Cascadia Center for Sustainable Design and Construction
Energy Performance

*By: Denis Hayes with Brian Court, Jim Hanford and Paul Schwer**

In 2007 Congress created a Zero Net Energy Commercial Buildings Initiative, with a goal of achieving a market transition to Zero Net Energy for new commercial buildings by 2030. The Cascadia Center will meet that goal in 2012.

The Cascadia Center will achieve extraordinary levels of energy efficiency through integrated architectural and engineering design, cutting-edge technology and components, carefully selected building materials, and conscious choices by tenants who care about their environmental footprints. These elements will reduce the six-story building's annual energy requirement to the point where it can be provided by a solar array on the building's roof.

High performance envelope

The building envelope greatly exceeds the Seattle Building Code requirements, using a triple-glazed curtain wall system that was engineered in Germany and is produced locally. The well-insulated walls have been designed to eliminate thermal bridging and dramatically reduce air infiltration.

Building mass and orientation, as well as glazing selection, are considerations to control heat gain. To the extent possible on a compact, 5-sided urban site, major glazing areas face south and north to improve daylighting and solar control. The building's windows (which open and close automatically in response to conditions outside) were selected for optimal control of heat loss and solar gain while maintaining superb visibility for daylighting.

Analysis shows that increasing the thermal performance of the envelope beyond current levels would have little overall impact on energy use in the proposed building.

Closed-loop geothermal system and Ventilation

The Center's very modest heating and cooling loads are met by ground source heat pumps and on-site geothermal wells. Water loops provide comfortable radiant heating and cooling to the office spaces. Ventilation is provided through a dedicated 100% outside air unit with an air-to-air heat exchanger, so that incoming fresh air is pre-conditioned by outgoing air.

Radiant floor heating and cooling with passive cooling and natural ventilation

Operable shading systems are designed for glare control to further mitigate solar heat gain. Operable windows provide free cooling and ventilation in response to ambient conditions.

Daylight dimming and efficient lighting design

Lighting loads in office spaces have been limited to 0.4 Watts per square foot, less than half the 0.9 W/ ft^2 currently allowed under the Seattle code. Automatic controls will dim or turn off the LED lights when daylight provides adequate illumination.

Aggressive reduction of plug loads
Plug loads for office equipment, such as computers, monitors, servers, printers, and copiers, will be limited to a maximum of 0.8W/ft^2 (and this will be significantly reduced by plug load occupancy sensors). This is approximately half the 1.5W/ ft^2 typical for new office buildings, while still allowing for a computer-intensive environment. Tenants will employ the most efficient state-of-the-art equipment that meets their professional needs.

Energy Performance
Based on the efforts above, we estimate the following performance data for the building.

Building floor areas:

- Gross Floor Area in square feet (G ft^2): 52,000
- Treated Floor Area in square feet (TFA, common in Europe): 39,000

The building heating, cooling, ventilating and pumping energy combined are only 3.96 kbtu/sf/yr.

Annual End Use Energy Breakdown (in KWH, multiply by 3.412 to convert to kBtu)

Lights	53,000 KWH
IT Server	20,000 KWH
Computers, Monitors, Printers, Copiers and other misc equipment	104,000 KWH
Space Heating	6,000 KWH
Space Cooling	5,600 KWH
Pumps (includes pumps to run water treatment system at about 5000 KWH/yr):	21,000 KWH
Ventilation fans	12,000 KWH
Elevator	7,000 KWH
Domestic HW	7,800 KWH
Total	236,400 KWH

The resulting EUI (Energy Use Intensity) for the project is as follows:

- 16 kBtu/ ft^2 based on G ft^2
- 21 kBtu/ ft^2 based on TFA

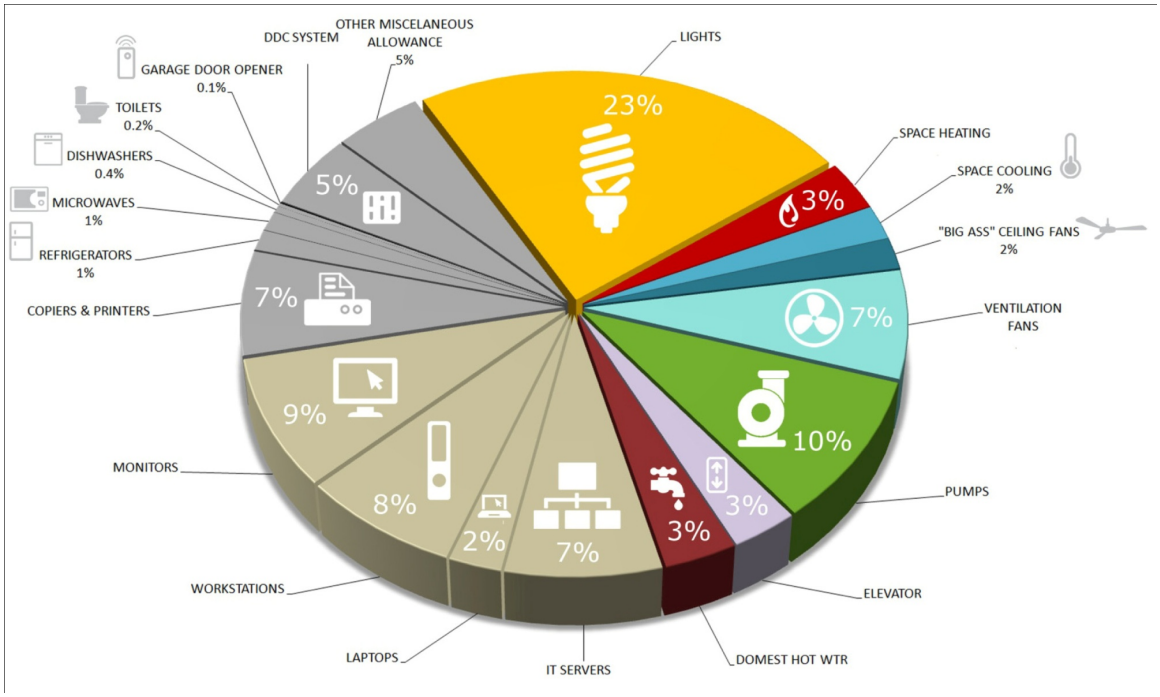

Figure 1: Cascadia Center for Sustainable Design and Construction - Energy Use

Comparisons with other high-performing buildings

There is a lack of good data on high-performing buildings in North America, but from the data that is available it appears the Cascadia Center will perform at the forefront of energy efficiency.

The U.S. Department of Energy (DOE) “Zero Energy Building” database currently contains no comparable buildings. The only urban commercial building is a tiny, 6,500 square foot lighting consultancy on the outskirts of San Jose, CA. The other net zero buildings are nature centers, recreation centers, and classroom buildings, all but two of which (a 3,500 square foot tennis club and a 2,200 square foot instructional facility) have higher EUIs than the Cascadia Center. (http://zeb.buildinggreen.com/)

In the DOE “High Performance Building” database, the Cascadia Center is significantly more efficient than any comparably sized urban commercial building currently listed. (http://eere.buildinggreen.com/mtxview.cfm?CFID=104739059&CFTOKEN=76487704)

While we are confident we have taken many steps to push the limits of building performance, this is not a competition with winners and losers. All the buildings in these databases have taken important strides in the right direction, and while the Cascadia Center plans to take yet another step forward, we too expect to be surpassed soon in this vibrant, creative field.

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