



COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

Sustainable Northern Communities

Promoting and advancing the development of healthy, affordable, sustainable shelter for Alaska and other circumpolar people

The Purpose

Affordable housing is one of the greatest challenges in rural Alaska—which faces a perfect storm of high energy costs, indoor air quality issues, high transportation costs, aging homes, and a general shortage of housing.

The Cold Climate Housing Research Center initiated the Sustainable Northern Communities program in 2008 to address the need for sustainable housing in both rural and urban communities. Since then, CCHRC has partnered with more than 20 Alaska villages to help design and build homes that combine traditional knowledge with 21st-century technology.

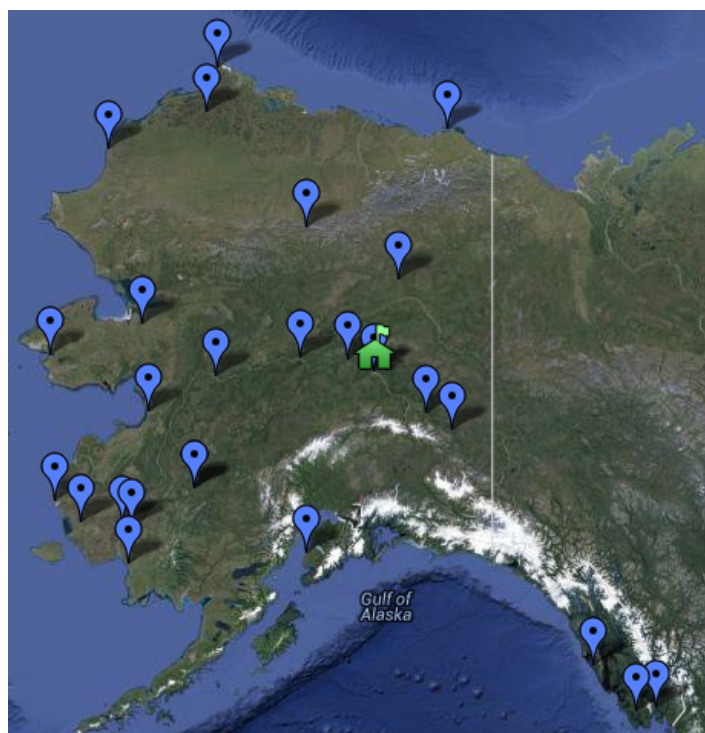
CCHRC incorporates its research and expertise in building science, mechanical systems, indoor air quality, and economics into prototype home designs. The prototypes are designed to improve energy efficiency and durability and reduce the cost of construction.

The Process

CCHRC works with residents, local governments, housing authorities, utilities, and other partners to develop innovative prototype home designs that fit the climate and culture of each community.

The community is engaged throughout the process—from initial design development through construction and monitoring—to ensure the design incorporates local traditions and knowledge and reflects the people and place. This format gives the community and CCHRC ample time to ask questions, listen, share knowledge, and collaborate.

At the core of the Sustainable Northern Communities program is the understanding that each climate and location presents unique challenges. Piecing together the puzzle of lifestyle, climate, tradition, and modern building science is the challenge. Partnerships are the key to success.



SNC projects span the entire state, from the arctic tundra to the dry Interior to the wet river delta of Southwest Alaska.



SNC practices community-driven design to ensure that housing matches the climate, culture, and lifestyle of residents. Here, a CCHRC designer discusses housing needs and gathers local knowledge from community members in Anaktuvuk Pass.

Anaktuvuk Pass

Location: Brooks Range, North Slope, Alaska

Project Completion: 2009

Walls: light steel studs, spray foam applied from outside, elastomeric coating for weather proofing

Foundation: insulated raft foundation

Insulation: 9" polyurethane spray foam in entire building envelope, R-55

Cost: \$250,000

Average annual energy use: 1,000 gallons heating oil

Prototype annual energy use: 240 gallons

Ventilation: HRV



Anaktuvuk Pass is a Nunamiut Inupiat Eskimo community with a dry, arctic climate. Most homes in the village are cold and drafty. Construction costs are driven up by expensive shipping and outside labor costs. In 2008 there was a 10-year waiting list for new housing in the village of 300.

The warm, airtight envelope of the prototype home reduces fuel use by 80 percent. The super-insulated foundation rests on the ground, unlike most raised foundations in the village, which drastically reduces heat loss through the floor. The sod roof and earth berming mimic traditional sod igloos that villagers once lived in.

Quinhagak

Location: Bering Sea Coast, Southwest Alaska

Project Completion: 2010

Walls: stand-off wall, R-40

Roof: half trusses with central hub, R-60

Foundation: insulated raft & adjustable cribbing, R-60

Insulation: polyurethane spray foam

Cost: \$220,000

Average annual energy use: 600-800 gallons heating oil

Prototype annual energy use: 180 gallons

Ventilation: HRV



Quinhagak is a Yup'ik Eskimo community of about 700 located in a cold coastal climate. Wind-driven rain combined with inappropriate building designs has caused serious mold and rot issues in many homes in Quinhagak, and one-third of the total housing stock needs to be replaced.

The prototype uses a traditional octagonal shape to improve heating efficiency and reduce wind load and snow drifting. The house has light-weight steel studs offset with plastic bracing, to reduce thermal bridging, and filled with 7 inches of polyurethane spray foam. In the roof, half trusses are connected with a central steel hub so all the components can be assembled and moved by hand.

Crooked Creek

Location: Upper Kuskokwim, Southwest Alaska
Project Completion: 2011
Housing units: 9 homes completed in 6 weeks
Cost: average \$78,000 per house (using volunteer labor)
Ventilation: exhaust-only fans with Fresh 80 inlets

Galena

Location: Yukon River, Interior Alaska
Project Completion: 2013
Foundation: steel pilings
Integrated Heating & Ventilation: BrHEAThe system injects heat into fresh ventilation air to maintain healthy air exchange, distributed through ducting



CCHRC works with disaster response agencies to develop energy efficient, affordable housing that can be rapidly built in the event of disaster. CCHRC is creating a matrix of approaches for the Alaska Division of Homeland Security & Emergency Management with different wall systems, foundations, insulation types, and materials that can be combined based on location, climate, season, and local resources. The Crooked Creek and Galena homes both use integrated trusses, which cater to unskilled labor and rapid assembly.

Atmautluak

Location: Southwest Alaska
Project Completion: 2013
Structure: integrated truss combines floors, walls and roof
Foundation: adjustable steel pilings
Insulation: 7" polyurethane spray foam, R-45
Regional average annual energy use: 1,000 gallons heating oil
Prototype annual energy use: 250 gallons heating oil
Ventilation: HRV
Wastewater: Separett waterless toilet

Atmautluak is a small Yup'ik Eskimo village in the Yukon-Kuskokwim Delta with extremely wet soils and high energy costs. CCHRC worked with the community to design and build two prototype homes and help the community establish a tribally owned construction company. The home was built over 9 weeks with a crew of 6 local workers and 2 instructors.

Atmautluak is a boardwalk community with highly saturated, unstable soils. The prototypes have steel piling foundations that residents can seasonally adjust using hand tools. The integrated truss house is super-insulated and simple to reproduce without heavy equipment. A waterless toilet improves sanitation, as there is no public water or sewer system in the village. A passive cold trap in the arctic entryway prevents heat from leaking outside.



Buckland

Location: Northwest Arctic, Alaska

Project Completion: 2013

Structure: integrated truss combines floor, walls and roof

Foundation: insulated foam raft, R-60

Insulation: polyurethane spray foam, 10" in walls and roof, 12" in floor

Average annual energy use: ~1,000 gallons heating oil

Prototype annual energy use: 300-400 gallons

Integrated heating & ventilation: BrHEAThe system injects heat into fresh ventilation air

Buckland is an Inupiat Eskimo village of roughly 600 in the northwest Arctic, 75 miles from Kotzebue, with long, cold, dry winters. CCHRC worked with the community and the University of Alaska Fairbanks Chukchi campus to design and build an affordable, energy efficient house as an example for the region.

The house rests directly on the ground on a raft-like foundation, resulting in warmer floors than the elevated foundations typical of Buckland. The roof has a diagonal ridge line that cuts wind and maximizes solar gain. The home was built in the summer of 2013 by CCHRC instructors and Chukchi students as part of a carpentry course.



UAF Sustainable Village

Location: Interior Alaska

Project Completion: 2012

Description: 4 super-insulated homes with different foundations, wall systems and mechanical systems

Cost: \$220,000 per house (\$185/sq. ft.)

Average energy efficient house in Fairbanks: 900 gallons

Annual energy use: ~360 gallons heating oil equivalent

CCHRC worked with the University of Alaska Fairbanks to create the Sustainable Village in 2012, with students helping design and build the four 4-bedroom homes. The village demonstrates various energy efficient technologies and sets an example of affordable, single-family housing for Fairbanks.

Each 1,600-foot home has a unique design so that researchers can compare the cost, performance, and payback of various wall systems, foundations, and mechanical systems: including foam raft and piling foundations; REMOTE and cellulose walls; solar, diesel and propane heating systems; and various ventilation strategies. CCHRC is monitoring the energy performance of each home for the first two years of occupancy. Results and more info can be found at cchrc.org/research-snapshots.

