Implementing Building Performance Outcome Requirements

July 30, 2014

Presented by:

Ryan Colker – NIBS

Mark Frankel – New Buildings Institute

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Duane Jonlin – City of Seattle
OUTCOME BASED DESIGN CASE STUDY
EDITH GREEN WENDELL WYATT

NBI Webinar: A Presentation by Clark Brockman, SERA Architects
July 30, 2014
Portland, Oregon

Population: 603,106 (Metro: 2,226,009)
Latitude: 45.5236° N
Metro Land Area: ~770 Square Miles
CLIMATE
PORTLAND - TEMPERATURE / HUMIDITY

Data Source: TMY3 726980 WMO Station Number
Location: Portland Intl. Airport
CLIMATE
PORTLAND TEMPERATURE BINS (6AM-7PM, M-F)
ENERGY USE
PREDICTED vs. ACTUAL (121 LEED BUILDINGS)

“ESSENTIALLY, ALL MODELS ARE WRONG, BUT SOME ARE USEFUL”
- George E.P. Box
Gravesend, Kent, U.K.

ENERGY USE
REALITY

REMEMBER, BUILDINGS DON’T USE ENERGY, PEOPLE DO.
ENERGY USE
PREDICTED vs. ACTUAL

PREDICTED EUI

ACTUAL EUI

ENERGY MODELLER
ENGINEER
ARCHITECT
OWNER
OCCUPANT
### Internal Loads

<table>
<thead>
<tr>
<th>Occupant Density (SF/Person unless otherwise indicated)</th>
<th>OWNER AND DESIGN TEAM PROVIDED DATA</th>
<th>ENERGY MODEL INPUT</th>
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<tbody>
<tr>
<td><strong>Building Average</strong></td>
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<td>Total Building FTE (# people)</td>
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<td>Short-term visitors &lt;1 hour (average #people/day)</td>
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<td>Long-term visitors &gt;1 hour (average #people/day)</td>
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<td>Occupied office sf</td>
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<td>Sample space type - Office</td>
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<tr>
<th>Lighting Power Density (Watts/SF)</th>
<th>OWNER AND DESIGN TEAM PROVIDED DATA</th>
<th>ENERGY MODEL INPUT</th>
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<td>Sample space type - Office</td>
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<th>Plug Load Power Density (Watts/SF)</th>
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<th>ENERGY MODEL INPUT</th>
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<td>Sample space type - Office</td>
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<th>Misc Load Assumptions</th>
<th>OWNER AND DESIGN TEAM PROVIDED DATA</th>
<th>ENERGY MODEL INPUT</th>
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<th>Elevator energy and usage assumptions (kWh)</th>
<th>OWNER AND DESIGN TEAM PROVIDED DATA</th>
<th>ENERGY MODEL INPUT</th>
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<td>Power Demand (kW or hp)</td>
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<td>Energy Use (kWh/yr)</td>
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<td>Quantity</td>
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### Team Members
- MECHANICAL ENGINEER
- ARCHITECT
- OWNER (FACILITY)
- LIGHTING DESIGNER
- OWNER (IT)
- ALL TEAM
- ELEVATOR CONSULTANT
OUTCOME BASED CODES
FOCUSED ON ACTUAL PERFORMANCE

OUTCOME BASED CODES
MEET PERFORMANCE REQUIREMENTS

CURRENT CODES
MEET PRESCRIPTIVE REQUIREMENTS

2030 CHALLENGE

ENERGY INDEPENDENCE AND SECURITY ACT (EISA)

NET ZERO ENERGY CERTIFICATION

LIVING BUILDING CHALLENGE

LEED

LAW BREAKING BUILDINGS

RESTORATIVE BUILDINGS

2030 CHALLENGE

LIVING BUILDING CHALLENGE

LEED

NET ZERO ENERGY CERTIFICATION

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LIVING BUILDING CHALLENGE

LEED

LAW BREAKING BUILDINGS

RESTORATIVE BUILDINGS
REPORTING
REQUIRED ENERGY USE REPORTING

WASHINGTON 2011-2013
MINNEAPOLIS MAY 2014
PHILADELPHIA JUNE 2013
NEW YORK CITY AUGUST 2011
SAN FRANCISCO OCTOBER 2011
WASHINGTON, DC OCTOBER 2011
SEATTLE OCTOBER 2011
CALIFORNIA 2012
AUSTIN JUNE 2012
PHILADELPHIA JUNE 2013
MINNEAPOLIS MAY 2014
WASHINGTON 2011-2013
SAN FRANCISCO OCTOBER 2011
WASHINGTON, DC OCTOBER 2011
SEATTLE OCTOBER 2011
CALIFORNIA 2012
AUSTIN JUNE 2012
ARCHITECTURE 2030
REDUCTIONS IN BUILDING FOSSIL FUEL USE

Source: Architecture 2030, based on statistics from Energy Information Administration

http://architecture2030.org/the_solution/solution_energy

* USING NO FOSSIL FUEL GHG-EMITTING ENERGY TO OPERATE
SERA

2011 EUI REPORTING

2011 PROJECT EUIs

AIA 2030 COMMITMENT PROJECTS

K BTU/ SF

10 20 30 40 50 60 70 80 90 100 110 120 130 140
Owner: GSA

A/E Team: SERA ARCHITECTS

CMc Team: HOWARD S WRIGHT

CUTLER ANDERSON ASSOCIATES
STANTEC
INTERFACE
PAE
KPFF
ATELIER DREISEITL

BENSON
McKINSTRY
DYNALECTRIC
OTIS
NUPRECON
# ARRA and EISA

## MINIMUM PERFORMANCE CRITERIA

<table>
<thead>
<tr>
<th>Energy Star Requirements</th>
<th>Water Conservation Requirements</th>
<th>Energy Conservation Requirements</th>
<th>LEED Requirements</th>
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</thead>
<tbody>
<tr>
<td>Score goal: <strong>97</strong></td>
<td><strong>20% Indoor potable water reduction</strong></td>
<td><strong>55% Fossil fuel reduction</strong></td>
<td>Gold Required</td>
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<td><strong>50% Outdoor potable water reduction</strong></td>
<td><strong>30% Energy usage reduction</strong></td>
<td><strong>30% Solar thermal</strong></td>
<td>Platinum Goal</td>
</tr>
</tbody>
</table>
ENERGY GOAL

NATIONAL AVERAGE FACILITY
CHESAPEAKE BAY FOUNDATION MARYLAND 30,600 SF
NREL (WITH DATA CENTER) COLORADO 218,000 SF
SCHLITZ AUDUBON NATURE CENTER WISCONSIN 39,000 SF
ALDO LEOPOLD LEGACY CENTER WISCONSIN 11,900 SF

77 – 83 Existing EGWW building (437,777 sf)
34 – 36 +/- 15% Renovated EGWW target range
PROJECT DELIVERY

GSA STANDARD (P-100) VS. COLLABORATIVE

EST. SAVINGS

$940,000

44,000 HRS in 15 MONTHS

VS.

53,000 HRS in 24 MONTHS

FOR PROJECT DOCUMENT PRODUCTION
• Take ownership of the project.
• Continuously improve the services, disciplines, and project delivery.
• Exceed the energy and water conservation goals of the project.
• Deliver the project using the building information model to its cost effective capacity.
• Challenge each other to find cost savings and schedule improvements to bring the project in at the best value to the American taxpayer, and
• Employ open book, transparent processes.
EGWW SAVED AN ESTIMATED $82,000 IN TRAVEL TIME TO MEETINGS FOR CONSULTANTS WHO WERE COLLOCATED
COLOCATION

BENEFITS

BETTER COMMUNICATION

• Highly coordinated overall design.
• Fewer assumptions made by disconnected design team members.
• More spontaneous design coordination discussions.
• Better understanding of other disciplines’ work flows and design problems.

LESS WASTED TIME

• Less time spent waiting for answers from email and voicemail.
Living Calendar

Cloud Based Shared Documents
- Design Issues Log
- Constructability Issues Log
- Technical Meeting Log
Transform a 512,400 square foot, 18-story, 1974 office building into a LEED Platinum cornerstone of GSA’s green building portfolio.

BUDGET: $141,000,000
ENVELOPE STUDY
SURROUNDING BUILDINGS

June 21
8 am
ENVELOPE STUDY
SHADING FROM ADJACENT BUILDINGS

East Elevation
10 am

South Elevation
2 pm

West Elevation
4 pm

North Elevation
8 am

Shaded Area
- March / September
- June
- December
SHADING STUDY
HELDION TESTING

% annual shading, south facade
DAYLIGHT STUDY
ARTIFICIAL SKY

Daylight Factor  min/max ratio  16 ft perimeter zone
# DAYLIGHT STUDY

## ENERGY SAVINGS

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**times when no electric lighting is required to light the daylight zone of the building (0'-16' from the window)**

% = energy savings if lights are dimmed

- times when there is no daylight
- times when there is no electric power draw
STUDY RESULTS
A HYBRID SOLUTION

Thermal analysis
- Percentage glazing
- Shading

Daylight analysis
- Surrounding buildings shading
- Building integrated shading
- Interior light quality
- Energy savings

Ongoing Studies
- Energy Sensitivity Analysis

A
- East 80%
- South 85%
- 3.2 ave. daylight factor

B
- East 72%
- South 72%
- 6.4 ave. daylight factor

C
- East 82%
- South 80%
- 5.2 ave. daylight factor
DATA DRIVEN DESIGN
FROM STUDY TO DESIGN TO CONSTRUCTION

REEDS ON EAST FAÇADE
**DESIGN/ANALYSIS**

**EAST & SOUTH ELEVATION STRATEGIES**

- **Summer mid-day sun (high angle)**
- **Equinox morning sun (lower angle)**

- Low Glazing to Wall Ratio
  - 40% glazing

- Low Infiltration Rate
  - 0.06 CFM

- Well-Insulated Wall

- Daylighting
  - Light shelves bounce light 16ft. into interior
Shading reduces the heat gain on the building minimizing the energy needed for cooling.

West Facade
Reeds provide avg. 50% shading

South & East Facades
Combination vertical + horizontal shades

North Facade
No shading
PROJECT DELIVERY

MOCK UPS AND PRODUCT SELECTION
AFTERCARE
TUNING PERFORMANCE

- Commissioning
- Post Occupancy Evaluation
- Measurement & Verification
- Energy Modeling
- Corrective Action Plan

Timeline:
- 2013: Substantial Completion, Tenant Agency Move-In and Orientation, LEED Certification
- 2014: Commissioning (start), Post Occupancy Evaluation
- 2015: Measurement & Verification, Energy Modeling (end), Commissioning (end)

*Corrective Action Plan marked with asterisk (*)
# Tenant Orientation Orientation

## Training and Milestones

### Tenant Design Process

<table>
<thead>
<tr>
<th>Phase</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Project Kick-Off:</strong></td>
<td>Introduction, Project Goals, Design Process</td>
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<tr>
<td><strong>Check-In:</strong></td>
<td>Committees, Occupant Behavior</td>
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<tr>
<td><strong>Walk-Through:</strong></td>
<td>Confirm ELEC/DATA</td>
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<tr>
<td><strong>Orientation Symposium:</strong></td>
<td>Geography, Systems, Goals, Involvement</td>
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### Project Guidelines

- Shared Amenities
- Model Unit
- 51 Standards
KNOW YOUR BUILDING
- Design History
- Systems and Strategies
- Sustainability Goals

KNOW YOUR IMPACT
- Occupant Behavior
- Shared Resources

KNOW YOUR NEIGHBORS
- Property Manager
- Green Team / Tenant Agencies
BEFORE & AFTER MOVE

Survey 3 largest agencies in their Existing Office spaces:

• First & Main Building
  2010 Class-A office building
  LEED-C&S Platinum
  One block away from EGWW

• Robert Duncan Plaza
  1991 office building
  Downtown Portland
INDOOR ENVIRONMENTAL QUALITY (IEQ)

- Thermal Comfort
- Lighting / Daylighting
- Indoor Air Quality
- Acoustics
+ Office Layout, Furnishings & General Satisfaction

Thermal Comfort

How satisfied are you with the temperature in your workspace?  
Very Satisfied ◆◆◆◆◆◆◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ Very Dissatisfied

Overall, does your thermal comfort in your workspace enhance or interfere with your ability to get your job done?  
Enhances ◆◆◆◆◆◆◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ Interferes

Air Quality

How satisfied are you with the air quality in your workspace (i.e. stuffy/stale air, cleanliness, odors)?  
Very Satisfied ◆◆◆◆◆◆◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ Very Dissatisfied

Overall, does the air quality in your workspace enhance or interfere with your ability to get your job done?  
Enhances ◆◆◆◆◆◆◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ Interferes

University of California, Berkeley – Center for the Built Environment (CBE)
POST OCC STUDIES
CBE, LBNL, M+V, MODELS and more...

TRACK 1: LEED

LIGHTING MEASUREMENT SUMMARY REPORT

6/2/2013 SUMMARY REPORT


Seasonal Testing - COOLING Seasonal Testing - HEATING 10 Month Cx Review

9/25/2014 - 10/25/2014
CONDUCT 2ND ROUND SURVEY (EG-WW)

1/1/2015
ISSUE CORRECTIVE ACTION PLAN

11/30/2014 - 12/18/2014
CORRELATE 2ND ROUND AND ACTUAL PERFORMANCE

TRACK 2: POST OCCUPANCY EVALUATION

TRACK 3: LEED M&V

5/1/2014
8/5/2013 - 9/9/2013
DRAFT FINAL

11/21/2014 - 2/2/2014
DATA COLLECTION

11/30/2014 - 1/1/2015
DATA ANALYSIS

3/15/2015 - 3/30/2015
WHITE PAPER
SUMMARY OF M&V

1/4/2015 - 2/2/2015
MODEL CALIBRATION

2/18/2015 - 3/14/2015
DEVELOP REVISED CODE BASELINE ENERGY MODEL

TRACK 4: ENERGY MODELING

5/1/2014


Energy Analysis Report (FINAL)
INDOOR ENVIRONMENTAL QUALITY (IEQ)

- Thermal Comfort
- Electric Lighting
- Daylighting
- Indoor Air Quality
- Acoustics

CORRELATE TO DESIGN

- IEQ parameters
  - Lighting & Daylighting Studies
  - Acoustics expectations
  - Thermal Comfort Study
- Energy model assumptions

Figure 20. East interior zone stratification pole and example hourly temperature profiles, 9/14/2011.

Figure 21. East perimeter zone stratification pole and example hourly temperature profiles, 9/14/2011.

University of California, Berkeley – Center for the Built Environment (CBE)
COMMISIONING
ONGOING TUNING & OPTIMIZATION

SEASONAL TUNING

CALIBRATE ENERGY MODEL

CONNECT TO MEASUREMENT & VERIFICATION

• Tie into M&V and energy modeling cross-walk

TIE-IN WITH POST OCCUPANCY EVALUATIONS

• Involvement in corrective Action plan from occupant satisfaction
ONGOING M&V
ENERGY & WATER PERFORMANCE

ENERGY END USE METERS
• Major systems submetered

CORRELATE ACTUAL PERFORMANCE TO DESIGN
• Cross walk to early design energy model

CALIBRATED MODEL FOR ONGOING OPTIMIZATION

WATER CALCULATOR
• Potable Water Use
• Rainwater catchment & Reuse
EDITH GREEN - WENDELL WYATT FEDERAL BUILDING

ANNUAL ENERGY USAGE

Calculated Based on AVERAGE Monthly Usage from May to December 2013

MBtu

Costs would continue to rise over time.

33,000

ORIGINAL BUILDING

$692,500*

“CODE” BUILDING

ASHRAE 90.1 - 2007

23,500

$536,500*

MODERNIZED BUILDING

FORECASTED ENERGY USAGE

12,850

$323,000*

MODERNIZED BUILDING

ACTUAL ENERGY USAGE

12,600

$290,000*

45% SAVINGS

* Calculated at 2013 energy cost.

** Modernized building includes a 14% increase in leasable area compared to the original building.
THANK YOU!

Questions / More Information:

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DESIGNING FOR BETTER ENERGY OUTCOMES
Federal Center South
The oxbow is one of the remaining historic features of the industrialized Duwamish River.
Overall Energy Goals

Contract:
- 0.5% of total project cost at risk
- Approx $350K ($1.75/ft²)
- Risk shared between
  - Design Team (1/3)
  - Construction Team (2/3)
- 1 Year M&V
- Document assumptions thoroughly
The Collaborative Workplace

Flexibility. Efficiency. Daylight.
Unified. Open.

Central and convenient.

No “Silos”.

Optimize Mechanical Systems

Optimize Structural

Builds Community
Optimizing Workplace for Daylight & Views

Original Workplace

21st Century Workplace
Decoupled Ventilation and Conditioning

Flow Cross Section Ratio
1:327

WATER PIPE
AIR DUCT

- Temperatures in the occupied zone are comfortable, between 70°F and 74°F.
- Temperature change across the body is less than 3°F.

Figure 6: CFD Results – Building Section (North-South)
Thermal Storage & Geo Exchange

Loose to medium dense, trace to slightly silty, fine to medium SAND; scattered shell fragments; (Alluvium)

Medium dense, slightly silty to silty, fine to medium SAND; scattered shell fragments; (Alluvium)

Soft, slightly clayey SILT; (Estuarine)

Hard, trace to sandy, clayey SILT; (Glacially Overridden Deposits)
Energy Model Assumptions
Weather [adjustments]

Annual Weather Data - Seattle Boeing Field TMY3 (during working hours)

WEATHER ADJUSTMENTS: JUNE

<table>
<thead>
<tr>
<th>HDD MODELED</th>
<th>HDD MEASURED</th>
<th>VARIATION</th>
</tr>
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<tbody>
<tr>
<td>44.0</td>
<td>44.6</td>
<td>101%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CDD MODELED</th>
<th>CDD MEASURED</th>
<th>VARIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.9</td>
<td>17.6</td>
<td>118%</td>
</tr>
</tbody>
</table>

\[(\text{modeled heating energy}) \times (1 - \text{HDD variation}) + (\text{modeled cooling energy}) \times (1 - \text{CDD variation}) = \text{weather adjustment}\]

\[1,279\text{kHz} \times 1\% + 7,523\text{kHz} \times 18\% = 1,379\text{kHz}\]

Peak temperature of 98°F compared to an ASHRAE 0.4% design day of 86°F.
Whether **it is operated as modeled**
Tracking EUI Performance

• Detailed Analysis of Meter Data
• Plug load much greater than model
• Lighting energy is about right
• Heating and cooling energy is much greater than model
• Pump energy is much greater than model
Normalized Performance for 2013

25.7
Metered in 2013
Adjusted for Plug loads and weather

Mostly on track with model after April
Site Context

WINDS FROM THE NORTH [MARCH - OCTOBER]

SUMMER SUNPATH

WINTER SUNPATH

WINDS FROM THE SOUTH [NOVEMBER -

58%

Free cooling available.
Contract:

- $420K (Approx $2/ft²)
- 5 Year M&V
- Percentage released annually pending compliance
- Document assumptions thoroughly

48% open program spaces
52% enclosed rooms
Program – Need for Daylight

68% of floor plate has daylight autonomy over 50% of the year

70% of program has need for daylight

Daylight Priority:
- **Highest**
- **High**
- **Medium**
- **Low**
- **Lowest**

Spaces with higher daylight priority should be placed closer to windows.
Daylight Optimization

68%
Access to daylight from atrium and exterior walls.
Façade Optimization

12% Reduction in solar load

66% Reduction in solar load
Façade Optimization

East & West

South
Façade Optimized

- Cool summer breezes from the north are captured by the building shades.
- Shades block direct sunlight while redirecting diffused daylight back into the office.
- Views north to the Puget Sound and the city.
- Shades shield the glass from the cold winter winds from the south.
- Light redirecting blinds (better option)
- Operable windows provide natural ventilation and views.
- Scrim with Variable Openness to Maximize Daylight and Minimize Peak Solar Loads, Saving Energy and Improving Comfort.
- High efficiency lighting with daylight dimming.
Access to Operable Windows

45% of floor plate within 25 feet of an operable window

58% program within green zone
Occupant Enabled Mechanical Systems

Baseline System

Active Energy Saver

Occupant Enabled System

Occupant controlled in-zone heating and cooling

Free cooling with operable windows
Integrated Design Approach

- Thermal Storage with a Phase Change Material: Offsets simultaneous heating and cooling demands and leverages night time temperature depressions.

- Heat Recovery Chiller: Takes advantage of simultaneous heating and cooling needs and reduces overall energy use. Thermal Storage makes the chiller even more effective.

- Occupant Controlled, Zoned Heating and Cooling with 100% Fresh Air: Provides control and improved indoor air quality.

- Scrim with Variable Openness: Maximizes daylight and minimizes peak solar loads, saving energy and improving comfort.

- Operable Windows: Provide control to occupants, improved indoor air quality.

- Daylight Harvesting: Coupled with a high efficiency lighting system to minimize electric light energy.

- Ground Source Heat Exchanger: Saves energy and water by providing a source of heat and waterless heat rejection in the summer.

- Heat Recovery from exhaust air: Preconditions ventilation air to reduce space conditioning demands.

- Air return as a return air plenum: Uses the architecture as mechanical system components.

- Reflected Daylight from the Commons: Makes the best use of available resources.

- Prominent Stair: Encourages an active and healthy lifestyle.

- Rainwater Capture and Reuse: For flush, greatly reduces annual flush demand.
Getting to the Target EUI

1. Reduce loads with Passive Systems
   - Shading
   - Daylight
   - *Additionally, users can use operable windows to get to below **30.1 EUI**

2. Efficient Active Systems
   - Decoupled HVAC approach
   - Occupant enabled Cooling
   - Geothermal
   - Heat recovery chiller
   - Energy Recovery Ventilation
   - LED Lighting

3. On-Site Renewable Energy Generation [Betterment]
Words to the Wise

- 4-6 Months Break in Period for Controls and Diagnostics
- 1 year contract is too short
- Submetering is important.
- Change management is critical

- It takes a village.
- Trust
- Let ideas marinate
- Communication – with team and client.
- Establish Value Chain.
Sticks v/s Carrots
Governor George Deukmejian
Courthouse
Performance Based Infrastructure
July 30, 2014
National Institute of Building Sciences
Outcome Based Performance
Governor George Deukmejian Courthouse
Project Overview

- Design, Build, Finance, Operate & Maintain
- 35 year Agreement
- Complete Services
- Payments Depend on Performance & Availability
- Strong Public Counterparties
  - Judicial Council of California
  - County of Los Angeles
Project Overview

- Courtrooms: 31
- Overall Bldg: 531,000 GSF
- Court Space: 416,000 GSF
- County/Commercial: 105,000 GSF
- Construction Cost: $339,000,000 (approx.)
- Design Build Start: January 2011
- Occupancy September 2013
Project Development

- RFQ, RFP, Proposal/Competition
- 11 Consortiums submitted Qualifications
- Five teams shortlisted for Interview, three selected for final D/B/F/M competition
- Six Month Competition w/ Multiple Proprietary mtgs.
- Official Announcement of Selection of Long Beach Judicial Partners in June 2010
- Design, Build, Finance, Operate, and Maintain Proposals Submitted December 2009
- Selection of Long Beach Judicial Partners June 2010
- Financial Close Occurred December 20, 2010
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Long Beach Court – PBI Project Contract Structure

JUDICIAL COUNCIL

- Agreement & Payment
- Interest in Land

Lenders
- Senior Debt

LBJP

Equity Provider
- Equity

Clark/AECOM Design/Construction

Agreements

Johnson Controls Operations Maintenance
Long Beach Court - DBFOM Contract Structure

- Operation Services Johnson Controls
  - Security package
- Long Beach Judicial Partners
  - Service Agreements
- Design Builder Clark
  - Security package
  - Coordination Agreement
- AECOM
- Clark
Design, Build, Finance, Operate & Maintain

- Meridiam Infrastructure: Developer & Investor
  - Long Beach Judicial Partners
- Clark Construction: Design Builder
  - AECOM: Architects
- Johnson Controls: Operator & Design Assist
Risks Transferred

- Design and Construction Risks / Liability
- Entitlements and Utilities
- Completion Risk (Delay and Efficacy)
- Construction Cost Overruns
- Disputes Between Designer, Builder and Operator
- Landlord Risks & Rental Income Shortfalls
Risks Transferred

- Operation and Maintenance Risks
- O&M Cost Overruns
- Regulatory Compliance
- Capital Maintenance
- Technological Obsolescence
- Excess Energy Consumption
Risks Retained

- Owner’s Risk Under Any Delivery Method
- Changes In Law
- Uninsurable Force Majeure Events
- Pre-existing Site Environmental Conditions
- Such Uncontrollable = “Relief Events”
- Inflation (Service Fee 30% Index-Linked)
## Time Line Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Long Beach-Actual Timeline</th>
<th>Typical Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>6/25/2010</td>
<td>AOC Selects Project Company</td>
<td>10/12/20090</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
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</tbody>
</table>
Service Payment Deductions

Key Performance Indicators
- Calls Responded in 15 minutes
- % of Scheduled PMs Completed
- Asset Value maintained above threshold

Availability Concept
- Facility Maintained in Required tolerances
- Linked Functional Units

<table>
<thead>
<tr>
<th>Functional Unit</th>
<th># of Units / floor</th>
<th>Unit Deduction</th>
<th>Total Deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courtrooms</td>
<td>2</td>
<td>$384</td>
<td>$6,144</td>
</tr>
<tr>
<td>Holding Cells</td>
<td>7</td>
<td>$96</td>
<td>$5,376</td>
</tr>
<tr>
<td>Interview Rooms</td>
<td>2</td>
<td>$96</td>
<td>$1,536</td>
</tr>
<tr>
<td>Attorney/Client Room</td>
<td>4</td>
<td>$96</td>
<td>$3,072</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$21,128</td>
</tr>
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Deduction Example

- Prisoner Elevator is Down
- Elevator serves Holding Cells between Courtrooms
- 4 Floors are Affected
- Space Unavailable for 5 Hours
- Holding Cells & Linked spaces All Deemed Unavailable.

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PBI Influences on D/B

Thinking Ahead - System Architecture
PBI Influence on D/B
Availability Risk - Product Selections
PBI Influence on D/B
Light Fixtures O&M / Life Cycle Risks - Frequency & Access
What Made Us Successful

- Design Build tied to Building Performance
- Integrated Delivery – DBFOM
- RFP allowed Creativity – Outcome Focused
- Quality Management & Monitoring
- Discipline of 35 Yr Performance with Availability Penalties
Lessons We Learned

- External Communications Important & Challenging
- Bring Operator on Early before Finishing
- Close-out Planning 6 months before finishing
- Occupational Training of Court staff on Equipment & Systems
Governor George Deukmejian Courthouse

Performance Based Infrastructure

Freddy Rayes – Long Beach Judicial Partners
Chip Hastie – Clark Construction
Sean Maher – Johnson Controls
Clifford Ham – Judicial Council of California
PBI Influence on D/B Mechanical Systems
Seattle
From OBC to TPP
DUANE JONLIN
SEATTLE DEPARTMENT OF PLANNING AND DEVELOPMENT
City of Seattle & Preservation Green Lab

- Energy code doesn’t always work for historic buildings
- Energy code doesn’t always ensure energy performance
“Outcome-based” pilot project

- City agrees to relax code requirements
- Owner agrees to operated below an EUI target
- PGL agrees to facilitate process

- **Predict** it with energy model
- **Prove** it with utility bills
Three pilot projects

- Supply Laundry
- 1510 Melrose
- Anhalt Apartments

Wasn’t easy to recruit!
Regulatory Framework

- Commercial buildings converted to residential: full energy code compliance
- Historic buildings get special consideration
- “Pilot project” status also allows leeway
Supply Laundry

- Industrial windows
- Brick walls
Supply Laundry

- Shell work completed
- Just leased to a little local tech company
- Try for 60% below CBECS
- Obligated for 50% below CBECS
1510 Melrose

- Set energy target with energy modeling
- Permit drawings match energy modeling inputs
1510 Melrose
Anhalt Apartments

- Combined new and existing buildings for energy code
- Audit & retro-commissioning required if they don’t meet target
- Agreement recorded on property title at County
- $50,000 performance bond posted
Anhalt Apartments

- Preserved historic windows and entry features
- Addition went beyond code
Is an OBC possible?
Four problems to solve:

1. Selection of target EUIs
   1. With modifications and exceptions
2. Virtual code compliance methodology
3. Actual energy use tracking methodology
4. Consequences for non-performance
1. How to select target EUIs
2. Virtual compliance methodology

- Standard “Total Building Performance” from code
- …but only model the “proposed” case
- Energy modeling no longer theoretical
3. Tracking energy use

- Use Seattle Benchmarking procedure
- Forward utility data to building department
- The bell rings when they hit 12-month EUI target
4. Consequences

What if they go over their energy use target?

- Penalty big enough to make them pay attention…
- …but small enough to not scare them away
- Max $4 / SF for 30% over target
- (If mandatory code, penalties could be bigger)
- Using “pledge and fine” instead of bond
What if they gave a code and nobody came?

- Almost everybody *loved* the concept of this code
- ...but almost nobody is actually *using* this code

**Issues for project teams:**

- Avoiding uncertainty
- Minimizing risk
- Defining an end point
Thank you!

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Ryan Colker
rcolker@nibs.org