The Changing Role of Architects in a Built Environment (trending) NZE
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)
WHY BUILDINGS?

Greenhouse Gas Emissions

Source: Architecture 2030, based on statistics from Energy Information Administration
ARCHITECTURE 2030
REDUCTIONS IN BUILDING FOSSIL FUEL USE

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

* USING NO FOSSIL FUEL GHG-EMITTING ENERGY TO OPERATE
http://architecture2030.org/the_solution/solution_energy
SHADES OF GREEN

TYPICAL “CODE” BUILDINGS

BETTER BUILDING PRACTICES

HIGH PERFORMANCE GREEN BUILDINGS

PURSuing SUSTAINABILITY

RESTORATIVE BUILDINGS

LEED Silver + Gold

LEED Certified

The Living Building Challenge

Other Standards

LEED Platinum

Net Zero

The Natural Step

Current Technologies and Services

Evolving Technologies and Services
“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
STATE ENERGY CODES NEED MORE CONSISTENCY AS OF NOV. 1, 2011

BCAP Dedicated to the adoption, implementation, and advancement of building energy codes. Get all the most up-to-date code status maps and other valuable resources at www.bcap-ocean.org.
REPORTING
ENERGY USE REPORTING LABELS

EU DISPLAY ENERGY CERTIFICATE

zEPI SCALE

USA ASHRAE BUILDING ENERGY QUOTIENT
EDITH GREEN-WENDELL WYATT
FEDERAL BUILDING

THE NEXT STAGE OF THE JOURNEY:
Commissioning and Performance-Based Occupancy and Operations

June 7, 2013
GSA Region 10 Update
Owner: GSA

A/E Team:
SERA ARCHITECTS
CUTLER ANDERSON ASSOCIATES
STANTEC
INTERFACE
PAE
KPFF
ATELIER DREISEITL

CMc Team:
HOWARD S WRIGHT
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>
</tr>
</thead>
<tbody>
<tr>
<td>Score goal: <strong>97</strong></td>
<td><strong>20%</strong> Indoor potable water reduction</td>
<td><strong>55%</strong> Fossil fuel reduction</td>
<td>Gold Required</td>
</tr>
<tr>
<td></td>
<td><strong>50%</strong> Outdoor potable water reduction</td>
<td><strong>30%</strong> Energy usage reduction</td>
<td>Platinum Goal</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>30%</strong> Solar thermal</td>
<td></td>
</tr>
</tbody>
</table>

**ARRA and EISA**

**ENERGY STAR**

**LEED**

**FEDERAL BUILDING MODERNIZATION**
ENERGY GOAL

77 – 83 Existing EGWW building (437,777 sf)

34 – 36 +/- 15% Renovated EGWW target range

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
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
HELIDON TESTING

% annual shading, south facade
DAYLIGHT STUDY

ARTIFICIAL SKY

Daylight Factor min/max ratio 16 ft perimeter zone
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)

Low Glazing to Wall Ratio
40% glazing

Low Infiltration Rate
0.06 CFM

Well-Insulated Wall

Equinox morning sun (lower angle)

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
PORTLAND
DOWNTOWN AREA NETWORK

• Reverse power flow not permitted in downtown network.
• 100 kW buffer required by utility.
• Lost PV production between 15-20%.
EGWW
NET ELECTRICITY

DAILY SOLAR HARVEST

ENERGY (kWh)

PV AVAILABLE
PV CAPTURED
BUILDING LOAD

FRIDAY
SATURDAY
EGWW
OPPORTUNITY LOST

More than 35% of possible production is lost

ANNUAL SOLAR HARVEST

ENERGY (kWh)

MONTH

PV AVAILABLE
PV CAPTURED
NETWORKS ARE EVERYWHERE

285 US CITIES WITH POPULATION > 100,000

90% OR ROUGHLY 250 US CITIES USE SECONDARY NETWORKS
POST OCC STUDIES
CBE, LBNL, M+V, MODELS and more...

TRACK 1: LEED
6/1/2013 - 10/1/2013 Seasonal Testing - COOLING
6/1/2013 - 12/1/2013 Seasonal Testing - HEATING
5/1/2013 10 Month Cx Review

TRACK 2: POST OCCUPANCY EVALUATION
3/1/2013 - 3/3/2013 EVALUATE EXISTING FACILITIES (Survey Planning)
3/1/2013 - 4/1/2013 Survey Execution
6/2/2013 SUMMARY REPORT
3/1/2013 - 9/25/2014 CONDUCT 2ND ROUND SURVEY (EG-WWV)
9/25/2014 - 10/25/2014 EXAMINE ACTUAL PERFORMANCE
1/15/2015 ISSUE CORRECTIVE ACTION PLAN
11/30/2014 - 12/18/2014 CORRELATE 2ND ROUND AND ACTUAL PERFORMANCE

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
# Tenant Orientation: Training and Milestones

## Tenant Design Process

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Programming</strong></td>
<td>Project Kick-Off: Introduction, Project Goals, Design Process</td>
</tr>
<tr>
<td><strong>Config Plans</strong></td>
<td>Project Guidelines: Shared Amenities, Model Unit, 51 Standards</td>
</tr>
<tr>
<td><strong>Design Intent</strong></td>
<td>Check-In: Committees, Occupant Behavior</td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td>Walk-Through: Confirm Elec/Data</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>Orientation Symposium: Geography, Systems, Goals, Involvement</td>
</tr>
<tr>
<td><strong>Move-In</strong></td>
<td></td>
</tr>
</tbody>
</table>

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**Introduction**

- **Project Goals**
- **Design Process**

**Project Guidelines**

- Shared Amenities
- Model Unit
- 51 Standards

**Check-In**

- Committees
- Occupant Behavior

**Walk-Through**

- Confirm Elec/Data

**Orientation Symposium**

- Geography
- Systems
- Goals
- Involvement
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
POST OCC EVALS
OCCUPANT SATISFACTION SURVEYS

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
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 EVALS

PHYSICAL MEASUREMENTS

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

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
Oregon Sustainability Center
Living Building Challenge
PUBLIC / PRIVATE PARTNERSHIPS

OSC Board:
• City of Portland Bureau of Planning and Sustainability
• Oregon University System
• Portland State University
• Portland Development Commission
• Oregon Living Building Initiative

• Plus dozens of other organizations, researchers, companies and others
SECTION PERSPECTIVES
ENERGY CHALLENGE
FLOOR TO ROOF AREA

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

OREGON SUSTAINABILITY CENTER
OREGON
130,000 SF

ENERGY UTILIZATION INTENSITY kBTU/SF/yr
ENERGY USE
BEFORE TENANT ENGAGEMENT

TYPICAL BUILDING
ENERGY USAGE

POTENTIAL
ASHRAE SAVINGS
Without Tenant ECMS
ENERGY DISTRIBUTION WITH TENANT ENGAGEMENT

POTENTIAL ENERGY SAVINGS
Without Tenant ECMS

ENERGY SAVINGS GOAL
With Tenant ECMS
FEEDBACK MECHANISMS
“FRACTAL DASHBOARDS”

BUILDING FAÇADE
Compare to other buildings

BUILDING LOBBY
Compare floors within the building

DEPARTMENT/OFFICE
Create inter-office competition

INDIVIDUAL
Understand personal contribution
FEEDBACK MECHANISMS
INFORMATION SOURCES

BUILDING FAÇADE
Smart Grid Connections

BUILDING LOBBY
Building Management System

DEPARTMENT/OFFICE
Utility Submetering

INDIVIDUAL
Plug Load Monitors
(Enmetric Systems
Power Port shown)
RESEARCH
A LIVING LABORATORY

Knowledge and products to pursue net zero energy, net zero water, and use local green materials
Welcome to the Seattle 2030 District, a ground-breaking, high-performance building district in downtown Seattle. By targeting a district-wide reduction in energy and water use in buildings and CO2 emissions from commute trips, we will work collaboratively to meet a 50% energy reduction by the year 2030. The progress below represents actual data tracking of these three metrics in the Seattle 2030 District member base:

- 23.6 million Square Feet of Building Space
- 73 Buildings - Office, City, County, Hotel, and Healthcare
OPTIMAL SCALES

Key Variables

- Resource Intensity
- Climate Intensity
- Resource Cost
- Mixed Use
- Space Availability

Energy

<table>
<thead>
<tr>
<th>Resource</th>
<th>Climate</th>
<th>Resource Cost</th>
<th>Mixed Use</th>
<th>Space Avail.</th>
<th>Optimal Technology</th>
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<td>1.0</td>
<td>1.0</td>
<td>Micro-Grid</td>
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</tbody>
</table>
**Key Variables**

- **Anaerobic Digestion**
  - Resource Intensity: 1.0
  - Climate Intensity: 1.0
  - Resource Cost: 1.0
  - Mixed Use: 1.0
  - Space Availability: 1.0

- **Autoclave/Gasification**
  - Resource Intensity: 1.0
  - Climate Intensity: 1.0
  - Resource Cost: 1.0
  - Mixed Use: 1.0
  - Space Availability: 1.0

- **Automated Waste Collection**
  - Resource Intensity: 1.0
  - Climate Intensity: 1.0
  - Resource Cost: 1.0
  - Mixed Use: 1.0
  - Space Availability: 1.0
OPTIMAL SCALES

![Diagram showing optimal scales for various district sizes](image-url)
PILOT ROADMAP

PoSI’s Toolkit
http://www.pdxinstitute.org/index.php/publications
Making EcoDistricts

Concepts and Methods for Advancing Sustainability in Neighborhoods
CONTRIBUTIONS

EcoDistricts Institute:  http://ecodistricts.org/

Arup:  http://www.arup.com/

Sherwood Design Engineers:  http://www.sherwoodengineers.com/

International Living Future Institute:  http://living-future.org/

Living Building Challenge:  http://tinyurl.com/Living-Building-Challenge

Living Building Challenge Financial Study:  http://living-future.org/node/265


AIA 2030 Challenge:  http://network.aia.org/2030Commitment/Home
THANK YOU!

Questions / More Information:

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