



COLD CLIMATE HOUSING RESEARCH CENTER

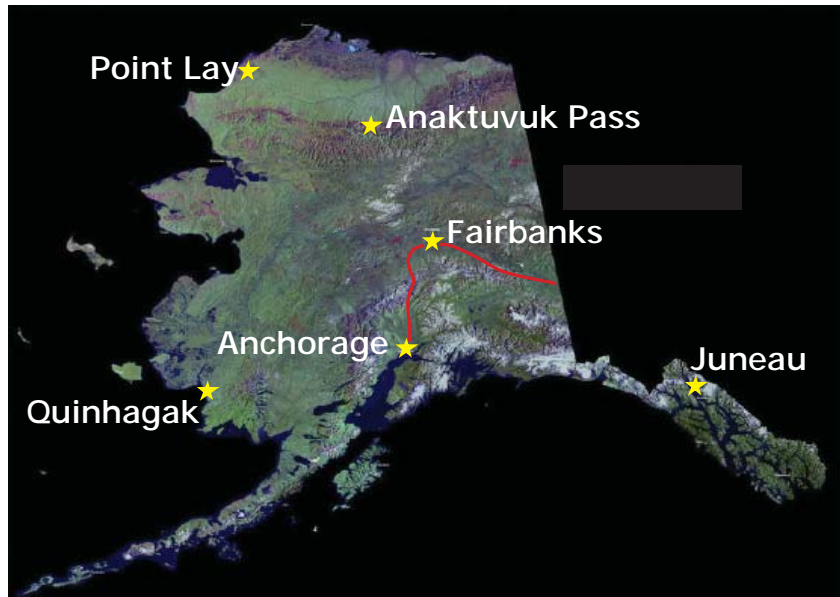
CCHRC

Our Mission: Promoting and advancing the development of healthy, durable, and sustainable shelter for Alaskans and other circumpolar people.

Sustainable Northern Shelter Program

Background

Of the challenges facing rural Alaska, affordable, durable and healthy housing must be at the top of the list. Housing shortages, aging housing stock and prohibitively high heating fuel costs have combined to make this a genuine crisis. Since being asked by community leaders in Anaktuvuk Pass to help design a home to meet these needs, CCHRC has become partners with several other villages in helping to design and build homes that honor the past using today's technology. The resources available at CCHRC--up-to-date research in building science, innovative building design and the flexibility of a private non-profit organization--make it possible to form the required partnerships to respond rapidly and provide homes that are comfortable and efficient.



Sustainable Northern Shelter Program

CCHRC established the Sustainable Northern Shelter (SNS) program in 2008 to work with willing communities to develop housing designs that address sustainability, affordability, and health. CCHRC works with community members throughout the design process to ensure the design reflects the people and place, and addresses local challenges. The community engagement process includes frequent visits to the community, each one typically lasting several days. This format gives the community and CCHRC ample time to ask questions, listen, share knowledge, and collaborate to shape the design.

Anaktuvuk Pass, Alaska

Background

The first SNS building site is in Anaktuvuk Pass, which is a Nunamiut Inupiat community of 312 residents, located in Alaska's Brooks Range. The average temperature in January is -14°F with summer temperature averaging 50°F . Anaktuvuk Pass is only accessible by plane, which makes shipping costs for housing materials a key issue. A ten-year housing shortage has led to overcrowding, which exacerbates indoor air quality concerns. Many of the existing homes are drafty, leading to high energy use and difficulty staying warm.



Prototype house in construction June 2009

Project Status and Highlights

The prototype home in Anaktuvuk Pass was constructed during the summer of 2009, and is designed to be substantially more affordable than conventional construction, while being modeled to reduce energy use up to 90%. The home uses an inside-out wall technique that allows soy-based spray foam to be applied on the outside to create a monolithic foam shell, which is covered with an elastomeric coating for weatherproofing. The result is a very warm and air tight envelope that is extremely energy efficient. The home is ventilated through a combination of an exhaust fan which feeds air to an onsite sewage treatment plan and make up air, as well as traditional passive ventilation known as a "qingok."

All the materials for the home were selected so they would substantially reducing shipping costs. In fact, instead of the 10 planeloads of supplies needed for a standerd home, this prototype was shipped in a single plane. Local labor was involved in the construction of the prototype, and students from Ilisagvik College learned alongside experienced hands.



Completed prototype home with solar photovoltaic and wind power installations



Student from Ilisagvik College discuss the construction process

Anaktuvuk Pass Partners: Tagiugmiullu Nunamiullu Housing Authority, Canada Mortgage Housing Corporation, City of Anaktuvuk Pass, U.S. Dept. of Commerce, GW Scientific, Alaska State Museum, Alaska Housing Finance Corp., Nunamiut Corp., Ilisagvik College, Denali Commission, Yukon Tiver Inter-Tribal Watershed Council, Lifewater Engineering Co., Engineering and Environmental Internet Solutions, Demilec USA.

Point Lay, Alaska

Background

The rural village of Point Lay sits on the coast of the Chukchi Sea, 152 miles southwest of Barrow. A community of about 250 residents, Point Lay is a traditional Inupiat Eskimo village with a predominantly subsistence lifestyle, mostly dependent on Beluga whale.

Building a home in Point Lay means dealing with some extreme challenges: the soils in Point Lay contain about 80% ice; the average maximum temperature is 46°F, and the average minimum is -10°F. With wind speeds averaging from 11-14 mph, extremely low wind chill factors in winter require special housing.



Testing foundation design for Point Lay prototype

The primary housing design considerations relate to the omnipresent permafrost, subsidence, extreme cold, thermal performance, ventilation, and material shipping cost.

Project Status and Highlights

Tagiugmiullu Nunamiullu Housing Authority will construct the prototype home in Point Lay during the summer of 2010. CCHRC worked with the community to design a prototype that addresses the main housing issues in Point Lay, and like in other SNS projects, the result incorporates traditional design elements including a low profile shape, earth berming, and cold storage.

A feature innovation of the prototype in Point Lay is the development and use of a foundation that is designed to substantially mitigate adverse impacts to permafrost and eliminate the use of gravel, since there is very little gravel available locally.



Architectural representation of Point Lay prototype

Point Lay Partners: Tagiugmiullu Nunamiullu Housing Authority, Village of Point Lay, Permafrost Technology Foundation and the Institute of Northern Engineering, University of Alaska Fairbanks.

Quinhagak, Alaska

Background

The rural village of Quinhagak is on the Kanektok River on the east shore of Kuskokwim Bay, less than a mile from the Bering Sea coast and 71 miles southwest of Bethel. Ninety-seven percent of the nearly 700 residents are Yup'ik Eskimo. Precipitation averages 22 inches a year, with 43 inches of snowfall annually. Summer temperatures average 41 to 57 °F, and winter temperatures average 6 to 24 °F.

Wind-driven rain contributes to moisture and mold presence in numerous homes in Quinhagak, and in some cases has rotted wood to the point of jeopardizing the building's structural integrity.



Quinhagak prototype design meeting



Testing wall design for Quinhagak prototype

Project Status and Highlights

A prototype home will be built during the summer of 2010. CCHRC staff worked with community members to develop a home design that will meet the four major housing challenges in Quinhagak: material shipping cost, operating cost, moisture mitigation, and wind. CCHRC and the community also incorporated traditional design elements including the home's circular shape, which maximizes square-foot-to-surface-area ratio; an "arctic entry" in order to reduce living space exposure to weather; and a low profile design to limit exposure to the wind.

An important innovation in the prototype in Quinhagak is the development and use of a new wall system that combines spray foam insulation with light-weight steel into an approximately R-35 wall that will withstand the cold and other unique climatic conditions in the region.



Architectural representation of Quinhagak prototype

Quinhagak Partners: Native Village of Kwinhagak, Native Village of Kwinhagak Housing Authority, Qanirtuuq Inc., Alaska Housing Finance Corporation, Rural Community Development Consultants and Three Star Enterprises LLC.