COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

Promoting and advancing the development of healthy, durable and sustainable shelter for Alaskans and other circumpolar people through applied research.

Energy Use at the Research Test Facility

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The Cold Climate Housing Research Center Research and Test Facility in Fairbanks, Alaska.

Sustainable Building for the 21st Century

The Cold Climate Housing Research Center (CCHRC) building, known as the Research and Testing Facility (RTF), is a model of green building design. The RTF is twice as energy efficient as an average commercial building built to today's standards and twice as efficient as an average four-star plus house in CCHRC's hometown of Fairbanks, Alaska.

The RTF integrates solar technology, superior insulation, and advanced control systems to maximize efficiency and comfort. Rainwater collection, on-site water treatment, and effluent recycling conserve water. During the winter, heat from high-efficiency boilers is supplemented by a low-emission masonry wood stove. Sensor-adjusted indoor lighting complements natural day lighting, which is optimized by an array of south-facing windows. In the summer, shading eaves and a vegetative roof help keep the building cool. Indoor air is filtered and moisture is precision controlled. Built with local materials as much as possible, the building can adapt to its subarctic environment by adjusting its foundation.

CCHRC RTF Energy-use Calculations				
Location	**BTU/ft²/yr**	**BTU/DD/ft²/yr**	**DD**	**Location**
Actual	42,153.4	2.953	14,274	Fairbanks, Ak
Modeled Energy Use	52,033.5	3.645	14,274	Fairbanks, Ak
Standard Building Energy Us	89,062.9	6.240	14,274	Fairbanks, Ak
Commercial Building Energy-use [4] (less than 2,000 CDD and more than 7,000 HDD)				
Type of Building	**BTU/ft²/yr**	**BTU/DD/ft²/yr**	**DD**	**Location**
10,001 to 25,000 ft²	75,897.8	N/A	N/A	Climate Zone 1
Office (Used for)	90,690.1	N/A	N/A	Climate Zone 1
2000 to 2003 (Built in)	73,612.3	N/A	N/A	Climate Zone 1
Canadian Multi-User Residential Building[2]				
Location	**BTU/ft²/yr**	**BTU/DD/ft²/yr**	**DD**	**Location**
Grandin Green MURB [2]	61,899.1	6.368	9,720	Edmonton Alberta
Governors Road MURB [2]	43,488.1	6.711	6,480	Dundas, Ontario
Almon Street MURB [2]	50,154.1	6.796	7,380	Halifax, Nova Scotia
Conservation Co-op MURB [2]	59,042.2	7.131	8,280	Ottawa, Ontario

Table 1

Project Background

Energy efficiency was a top priority during the planning process for the RTF. CCHRC adhered to Leadership in Energy and Environmental Design's (LEED) highest specifications. LEED is an international standard for energy-efficient and environmentally-friendly building. Two energy use studies were conducted before construction to make best use of the design and establish a baseline comparison for the RTF; a model showing the expected energy-use of the RTF and a comparison of the RTF to a similar sized building built to current commercial construction standards (see table 1).

Related Topics:

Snapshots

- REMOTE Wall Performance, 2008-03

Northern Fundamentals

- REMOTE Walls

Please visit the CCHRC website for more information or other studies: http://cchrc.org/resources.aspx
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To analyze and demonstrate how efficient a building can be in northern climates, CCHRC constantly monitors the RTF's energy use with more than 1,000 sensors. This data can be compared to averages around the globe.

Details of Resulting Efficiencies

The RTF uses much less fuel and electricity than a standard commercial building of its size. For the July 2007 – June 2008 year, the RTF used a total of 2,250 gallons of fuel and 86,280 kWh of electricity to heat and light 15,000 square feet – this in a location where winter temperatures average -12 degrees Fahrenheit and daylight dwindles to a few hours per day. The LEED method of estimation for a standard commercial building shows that a comparable standard building would use 6,482 gallons of fuel and 129,240 kWh a year. The RTF was estimated to be 42 percent more efficient in its total energy use than a comparable standard commercial building, but is actually 53 percent more efficient due to the energy saving techniques used.

In a typical commercial building, 66 percent of energy consumption is used for heating. In the RTF, only 53 percent of its energy usage goes to heating. In order to compare the RTF's energy use to other commercial buildings' directly, regardless of size, energy-use per square foot, per year can be studied. This number is expressed in BTU, per square foot, per year (BTU/ ft²/yr) and includes energy from space heating, water heating, appliances, and lighting (see table 1). The data shows the RTF has a much better energy-use rating than several individual buildings in Canada and also a much better energy-use rating than the average commercial building in the United States.

For an additional comparison, energy-use ratings can be divided by the number of heating degree days in the location of a building. This method removes the factor of exterior temperature from the equation. The RTF uses even less energy per square meter compared to other analogous buildings (see table 1). The RTF's energy-use is much lower than standard commercial buildings around North America, but it is also more energy efficient than an average four star plus home in Alaska.

A 2,500 ft² home would use approximately 75,548.6 BTU/ ft²/yr, including about 1,136 gallons of fuel a year for space and water heating. The difference in energy use between the RTF and a four star plus home is 33,647.7 BTU/ft ²/yr, which includes about 408 gallons of fuel for space heating. At a rate of $4.00 a gallon, the RTF saves about 65 cents per ft²/yr in space heating alone, which amounts to about $1620 a year. As fuel prices increase so do the savings.