



COLD CLIMATE HOUSING RESEARCH CENTER

**CCHRC**

# Sustainable Northern Communities

## Venetie

The new teacher housing complex in Venetie looks like the other log homes dotting the small arctic village, but uses a fraction of the energy.

That's because there's nearly a foot of foam insulation inside the logs, an innovative double-wall system designed to perform better yet fit in culturally in the Gwich'in community.

Venetie, population 160, is on the Chandalar River 150 miles north of Fairbanks. About sixty students attend the K-12 Venetie school, one of eight in the Yukon Flats School District, which spans a vast chunk of northeastern Alaska.

Venetie has a housing crisis. Most homes in the village are aging, inefficient, and overcrowded. There's a severe housing shortage because of the high cost of construction, making it difficult to recruit teachers to work at the school.

The new four-plex was built by the school district to provide comfortable, affordable housing for teachers. Working with the Cold Climate Housing Research Center (CCHRC) in Fairbanks, the district came up with a multi-family housing design that would drastically reduce fuel use and incorporate local traditions and resources.

A half dozen villages are scattered throughout the Yukon Flats, a vast watershed for the Yukon River filled with wet lowlands and boreal forest. Venetie sits on the edge of the Flats, where the foothills begin to rise into the Brooks Range, the northernmost branch of the Rocky Mountains. It's an extreme climate, with long winters and severe cold temperatures.

Most homes in Venetie are log. While they are a popular and widely available resource, logs don't have the high insulation value of other building materials. So CCHRC designed a super-insulated log wall that reduces energy use while maintaining the aesthetic of the region.

### Building Features

The house uses a unique wall system that combines the strength of logs with the insulating value of spray foam. The structural wall consists of three-sided logs gathered from the forests around Venetie. The school district purchased building materials locally. Venetie residents harvested and

peeled logs using their own equipment, and were paid per log.

A steel stud wall was framed to the inside of the log wall, and 10 inches of polyurethane foam was sprayed in the cavity for a thick, vapor-tight wall with an approximate R-value of 70 (an average log wall is about R-15). A space was left between the spray foam and inner steel wall for plumbing and electrical runs.

Logs take several years to season after being cut down. To account for this, villagers harvested timber from the standing dead wood around Venetie—much drier than average wood. During construction, builders provided space within the structure to allow logs to dry and settle over time. On top of the steel stud wall is a track with a slip joint that supports the roof and prevents it from resting on the logs. Extra gaps were also left around door and window frames to allow logs to settle as they dry.



Village residents hand-picked the logs from standing dead wood for-ests and allowed them to season for three years before construction.



## Building Performance

CCHRC researchers are also interested in the moisture performance of the wall because of its unusual design. Typically when you retrofit a log home, the insulation goes on the outside and the logs are exposed to the inside to take advantage of their thermal mass. That keeps logs in the heated indoor space, protecting them from condensation.

In this prototype home, insulation was added to the inside of the wall, because the community wanted the logs to show on the outside. That means the logs are exposed to the Arctic elements. Because of this unique design, we embedded moisture sensors in the walls to see how the logs would handle cold temperatures and wetting events. For example, how long will it take the wood to dry out after a spring storm?

To address moisture inside the home, each unit has a heat recovery ventilator (HRV), which exchanges stale indoor air with fresh outdoor air, transferring heat between the air streams. For a tight home, this type of balanced mechanical ventilation system is essential to maintain healthy indoor air quality.

## Construction

Another goal of the project was to create economic development in the community, with a focus on workforce training. The building crew was made up entirely of local residents, who learned a range of construction skills. For example, the tribe owned a sawmill but nobody in the community knew how to operate it. During this project, an outside instructor trained local residents to use the mill and milled all of the lumber for the homes.

### Project Highlights

- 90% less energy use than average home in the region
- Culturally compatible log design without sacrificing energy efficiency
- Community outreach heightened by using local resources and developing local skills

## ENERGY PERFORMANCE

UNIT	HEATING OIL (gallons)
3 bedroom	160
2 bedroom	80
1 bedroom	40
1 bedroom	50
<b>TOTAL</b>	<b>330</b>

The new housing complex has four units: a three bedroom, a two-bedroom, and two one-bedroom apartments, designed to accomodate the wide demographic of teachers in Alaska (including one unit for a teacher with disabilities). Each unit has a private front porch, a small, efficient oil heater, and a wood stove.

The building demonstrated remarkable energy performance in the first year of occupancy, using only 330 gallons of heating oil, 90% less than the average home in the region.

## The Numbers

The final construction cost of the building was \$380 per square foot, slightly less than the average cost for school district housing in Alaska. Yet the cost of heating the homes is dramatically less than average for the region. At the current heating oil price of \$8.50 per gallon in Venetie, the new homes reduce energy costs by about \$29,000 per year, savings that will continue to add up over the life of the building.

