Learning Objectives

At the end of this program, participants will be able to:

Learning Objective 1: Understand what the 7 petals and 20 imperatives of the Living Building Challenge (LBC) are.

Learning Objective 2: Understand the challenges of Type-4 Heavy Timber construction type and the benefits it offers in a low-carbon, high performance building.

Learning Objective 3: Understand the strategies employed by the design team to achieve a net-zero energy, water and waste.

Learning Objective 4: Understand the complexities inherent in meeting the materials red list and radius requirements of the LBC.
U.S. Energy Consumption by Sector

Source: ©2010 2030 Inc. / Architecture 2030. All Rights Reserved.
Data Source: U.S. Energy Information Administration (2009)

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U.S. Electricity Consumption by Sector

Source: ©2010 2030 Inc. / Architecture 2030. All Rights Reserved.
Data Source: U.S. Energy Information Administration (2009)

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U.S. CO₂ Emissions by Sector

Source: ©2010 2030 Inc. / Architecture 2030. All Rights Reserved.
Data Source: U.S. Energy Information Administration (2009)

Architecture2030.org

"Our desire is to open a wedge into the future so that we, and others can see what is possible in a contemporary office building."

Denise Hayes
Bullitt Foundation, President

Architecture2030.org
The Living Building Challenge™ 2.0

1. **SITE**
   - Limits to Growth, Urban Agriculture, Habitat Exchange, Car Free Living

2. **WATER**
   - Net Zero Water, Ecological Water Flow

3. **ENERGY**
   - Net Zero Energy

4. **HEALTH**
   - Civilized Environment, Healthy Air, Biophilia

5. **MATERIALS**
   - Redlist, Embodied Carbon Footprint, Responsible Industry, Materials Radius, Conservation & Reuse

6. **EQUITY**
   - Human Scale + Human spaces, Democracy + Social Justice, Rights to Nature

7. **BEAUTY**
   - Beauty and Spirit, Inspiration and Education
determining the CARRYING CAPACITY of the site:

solar harvest
230,000 kWh/year
÷
gross building area
52,000 gsf
=
Energy Use Index (EUI)

EUI – Energy Use Index

Energy Efficiency Measures
Energy Consumption

Typical Building

Energy Consumption

Proposed Building

Proposed Building Energy Use
No “Height Departure”
11'-6" floor to floor
77% of the floor area has daylight levels below 2%.

Proposed Plan with “Height Departure”
14'-2" floor to floor
38% of the floor area has daylight levels below 2%.
Meeting room

- No skylight
- 50% skylight
- Skylight

Analysis Grid
- Light distribution
- Color-coded intensity

Architectural plans
- Structural and layout details
- Interior design elements
Energy Use | Solar Budget

Scheme 2 - FLAT ROOF ARRAY (15 deg tilt @ Back):
- ROOF (5 deg West) = 11,573sf = 187,000 kWh/yr
- SOUTHEAST WALL = 750sf = 9,000 kWh/yr
- SOUTH WALL = 4,015sf = 50,000 kWh/yr (3,500kWh/yr/row)

246,000 kWh/yr (BASE)

Scheme 2 - TILTED ROOF ARRAY (15 deg tilt @ Back):
- ROOF (5 deg West) = 7,258sf = 123,000 kWh/yr
- ROOF (15 deg Southeast) = 4,240sf = 73,000 kWh/yr
- SOUTHEAST WALL = 750sf = 9,000 kWh/yr
- SOUTH WALL = 4,015sf = 50,000 kWh/yr (3,500kWh/yr/row)

255,000 kWh/yr (+9K v. BASE)

July 28, 2009
Scheme 4B – DOUBLE TILTED ROOF ARRAY (10 & 25 deg tilt):
ROOF (10 deg Southeast) = 4,115sf = 73,000 kWh/yr
WEST WALL = 1,384sf = 14,000 kWh/yr
SOUTH WALL = 3,455sf = 49,500 kWh/yr
250,000 kWh/yr (+ 5K v. BASE)
Solar Equipment:

A typical building of this size has an Energy Use Intensity of 72 kBtu/ft²/year. A PV array with an area of 64,348 ft² is required to meet its energy needs.

A building of this size meeting Seattle Energy Code has an EUI of 51 kBtu/ft²/year, requiring a PV array with an area of 44,752 ft² to meet its energy needs.

A LEED Platinum certified building of this size has an EUI of 52 kBtu/ft²/year, requiring a PV array with an area of 28,599 ft² to meet its energy needs.
The proposed building, meeting the Living Building Challenge, has an EUI of 157 ft²/ft²/year and needs only 14,303 ft² of PV to meet its net-zero energy goal.
Energy Conservation: Tenant

20" CFL-LCD 20" CFL-LCD
75 watts 75 watts
100 watts

250 watts

Plug Loads | 2009

22" CFL-LCD 22" CFL-LCD
40 watts 40 watts
80 watts

160 watts

Plug Loads | 2010

22" LED-LCD 22" LED-LCD
14 watts 14 watts
62 watts

90 watts

Plug Loads | 2010

22" LED-LCD 22" LED-LCD
14 watts 14 watts
14 watts

42 watts
MATERIALS

Endorsing products and processes that are safe for all species through time.

Asbestos
Cadmium
Chlorinated Polyethylene and Chlorosulfonated Polyethylene
Chlorofluorocarbons (CFCs)
Chloroprene (Neoprene)
Formaldehyde (added)
Halogenated Flame Retardants
Hydrochlorofluorocarbons (HCFCs)
Lead (added)
Mercury
Petroleum Fertilizers and Pesticides
Phthalates
Polyvinyl Chloride (PVC)
Wood treatments containing Creosote, Arsenic or Pentachlorophenol

RED LIST

The project cannot contain worst-in-class materials or chemicals, such as carcinogens, persistent organic pollutants, bioaccumulative toxins, and endocrine disruptors.

362 CHEMICALS
Material Safety Data Sheet

LBC Red List Toxins:
- Asbestos
- Cadmium
- Chlorinated Polyethylene
- Chlorosulfonated Polyethylene
- Chlorofluorocarbons (CFC)
- Chloroprene (neoprene)
- Formaldehyde
- Halogenated Flame Retardants
- Hydrochlorofluorocarbons (HCFC)
- Lead
- Mercury
- Petrochemical Fertilizers and Pesticides
- Phthalates
- Polyvinyl Chloride (PVC)
- Creosote, Arsenic Wood treatment

Formaldehyde
14 APPROPRIATE SOURCING

The project must incorporate place-based solutions and contribute to the expansion of a regional economy rooted in sustainable practices, products and services.

14 APPROPRIATE SOURCING

Source locations for materials and services must adhere to the following restrictions:

<table>
<thead>
<tr>
<th>ZONE</th>
<th>MAX DISTANCE</th>
<th>MATERIALS/SERVICES</th>
<th>MASTERFORMAT 2004 CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>20,004 km</td>
<td>Ideas</td>
<td>Divisions: 42, 48</td>
</tr>
<tr>
<td>6</td>
<td>15,000 km</td>
<td>Renewable Technologies</td>
<td>Divisions: 08 (exterior), 11, 14, 22, 23, 26, 33, 44</td>
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<td>5</td>
<td>5,000 km</td>
<td>Assemblies that actively contribute to building performance + adaptable reuse once installed</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2,500 km</td>
<td>Consultant Travel</td>
<td>Sections: 07 50 00, 10 21 23, 10 22 00, 10 70 00, 44 40 00</td>
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<tr>
<td>3</td>
<td>2,000 km</td>
<td>Light or low-density materials</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1,000 km</td>
<td>Medium weight or density materials</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>500 km</td>
<td>Heavy or high-density materials</td>
<td></td>
</tr>
</tbody>
</table>

15 CONSERVATION + REUSE

All projects teams must strive to reduce or eliminate the production of waste during design, construction, operation, and end of life in order to conserve natural resources.
Building at 15th & Madison before deconstruction  

2010-11.30_0021+26  
photo: John Stamets

Boards are removed one at a time so they can be used again  

2010-12.22_0489+91  
photo: John Stamets

RECYCLED MATERIALS

photo: John Stamets
Questions?

This concludes The American Institute of Architects Continuing Education Systems Course

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