BILL & MELINDA GATES FOUNDATION CAMPUS

Grande conférence du design | Section du Quebec | CaGBC

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The Gates Foundation

BACKGROUND INFORMATION
“We’re trying to change the world. Let’s be clear here.”

MELINDA GATES | CO-CHAIR
Oprah Winfrey Show 2006

http://www.gatesfoundation.org/
Place and History
Seattle Center 5th Avenue N Garage
A symbol of the civic presence and exuberance of Seattle Center
DAYLIT GARAGE
LIVING ROOF

1.5 Acres

Slows and reduces stormwater runoff

Cools, filters pollutants and adds oxygen

Hardy sedum and allium bulbs
A Place to Solve Global Problems
<table>
<thead>
<tr>
<th>Human Environment</th>
<th>Ecosystem</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Comfort</td>
<td>Site Ecosystem</td>
<td>Climate Neutrality</td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Materials Conservation</td>
<td>Energy Resource Conservation</td>
</tr>
<tr>
<td>Personal Control</td>
<td>Watershed Protection</td>
<td></td>
</tr>
<tr>
<td>Delight</td>
<td>Water Conservation</td>
<td>LEED Silver rating</td>
</tr>
</tbody>
</table>

**Sustainability Goals**

- LEED Silver rating
# Design precepts

<table>
<thead>
<tr>
<th>Workplace</th>
<th>Expression</th>
<th>Campus/Landscape Design</th>
<th>Sustainability</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working, Learning, Collaborating</td>
<td>Serene/Thoughtful, Reflective and quietly inspiring</td>
<td>Green Space, limiting outdoor spaces emphasizing plants and greenery, designed to be used more than just viewed</td>
<td>Health and comfort. Design for fresh air, heating and cooling with non-toxic materials</td>
<td>Updatable Infrastructure. Allow for upgrades in energy, and communications systems</td>
</tr>
<tr>
<td>Expression</td>
<td>Visually Appealing. Clean lines and simple forms with inflection</td>
<td>Consistency. Cohesive, distinctive form and style throughout the site of buildings, unified but not repetitive</td>
<td>Well-Being. Design for nature, views, aquatic access, and daylight for all employees</td>
<td>Reliable Systems. Use building systems that work together with other systems and are proven reliable</td>
</tr>
<tr>
<td>Campus/Landscape Design</td>
<td>Timeless. Uniquing qualities and excellent proportions, not faddish or dated</td>
<td>Internal Orientation. Campus design supports tranquility, repose, and social dimension of foundation</td>
<td>Personal Control. Provide opportunities for personal choice and control</td>
<td>Accessible infrastructure. Make infrastructure systems easy to use yet secure</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Humble/Wholesome. World-class design: realistic and respectful</td>
<td>Adaptability. Allow for design flexibility of future campus phases while retaining essential qualities that define the campus</td>
<td>Delight. Design to delight the senses and inspire creativity</td>
<td>Information Technology. Incorporate progressive yet tested technology while retaining ability to make future changes</td>
</tr>
<tr>
<td>Technology</td>
<td>Inspiring. Foundation global mission, expressed externally and internally</td>
<td>Legitimacy. Design well-defined campus ENTRY, create easy-to-navigate pathways throughout campus</td>
<td>Site Ecosystems. Develop site to enhance local ecosystems reduce load, improve air quality, enhance biodiversity</td>
<td>Event servicing. Design to accommodate events without compromising functional, transport quality, transparency to users/audiences</td>
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<td>Optimistic. Hopeful, ambitious, innovative yet practical, expressed externally and internally</td>
<td>Water. Incorporate water where appropriate to convey calm and create pleasant sound</td>
<td>Materials Conservation. Use earth friendly materials to minimize negative lifecycle impacts, encourage use of local/cyclical materials</td>
<td>Purposeful Technology. Tailor technology to the venue</td>
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<td></td>
<td>Detailed. Finely detailed, neither extraneous nor sparse, not deciated</td>
<td>Phasing. Allow for phasing of campus completion while creating interim “completenesses”</td>
<td>Watershed Protection. Accommodate natural water cycle (rain, evaporation, soil &amp; rock infiltration)</td>
<td>To be developed further, as Program determinations are made</td>
</tr>
<tr>
<td></td>
<td>Externally Focused. Emphasis on the greater and the foundation’s mission and presence in the world</td>
<td>Servicing. Provide efficient and functional yet discreet service access and facilities</td>
<td>Water Conservation. Minimize consumption and water reuse on site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dynamic. Sense of energy and urgency, not placed</td>
<td>Vehicular Circulation. Provide easy access to buildings and parking in support of each phase of completion</td>
<td>Climate Neutrality. Minimize greenhouse gas emissions and ozone depletion</td>
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<td></td>
<td>Continuity. Create connections between work areas to enhance flexibility and minimize isolation</td>
<td>Night Experience. Design for outdoor night use, considering outdoor lighting lighting from within, effect of skyfire</td>
<td>Energy Resources Conservation. Conserve energy and maximize renewable energy options</td>
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<tr>
<td></td>
<td>Productivity. Create a workplace that inspires productivity and success</td>
<td>Context Response. Allow for increased connection to changing community in future while meeting security requirements</td>
<td></td>
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</tr>
</tbody>
</table>
Campus Design: Local Roots / Global Mission
A Place to Do Their Best Work … Inside
... and Out

The atrium, with espresso bar and café tables, is a place for focused tasks away from the individual work spaces. It serves as a central gathering space and supports informal meetings.

The heart of the outdoor campus offers more options for larger team gatherings or foundation events, weather permitting.

Boardwalks and bridges criss-cross the campus, which allows more opportunities for chance encounters.

Larger meeting rooms in Building B are available to the entire campus, which provides more opportunities for employees to move about the campus.
ATRIUM
The central gathering place for staff, this airy space uses radiant heat and passive ventilation to conserve energy.

RAINWATER STORAGE
A one-million gallon underground tank stores rainwater for use in reflecting pools, irrigation and toilets.

LIVING ROOFS
Living roofs – 1.4 acres on the garage and more than half an acre on campus buildings – insulate, reduce heat-island effect, limit rainwater runoff, and add a bird friendly habitat.

LANDSCAPE
Plantings feature native and non-invasive drought-tolerant plants and trees.

THERMAL ENERGY STORAGE
A 750,000-gallon underground tank minimizes energy used to cool buildings. It stores water chilled at night for recirculating during the day.
Human Environment

Health and Comfort
Wellbeing
Personal Control
Delight
Daylight
COMFORT

- air temperature
- clothing
- metabolic rate
- activity level
- relative humidity
- air speed
- radiant temperature
COMFORT – OFFICES

Design

Operation

20 °C

21 – 24 °C

22 – 25.6 °C

25.6 °C
CBE Thermal Comfort Tool

Select method: PMV method

Air temperature
21 °C

Mean radiant temperature
21 °C

Air speed
0.1 m/s

Humidity
30 %

Metabolic rate
1.2 met

Clothing level
1 clo

Complies with ASHRAE Standard 55-2013
PMV
-0.23
PPD
6%
Sensation
Neutral
SET
24.8°C

Temperature - Relative Humidity chart

Dry-bulb Temperature [°C]

Relative Humidity [%]
CBE Thermal Comfort Tool

Select method: PMV method

Air temperature: 21 °C
Mean radiant temperature: 21 °C
Air speed: 0.1 m/s
Humidity: 30%
Metabolic rate: 1.2 met
Clothing level: 0.67 clo

PMV: -0.80
PPD: 18%
Sensation: Slightly Cool
SET: 22.4 °C

 Wonderland Systems

Create custom ensemble
Dynamic predictive clothing
LEED documentation
Globe temp SolarCal Specify pressure SI IP Local discomfort Help

Does not comply with ASHRAE Standard 55-2013

Temperature - Relative Humidity chart

Dry-bulb Temperature [°C]

Relative Humidity [%]
operable windows

trickle vents

trench heater

solar and blackout blinds
ATRIUM PREDICTED INTERNAL COMFORT CONDITIONS:
WORST CASE OCCUPANCY LEVEL (Occupied Zone)
(LOW IN WINTER, HIGH IN SUMMER,
TESTED OCCUPANCY LEVELS RANGE FROM 100 TO 1000 PEOPLE)

Typical office temp. range

ATRIUM THERMAL RANGE

Temp. limit based on high occupancy

Temp limit based on low occupancy

OUTSIDE CONDITIONS COLDER THAN 24 F HAVE NOT BEEN ANALYZED TO DATE

TESTED/MODELED CONDITIONS

OUTSIDE CONDITIONS WARMER THAN 82 F ARE ESTIMATED AND HAVE NOT BEEN ANALYZED TO DATE
Atrium Indoor vs. Outdoor Temperature, August through October
Biophilia
Arts and equity
Ecosystem

Site Ecosystem
Materials Conservation
Watershed Protection
Water Conservation
System Arrangement

1,000,000 gallon storage tank

Rainwater harvesting system:
- Rainwater from downsputs
- Sediment tank
- Overflow to sewer
- Water feature (used for backwash purposes)
- Water feature top up
- UV treatment
- Fine mesh filter
- Pump (100 gpm, 150 ft head)
- Irrigation
- Top up WC flushing

Rainwater recycling scheme

ARUP
WATERSHED IMPACT

57% Less Runoff
49% Less Total Water
79% Less Potable Water

Landscape: 100% Rainwater
Toilets Flushed: 100% Rainwater

TOTAL WATER USE: 4.53 GAL/SF/YEAR BASELINE
2.32 GAL/SF/YEAR DESIGN
POTABLE WATER USE: 3.76 GAL/SF/YR BASELINE
.78 GAL/SF/YR DESIGN
WC & Water Features: 18% higher than predicted

Irrigation: Off the chart!
“RIPPLE” EFFECT OF WATER COLLECTION

Rainwater Collection in Washington State
Researchers from the Fundacion In Terris in Ecuador assemble a prototype for the Reinvent the Toilet Fair.

Photo: http://www.fastcoexist.com/
MATERIALS SOURCING and USE

VOC compliant
21% recycled and/or local materials
96% construction waste diversion (15,987 tons)
Jobsite composting of food waste
74% of all wood is FSC certified
End grain alder flooring is regionally sourced from reclaimed lumber
LOCALLY SOURCED

Seattle-area urban treefall becomes conference tables
Climate

Climate Neutrality
Energy Resource Conservation
Energy Systems
Drivers: Energy, carbon, water
Thermal energy storage

2.5 million gallons of water saved/year
<table>
<thead>
<tr>
<th>Importance Factor</th>
<th>Resultant Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air-cooled chiller, TES, Boilers</td>
</tr>
<tr>
<td>Workplace</td>
<td></td>
</tr>
<tr>
<td>Acoustics</td>
<td>4</td>
</tr>
<tr>
<td>Spot cooling adaptability</td>
<td>3</td>
</tr>
<tr>
<td>Expression</td>
<td></td>
</tr>
<tr>
<td>Architectural Impact</td>
<td>5</td>
</tr>
<tr>
<td>Operational visual Impact</td>
<td>4</td>
</tr>
<tr>
<td>Humble/mindful - prudent LCCA</td>
<td>5</td>
</tr>
<tr>
<td>Campus/Landscape Design</td>
<td></td>
</tr>
<tr>
<td>Building C/Phasing Adaptability</td>
<td>3</td>
</tr>
<tr>
<td>Long term load adaptability</td>
<td>5</td>
</tr>
<tr>
<td>Night Impact</td>
<td>4</td>
</tr>
<tr>
<td>Sustainability</td>
<td></td>
</tr>
<tr>
<td>Site emissions/air quality</td>
<td>3</td>
</tr>
<tr>
<td>Water consumption</td>
<td>4</td>
</tr>
<tr>
<td>Carbon emissions</td>
<td>4</td>
</tr>
<tr>
<td>Future sustainable flexibility/opportunity</td>
<td>4</td>
</tr>
<tr>
<td>Technology</td>
<td></td>
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<tr>
<td>Reliability &amp; redundancy</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Schedule risk</td>
<td>4</td>
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<tr>
<td>Operational risk</td>
<td>4</td>
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<tr>
<td>Total Score</td>
<td>147</td>
</tr>
<tr>
<td>Operating Cost Category</td>
<td>Option 1</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Water Cooled TES</td>
<td>-100%</td>
</tr>
<tr>
<td>Water Cooled Ice Storage</td>
<td></td>
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<tr>
<td>Air Cooled TES</td>
<td></td>
</tr>
<tr>
<td>Water Cooled No TES</td>
<td></td>
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<tr>
<td>GSHP Central</td>
<td></td>
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<tr>
<td>GSHP Distributed</td>
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</tbody>
</table>

| Total Operating Costs NPV | -100% | 68% | -185% | 0% | -224% | -168% |

<table>
<thead>
<tr>
<th>Cap Ex. Cost Data</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
<th>Option 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Cooled TES</td>
<td>-100%</td>
<td>-1%</td>
<td>-102%</td>
<td>0%</td>
<td>-125%</td>
<td>-134%</td>
</tr>
<tr>
<td>Water Cooled Ice Storage</td>
<td></td>
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<thead>
<tr>
<th>Total Life Cycle Delta</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
<th>Option 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Cooled TES</td>
<td>100%</td>
<td>-386%</td>
<td>-789%</td>
<td>0%</td>
<td>682%</td>
<td>768%</td>
</tr>
<tr>
<td>Water Cooled Ice Storage</td>
<td></td>
<td></td>
<td></td>
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<thead>
<tr>
<th>Relative 30 Year Costs</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
<th>Option 6</th>
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<td>682%</td>
<td>768%</td>
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</table>
Modeled & Measured (June 2011) CHW Load vs. Outside Air Temperature

- Modeled CHW Load
- Actual CHW Load

Chiller Load (tons) vs. Outside Air Temperature (deg F)

Graph showing a scatter plot with data points indicating a relationship between chiller load and outside air temperature.
Office loads: design vs reality
Iris Small Power Loads - Further Study

Diversity and equipment information based on detailed workplace study, July 6, 2007

- New Iris Estimates: calculations based on workplace study
- Curve fit for Arup UK measured studies
- Revised design criteria
- SD Basis of Design
- Arup UK measured studies, typ.
- High estimate, no diversity
- High estimate, with diversity
- Low estimate, no diversity
- Low estimate, with diversity
- Measured in operation

- High estimates: include both desktop and laptop computer allowances
- Low estimates: reduce load to laptop with docking station and LCD monitor
- Load diversity of 70% for offices and 50% for conf. rooms based on occupancy studies
- Current TI plan average density of 163 SF/person

Occupant Density: SF/Person

Small Power Load: W/SF
Occupancy Schedules

<table>
<thead>
<tr>
<th>Occupant density</th>
<th>m²/p</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC design</td>
<td>14</td>
</tr>
<tr>
<td>Actual seat count</td>
<td>16</td>
</tr>
<tr>
<td>Actual occupancy (diversified)</td>
<td>46</td>
</tr>
</tbody>
</table>

The graph shows the occupancy schedules with two lines:
- Blue line: Office Occ WD
- Orange line: Code Occupancy

The table indicates the design and actual occupancy details.
### Performance

<table>
<thead>
<tr>
<th></th>
<th>Electric Use (kWh/yr)</th>
<th>Gas Use (Therms/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Usage (Billing Data)</strong></td>
<td>8,556,300</td>
<td>133,104</td>
</tr>
<tr>
<td><strong>LEED Model</strong></td>
<td>9,358,090</td>
<td>151,457</td>
</tr>
</tbody>
</table>

- **22% Calibrated Energy Savings**
- **Plug loads**
- **Occupancy**
- **Lighting**
- **IT Loads**
- **Solar thermal**
How is it doing now?

It’s been one year since the move in...

What in the campus inspires you towards collaboration?

If I sit in the atrium long enough, everyone I need to see eventually shows up.
“We have big goals: eradicating polio, cutting in half childhood deaths and the number of hungry people in Africa and overhauling the U.S. education system. Now we have a location that will help us reach those goals with our partners, while keeping us connected to this region that is the source of our values.”

MARTHA CHOE | CHIEF ADMINISTRATIVE OFFICER
“Our open work spaces have freed us to be more connected and flexible to move around the campus and interact with colleagues. I feel part of something that is really special again, like I did when we moved into our first office.” –JENNIFER HANSEN, INFORMATION SERVICES
Post-occupancy workplace feedback
Survey results

90% Post-occupancy research findings show a 90% staff satisfaction rating for the new workplace and higher degrees of cross-team collaboration.

90% of survey respondents rate campus as “Excellent/Good.”

<table>
<thead>
<tr>
<th>Workplace Goals</th>
<th>Survey Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure access to daylight and nature for everyone.</td>
<td></td>
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<tr>
<td>Establish a hub of creativity and innovation while enabling collaborative work processes.</td>
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</tr>
<tr>
<td>Inspire engagement in the foundation’s global mission.</td>
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</tr>
<tr>
<td>Provide support for both focused work and collaboration.</td>
<td></td>
</tr>
<tr>
<td>Create opportunities for interconnection and visibility.</td>
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</tr>
<tr>
<td>Provide an environment that can change and flex as the foundation grows and evolves.</td>
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</tr>
</tbody>
</table>
The ducks are back
Janet Echelman
“Impatient Optimist”
Looking forward – what would be different now?
Sustainability goals
The Living Building Challenge publishes a “Red List” of materials to be avoided in buildings seeking certification under the Living Building Challenge. What’s on it?

- Asbestos
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethylene
- Chlorofluorocarbons (CFCs)
- Chloroprene (Neoprene)
- Formaldehyde
- Halogenated Flame Retardants
- Hydrochlorofluorocarbons (HCFCs)
- Lead
- Mercury
- Petrochemical Fertilizers and Pesticides
- Phthalates
- Polyvinyl Chloride (PVC)
- Wood treatments containing creosote, arsenic or pentachlorophenol
Renewable energy
Questions?

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