# The Changing Role of Architects in a Built Environment (trending) NZE

NBI Getting to Zero National Forum: A Presentation by Clark Brockman, SERA Architects

September 17, 2013

### **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

# **AIA 2030 COMMITMENT**









http://network.aia.org/2030Commitment/Home/

### **SERA** 2011 EUI REPORTING



### SHADES OF GREEN





### LIVING BUILDING CHALLENGE<sup>™</sup> 2.0

#### A VISIONARY PATH TO A RESTORATIVE FUTURE

http://living-future.org/



### **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.



PREDICTED vs. ACTUAL ENERGY USE OF LEED BUILDINGS

Source: New Buildings Institute: Energy Performance of LEED NC Buildings, 2008

### ENERGY USE REALITY

REMEMBER, BUILDINGS DON'T USE ENERGY, PEOPLE DO.

### **ENERGY USE** PREDICTED vs. ACTUAL



### STATE ENERGY CODES NEED MORE CONSISTENCY



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 NOTE: These maps reflect only mandatory statewide codes currently in effect.

### **REPORTING** ENERGY USE REPORTING LABELS



EU DISPLAY ENERGY CERTIFICATE

**ZEPI SCALE** 

#### USA ASHRAE BUILDING ENERGY QUOTIENT

### **REPORTING** REQUIRED ENERGY USE REPORTING



### **OUTCOME BASED CODES** FOCUSED ON ACTUAL PERFORMANCE



#### 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









# **PROJECT TEAM**



**Owner:** 

GSA



### A/E Team:

SERA Cutler Anderson Architects

**SERA ARCHITECTS** 

#### CUTLER ANDERSON ASSOCIATES

STANTEC

INTERFACE

PAE

**KPFF** 

ATELIER DREISEITL

#### **CMc Team:** HOWARD S WRIGHT



BENSON

McKINSTRY

DYNALECTRIC

OTIS

NUPRECON

EDITH GREEN-WENDELL WYATT

### **ARRA and EISA** MINIMUM PERFORMANCE CRITERIA

Energy Star Requirements	Water Conservation Requirements	Energy Conservation Requirements	LEED Requirements
Score goal: 97	<ul><li>20% Indoor potable water reduction</li><li>50% Outdoor potable water reduction</li></ul>	<ul> <li>55% Fossil fuel reduction</li> <li>30% Energy usage reduction</li> <li>30% Solar thermal</li> </ul>	Gold Required Platinum Goal
ENERGY STAR			





EDITH GI

### **ANALYSIS** BUIDLING ORIENTATION







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



### SHADING STUDY HELIOON TESTING







#### % annual shading, south facade

# **DAYLIGHT STUDY**







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



### **DATA DRIVEN DESIGN** FROM STUDY TO DESIGN TO CONSTRUCTION





### **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

Daylighting Light shelves bounce light 16ft. into interior Equinox morning sun (lower angle)



### **DESIGN/ANALYSIS** WEST ELEVATION SHADING STRATEGY



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



### **EGWW** NET ELECTRICITY

DAILY SOLAR HARVEST



### EGWW OPPORTUNITY LOST

More than 35% of possible production is lost

ANNUAL SOLAR HARVEST





### **NETWORKS** ARE EVERYWHERE

0



SIREC SKANSKA PAE

### AFTERCARE TUNING PERFORMANCE



### **POST OCC STUDIES** CBE, LBNL, M+V, MODELS and more...



### TENANT ORIENTATION TRAINING AND MILESTONES

#### **TENANT DESIGN PROCESS**



### **TENANT ORIENTATION** TRAINING SYMPOSIUM

#### 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



### **POST OCC EVALS** OCCUPANT SATISFACTION SURVEYS

#### 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 🕼 🚺 🖉 o noncol 🎲 Very Dissatisfied

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

#### Air Quality

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

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

Enhances 🕼 💿 င င င င င 🖸 🍢 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



a) Photo of pole

b) Temperature vs. height

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



### 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



# SITE PLAN













### **ENERGY CHALLENGE** FLOOR TO ROOF AREA



### ENERGY USE BEFORE TENANT ENGAGEMENT





### ENERGY DISTRIBUTION WITH TENANT ENGAGEMENT





### 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 LOBBY

**Smart Grid Connections** 

**BUILDING FAÇADE** 

Building Management System





DEPARTMENT/OFFICE

**Utility Submetering** 

INDIVIDUAL

Plug Load Monitors



### **RESEARCH** A LIVING LABORATORY

Knowledge and products to pursue net zero energy, net zero water, and use local green materials





#### building dashboard 7.

2030



Q -

FLOW

5

#### Seattle 2030 District MAP Unior Sm ۲ SEATTLE Square 5 Hubbell PI Inion 611 TRICT Bayman University SI 5 Seneca 99 51 CH2 ( Western Ave 1201 Third Avenue Seattle POWERED BY 1111 Third Google Park Central Library Avenue Map data @2012 Google, Sanborn - Terms of Usa

Homepage



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** ENERGY



# **OPTIMAL SCALES** WASTE



## **OPTIMAL SCALES** ALL



### **EcoDistricts** Institute





# PILOT ROADMAP







http://www.sera-architects.com/blog/wp-content/uploads/documents/Making\_EcoDistricts.pdf

# CONTRIBUTIONS

EcoDistricts Institute: <u>http://ecodsitricts.org/</u>

Arup: <u>http://www.arup.com/</u>

Sherwood Design Engineers: <a href="http://www.sherwoodengineers.com/">http://www.sherwoodengineers.com/</a> International Living Future Institute: <a href="http://living-future.org/">http://living-future.org/</a> Living Building Challenge: <a href="http://tinyurl.com/Living-Building-Challenge">http://tinyurl.com/Living-Building-Challenge</a> Living Building Challenge Financial Study: <a href="http://living-future.org/node/265">http://living-future.org/node/265</a> Achieving Water Independence in Buildings: <a href="http://living-future.org/node/275">http://living-future.org/node/275</a>

Code and Regulatory Barriers to the Living Building Challenge for Sustainable, Affordable, Residential Development (SARD): <u>http://tinyurl.com/Code-and-Regulatory-Barriers</u>

Making EcoDistricts - Civic Ecology: <u>http://www.sera-architects.com/blog/wp-</u> content/uploads/documents/Making\_EcoDistricts.pdf

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

# **THANK YOU!**

**Questions / More Information:** 



**Clark Brockman** 

<u>clarkb@serapdx.com</u>

**Principal, Sustainability** 

SERA www.serapdx.com

Clark Brockman: http://serapdx.com/people/clark-brockman/

Sustainability Resources Group: http://serapdx.com/services/sustainability-resources/

LinkedIn: Clark Brockman Twitter: @clarkbrockman