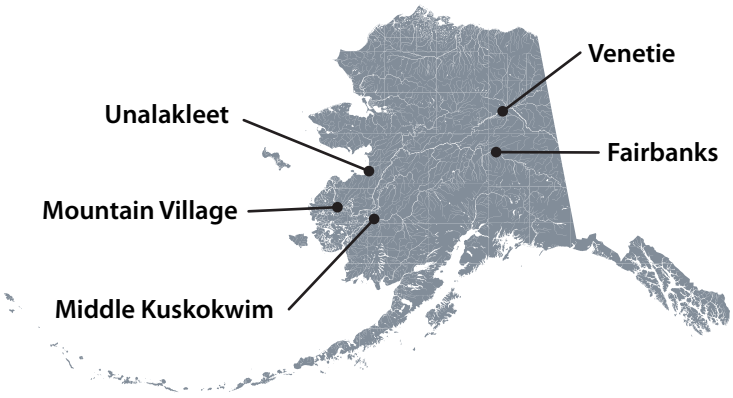
NREL's Alaska researchers works hand in hand with communities and tribes to design housing and energy solutions solutions that work for their unique environment. *Photo by Vern Slocum, NREL*

Advancing Energy Justice in Alaska

NREL works with remote and rural communities across Alaska and the world to develop energy and building technologies that enhance culture, strengthen economies, and improve resilience in a changing environment.

Alaska and Arctic communities not only face one of the harshest climates on earth; they also pay some of the highest energy and housing costs in the nation. NREL's Alaska Campus collaborates with communities and tribes to develop affordable, culturally appropriate homes and buildings that combine traditional knowledge and twenty-first century technology. Demonstration homes deployed all over Alaska prove out new technologies in energy efficiency, foundations, indoor air quality, and clean energy. Local workforce development is incorporated into every project: new homes are built by local workers, often including the home's future occupant.

With the Arctic warming twice as fast as the rest of the planet, coastal erosion and thawing permafrost are wreaking havoc on roads, buildings, and infrastructure across Alaska. With an inclusive approach to R&D, NREL is helping communities adapt to a changing environment and advancing energy justice in the world's extremes.



Semi-Modular Housing Protects Culture and Jobs in Unalakleet

NREL partnered with the Native Village of Unalakleet to design an affordable home that would drastically cut fuel costs and alleviate overcrowding in the primarily Inupiaq village. To prevent Elders and young families from leaving communities and protect their subsistence way of life, the tribe needed new homes that were both affordable and could be built by local workers. However, specialized trades like plumbers and electricians are in short supply in rural Alaska. To meet these dual challenges, NREL designed a house that was part-prefabricated, part site-built; the bathroom and kitchen portions were constructed in a shipping container at NREL's Alaska Campus and shipped to Unalakleet, fully equipped, where a local crew built a house around it. This innovative, semi-modular approach reduced the cost of the kitchen/bathroom (the most expensive part of the house) without taking precious carpentry jobs out of the community.

Local workers install floor decking after the placement of the kitchen/bath module. *Photo by Vern Slocum, NREL*

Mountain Village Model Designed for Expansion and Climate Change

NREL worked with the Asa'carsarmiut Tribal Council of Mountain Village to create small, energy efficient, affordable homes that enabled residents to transition out of homelessness. Because overcrowding is so rampant in the Yup'ik village of 850–with two to four families often sharing a single house–the tribe wanted a very small, affordable house design. They also needed something durable: the rotting, unstable homes throughout the community are a legacy of large federal housing projects in the 1970s imported from outside Alaska. With input from the community, NREL designed a durable, super-insulated wall and jackable foundation that allow the home to be adjusted up to nine inches when the permafrost settles. The 288-square-foot structure sits on an oversized foundation so it can be easily expanded into a 480-square-foot unit in the future. In the meantime, the oversized foundation provides a large deck.

The Mountain Village tiny homes emphasize affordability with a goal of transitioning residents out of homelessness. *Photo by Aaron Cooke, NREL*

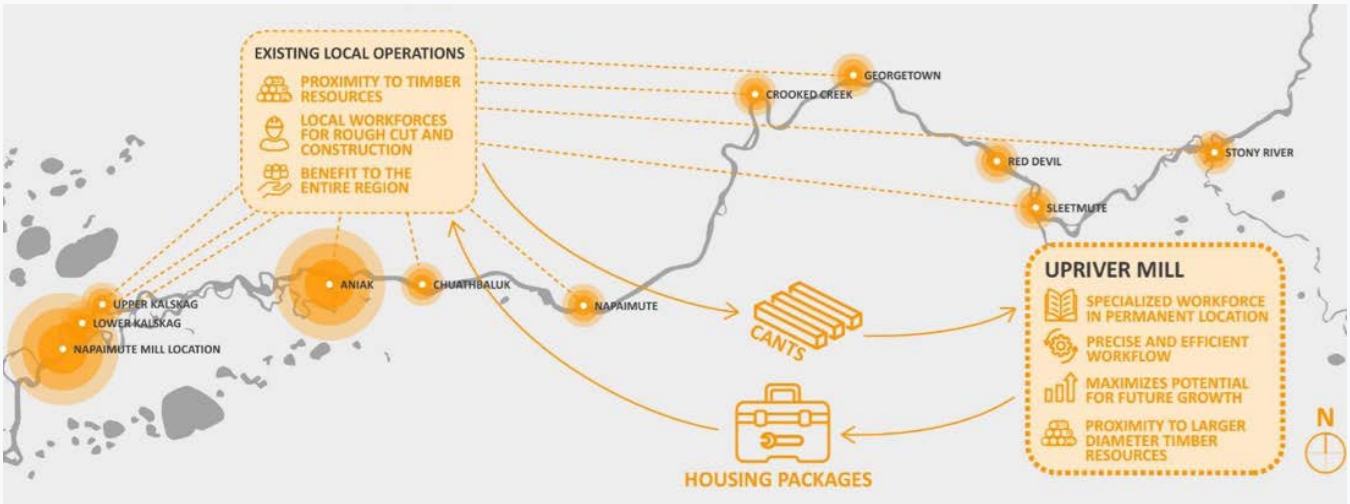
The Sustainable Village demonstrates a variety of building envelope, foundation, and heating approaches just outside NREL's Alaska Campus in Fairbanks. *Photo by Seth Adams, NREL*

University Village Provides Living Laboratory for Arctic Building & Energy Technologies

The Sustainable Village was co-designed by Cold Climate Housing Research Center researchers, now part of NREL, and University of Alaska Fairbanks students in 2012 to evaluate novel building and energy technologies for the north. The four buildings are home to students, academic fellows, and researchers and provide a proving ground for new innovations in energy efficiency, solar thermal, thermal storage, and more. Over the past decade, researchers and fellows have used the Sustainable Village to study permafrost, indoor air quality, and various heating strategies.

Studies include:

- Energy and moisture performance of various building envelopes and different types of insulation, available here: http://cchrc.org/media/SustainableVillageSnapshot.pdf.
- The effects of different foundations on permafrost, including strategies for leveling buildings, available here: http://cchrc.org/media/SustainableVillageGroundTempSnapshot_0.pdf.
- Balancing energy efficiency and indoor air quality through ventilation, available here: http://cchrc.org/media/SustainableVillage_IndoorAirQualitySurvey.pdf.



The Harvest to Home project utilizes resources and creates economic opportunity along the Middle Kuskokwim River in southwest Alaska.

Harvest to Home Projects Utilize Regional Resources

NREL worked with The Kuskokwim Corporation (TKC), an Alaska Native corporation comprised of 12 small villages along the middle part of the Kuskokwim River, to develop a housing package from local timber that could address the region's acute housing shortage. The team created a variety of building designs, including 1-, 2-, and 3-bedroom floorplans, using building technologies tailored to cold conditions. The project leveraged TKC's traditional knowledge and local renewable resources with NREL's expertise in advanced materials and high-performance buildings, coinciding with state policy that created more opportunities for local harvest and milling in remote communities.

In Venetie, Cold Climate Housing Research Center designers, who joined NREL in 2020, partnered with the community to build homes from locally harvested logs. Due to the lack of housing in rural Alaska, many villages are unable to fill vital positions such as teachers and police. Researchers partnered with the local school district to design multi-family housing that incorporated traditional log construction while greatly enhancing the insulation value and air-tightness. A steel stud wall was framed to the inside of a standard log wall to add 10 inches of polyurethane foam that makes the homes extremely warm and resistant to mold and moisture problems. Through this project, local residents learned how to mill lumber and build super-insulated walls. During the first year, the house used 90% less energy than the average home in the region while continuing the traditional log design.

Prototype of the milled log kit home being developed by The Kuskokwim Corporation with NREL guidance. *Photo from Dave Loeks, HTH Homes*

NREL Transforming ENERGY

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