Centre for Interactive Research on Sustainability, Vancouver, British Columbia

Synopsis

Intended to be the most sustainable building in North America, the Centre of Interactive Research on Sustainability (CIRS) strived to achieve regenerativity at all levels ranging from energy and water use to inhabitant comfort, and social sustainability. It also serves as a "living lab" wherein human behaviour, landscape planning, building science, and other key facets of sustainability are researched and tested within the context of the building.

Building Data

Building Type
New construction

Climate
Moderate oceanic with dry summer months and rainy, humid, and cool winters (2817 HDD, 56 CDD)

Age
Constructed in 2009
Construction period: 2008-2011

Construction Cost
$36,883,000 ($6,706/m²)

Net Conditioned Area
5,500 m²

Energy Model
eQUEST v3.61

Green Rating
LEED NC v2 Platinum

Owner
University of British Columbia

Architect
Busby Perkins + Will

Structural Engineer
Fast + Epp

Mech/Elec Engineer
Stantec

Design Features & Systems

A heat recovery system connects CIRS to the lab heat exhaust of an adjacent building. The system serves as the primary heat source of CIRS and allows excess heat to return to the adjacent building to reduce the energy footprint of both buildings. Heat recovery coils and a ground source geo-exchange field supplement the heat transfer system.

The building was designed with an on-site rainwater treatment system and a wastewater treatment system to be entirely water self-sufficient. A green roof and landscape areas are part of the stormwater management system that is connected to the local aquifer.

The main structural material is wood that is either certified or harvested from local forests infested by the mountain pine beetle.
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Summary of Results

This Building Performance Evaluation (BPE) began in May 2014 by interviewing two of the building’s designers. This was followed by spot measurements of indoor environmental quality along with the administration of the occupant survey.

Relevant documents were then obtained to analyze the performance of water and energy use, cost, occupancy, site, and materials, and these actual values were evaluated in comparison to design predictions. Fitting and these actual values were evaluated in

The actual water use of 6.12 m³/occupant/year was above the predicted 4.43 m³/occupant/year since the building was not entirely occupied.

The building consumes only 142 kWh/m²/year which is 29% above the predicted value, but still far below the consumption of a typical office building.

CIRS was originally designed to use a waste-heat transfer system with a neighbouring building that would reduce or eliminate its own thermal heat requirements as well as the natural gas consumption of the adjacent building. However, CIRS uses 29% more energy than predicted, mainly because it consumed far more electricity for lighting (61%) and plug-loads (85%).

The actual heat that was harvested and sent to the adjacent building was far below the predicted values (-70% or -86%). Nevertheless, the building performs 50% better than a typical academic building.

Water

KEY LESSONS:
Ensure that operators are trained and qualified to operate and maintain alternative water systems. Communication amongst the technology provider and the mechanical engineers is also important.

Energy & Emissions

KEY LESSONS: Integrate innovative design features and their energy consumption into energy models in order to make energy predictions for the total energy use intensity of the building.

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Energy predictions for the total energy use intensity for all operating end uses

KEY LESSONS:
Life-cycle costs for building systems related to energy and water should be included in cost calculations in order to provide the most realistic view for cost per kWh or per m³ of water.

The construction costs for this project were $6,706/m² while a reference green building LEED equivalent of the same would be $3,390/m².

Overall, the construction costs were more than would be estimated for a building of this size, and the water and energy costs are much more than predicted. The construction cost is higher than an average LEED equivalent building due to the number of sustainability features and their complexity. The energy and water costs are higher than anticipated due to increased demand and that the systems implemented to reduce variable costs and variable demand were not operating anywhere near anticipated capacity.

For more information see iisbecanada.ca/sb-14

Economic Factors

The construction and maintenance of the vegetated wall requires special equipment and cranes. Photo credit: Michael Robinson
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Summary of Results

Site & Materials
The building used a large quantity of recycled (21% by cost) and locally extracted (34% by cost) materials. The building was able to divert 69% of the construction waste from the landfill. This value is slightly higher than the average percentage of all Canadian LEED projects.

In terms of the site, 27% was restored to natural and adaptive vegetation through the green roof and vegetated ground areas, which contribute to the building’s stormwater management system as well as the reduction of the heat island effect. However, because the building did not use rainwater as planned, 792 m³ per year more stormwater is sent off site than predicted in the design.

Occancy Factors
In multi-use buildings, actual student and visitor occupancies are difficult to accurately assess, and change considerably throughout the calendar year.

CIRS was predicted to house 585 occupants on average per day; however, our calculations estimate the actual occupancy at approximately 250 staff and students per day, based on class schedules and administrative records of full time employees.

Importantly, occupancy in this building varies considerably throughout the year, in part from fewer classes in the auditorium in the summer months. CIRS is typically occupied from 8:00 AM to 7:30 PM on weekdays during the school year, which is somewhat higher than predicted.

Indoor Environmental Quality (IEQ)

Acoustics were problematic, despite some efforts to install acoustic design features such as acoustic tile and fabric partitions in open-plan office spaces.

Levels of CO₂ and indoor particulates were below reference standards, and indicate excellent air quality in the building.

The emphasis on natural lighting in this building contributed to lighting levels that exceeded traditional standards, but were well-received by occupants. Mechanical blinds may be preferable to translucent shades, which can create some glare. Although private offices are typically preferred by occupants, they limit the extent of natural light penetration. Textured glass in some areas is important to support occupants’ sense of visual privacy.

The psychrometric chart suggests morning temperature measurements were cooler, but not beyond that which could be addressed by clothing adjustments. However, the surveys and interviews with building designers suggest that thermal conditions were generally adequate, with the exception of some spaces that were reported by occupants as too warm on sunny days.

Acoustics were the most commonly-mentioned negative IEQ feature. Specifically, speech noise and a lack of speech privacy were the most problematic acoustical features.

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