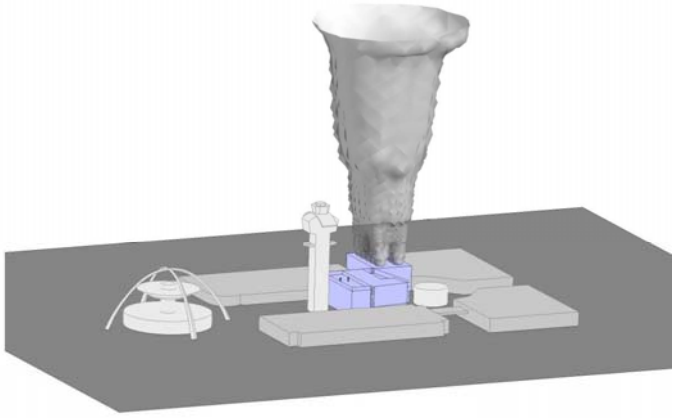


Challenges – keeping the CTA operating

Challenges – cooling tower phasing

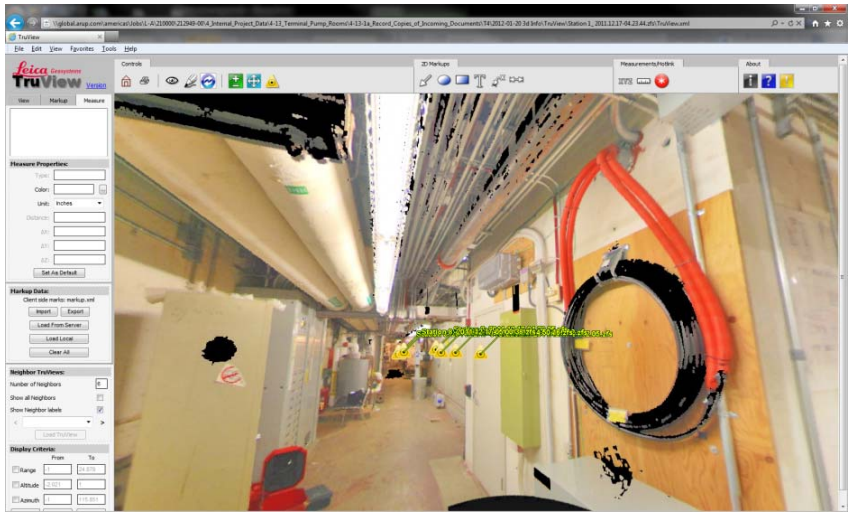


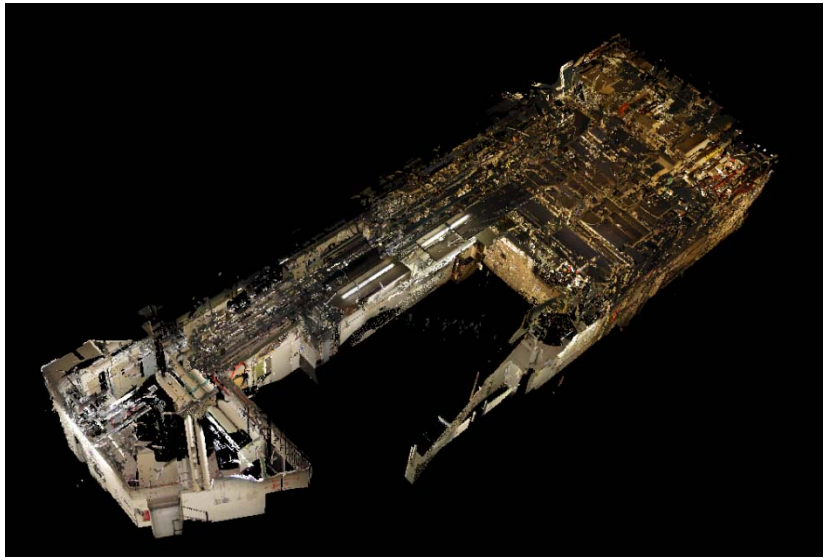


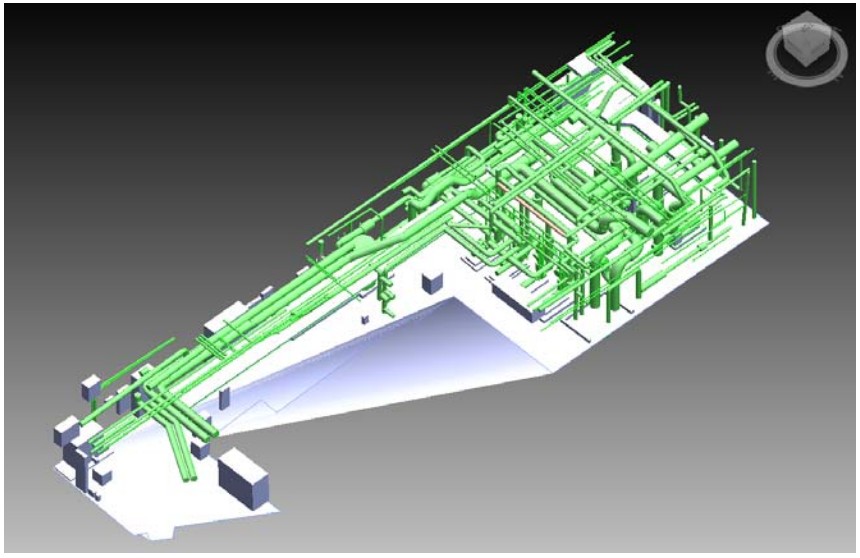


Potential Plume Visibility Extent

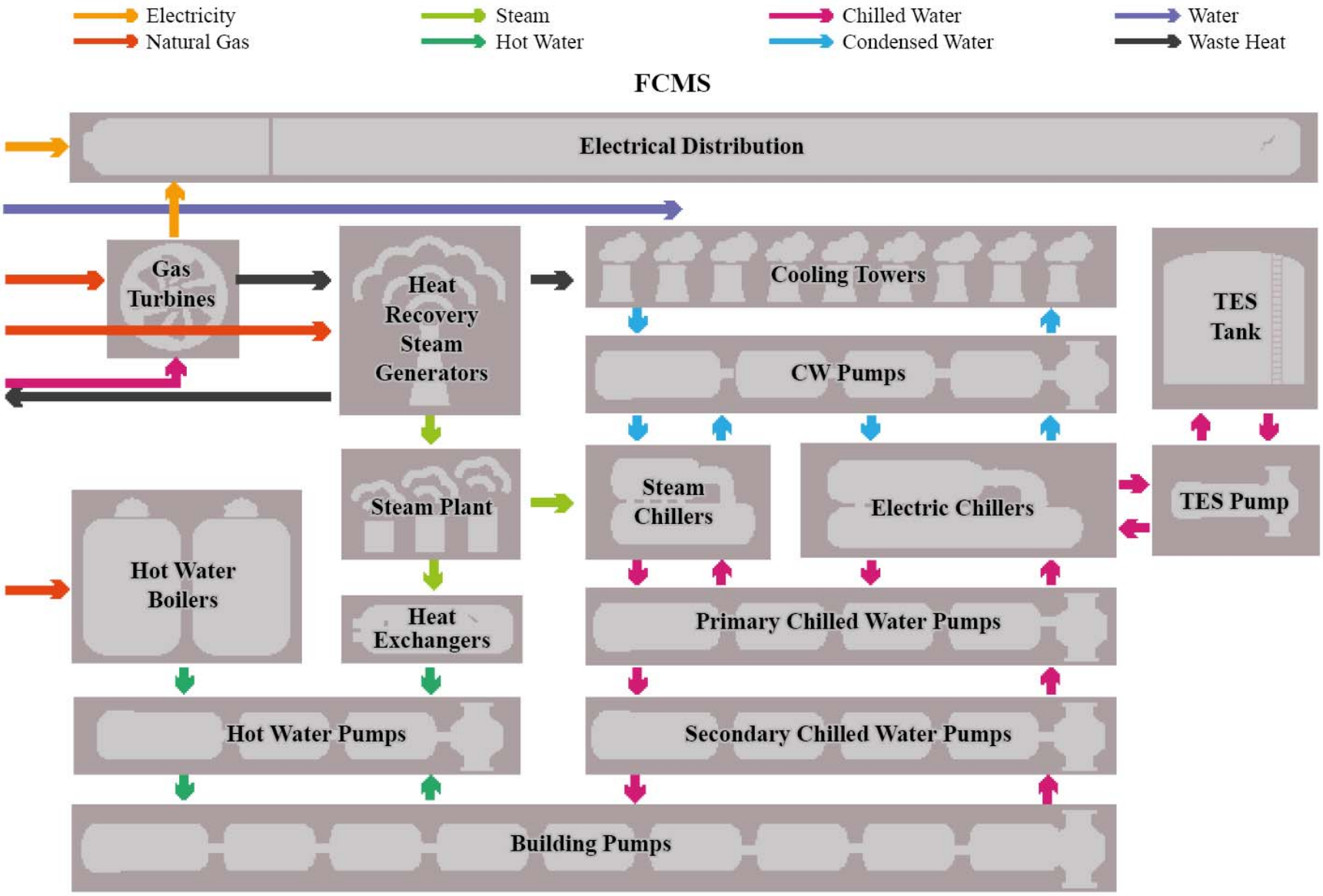
Challenges – terminal pump room upgrades





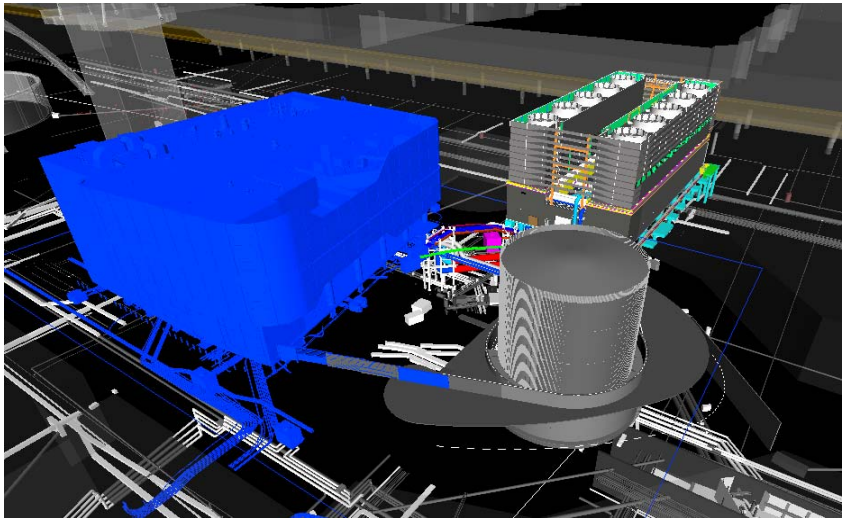


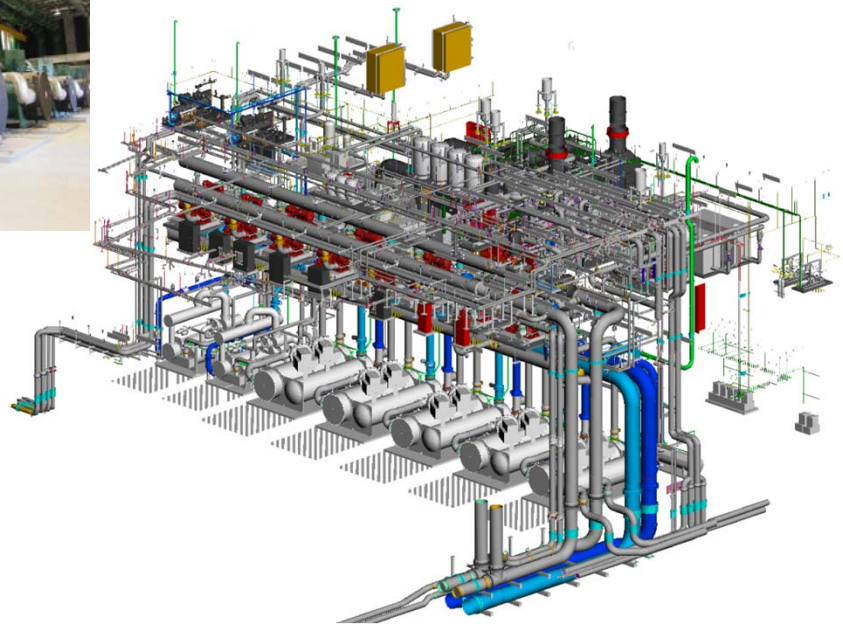
Getting the energy blend right



CUP systems

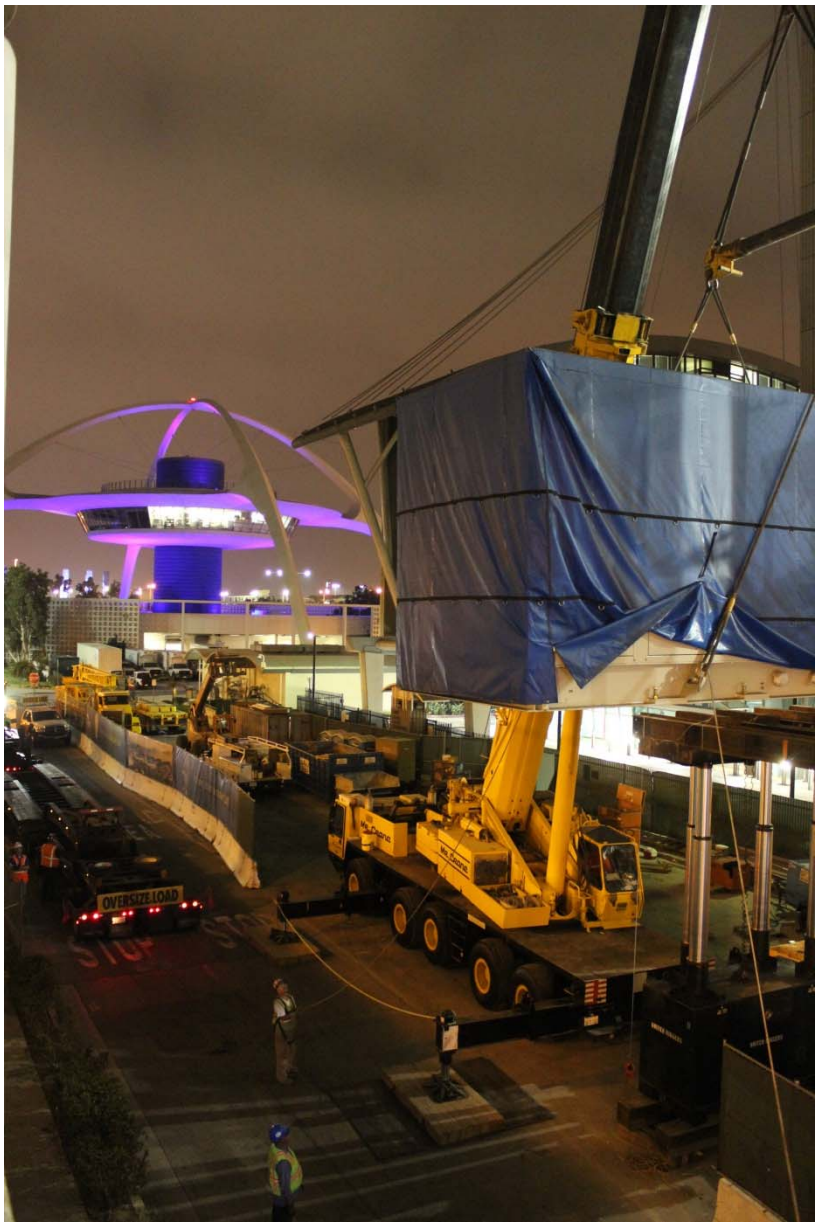
- 20,000 tons chiller capacity (N+1)
- 8.8MW cogeneration with heat recovery
- 1.54M gallon Thermal Energy Store (TES)
- Building HVAC and plumbing
- LEED Gold certification (vs Silver requirement)



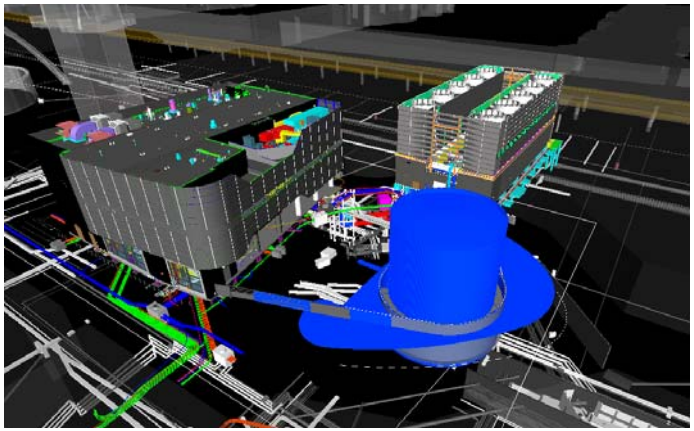


Cogeneration

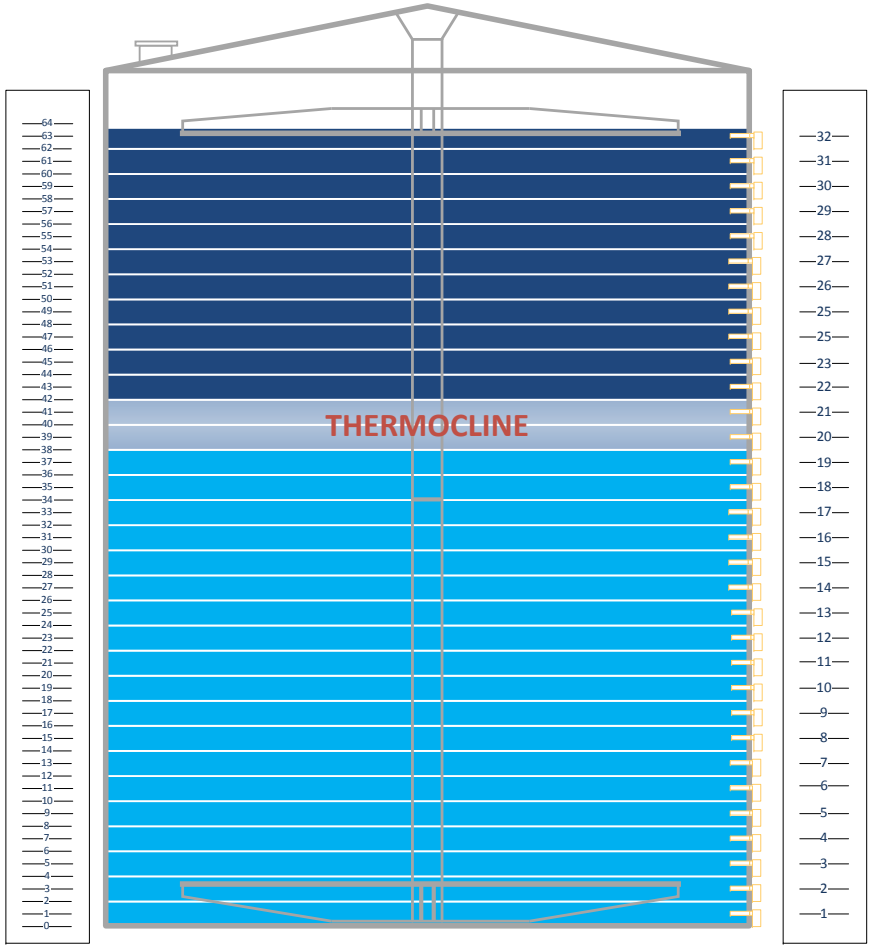
- **Cogeneration & Heating**
  - Gas Turbines
  - HRSG's
  - Boilers
- **Gas Turbines**
  - 2 x Solar Mercury 50 packages
  - 4,400 kWe output
  - 60ºF air to turbine (chilled water coil supplied for air cooling)
- **Natural gas fuel**
  - Fuel Gas Compressors
  - 2 x 100% compressor packages
  - Suction pressure: 119 psig
  - Discharge pressure: 220 psig



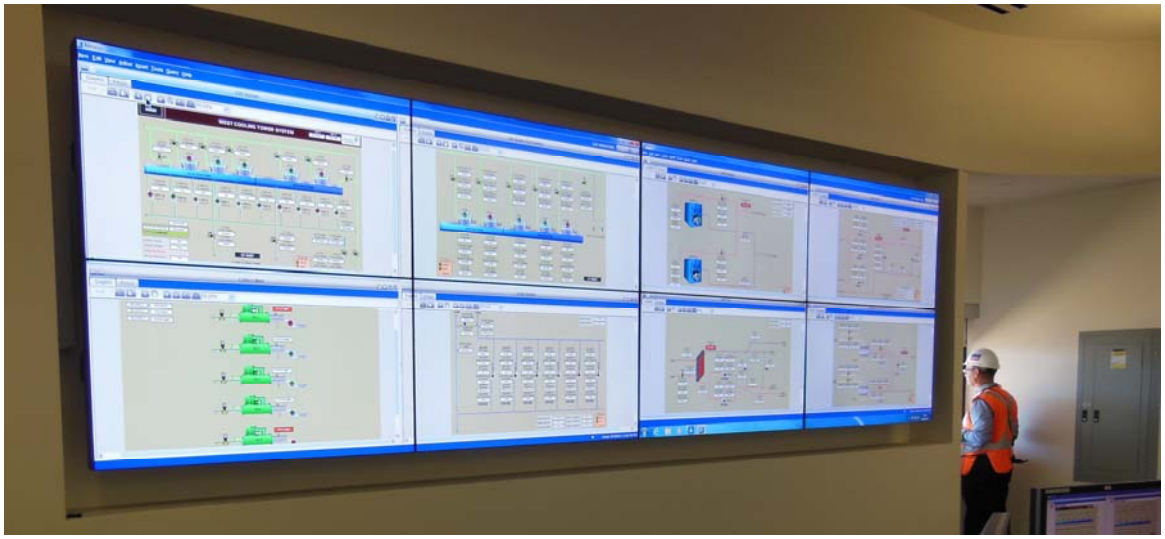
Thermal Energy Storage

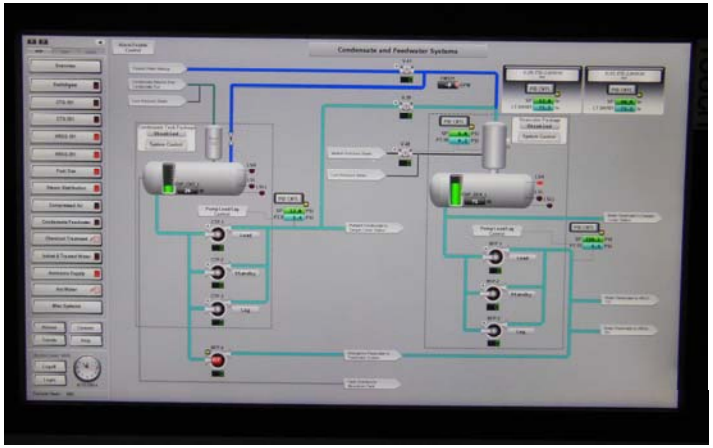


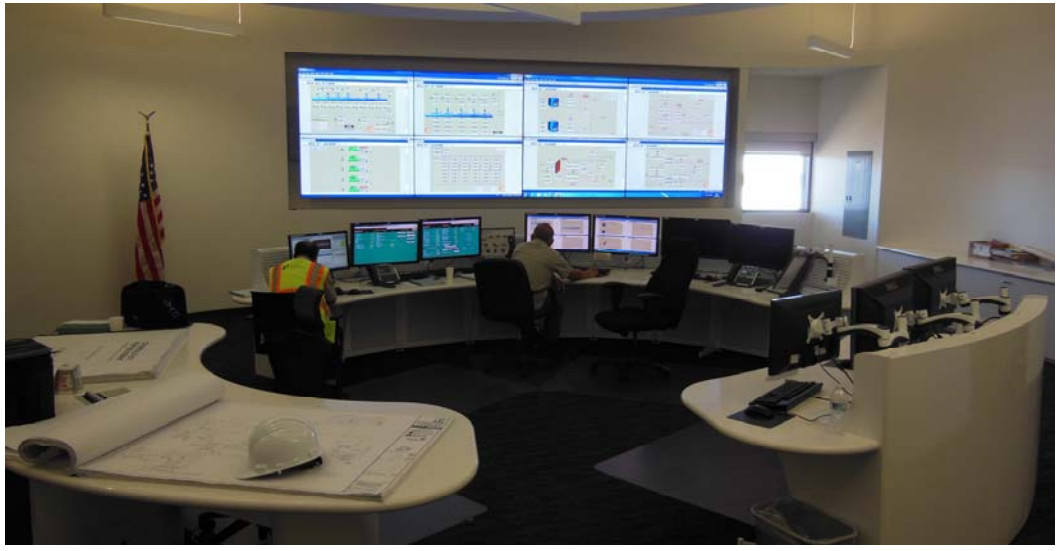
- Thermal Energy Storage
- Size and Performance
- Peak Load : 3,260 Tons
- Discharge Cycle : 4.75 hours
- System ΔT : 16° F
- CHW Capacity : 15,500 Ton-hr
- Tank Dimensions : 64’ Ø x 71’ High
  Water depth : 64’
- Water Volume : 1,537,978 Gal
  (246,912.7 cu.ft.)



Controls







Air Quality

SCAQMD governs:

- Emergency Generator Particulate Emissions
- Standby Boiler NOx and CO_2 emissions
- CTG/Duct Burner Emissions, as well as CEMS system and Ammonia injection system
- Early Interface and Coordination
- Carbon Credits - $6 million
- Project will achieve LEED Gold Certification

System economics

- Project budget = $438,000,000
- Calculated annual energy cost savings = $7,000,000
- Local utility rebates = $4,000,000 (including $2.2M for TES from LADWP's Custom Performance Program)
- Operational savings from variable flow pumping in CUP and terminals will save pumping energy while maintaining comfort
- The **$438M investment** will support a wider **$7Bn modernization program** at LAX (**6.25%** of the CIP)

Questions?