



NREL's Collaboration with Alaska's Cold Climate Housing Research Center Builds Mission Impact in Extreme Climates

The National Renewable Energy Laboratory (NREL) has been conducting innovative buildings research for decades, much of it occurring at its LEED Zero-certified Research Support Facility. NREL's campus is a living laboratory—a showcase for advanced buildings technology. In Alaska, employees at the Cold Climate Housing Research Center (CCHRC) are working the same way in their own LEED Platinum-certified buildings, but in an extreme climate.



CCHRC built the Sustainable Village at the University of Alaska, Fairbanks in 2012 to create a living laboratory for students and researchers. The four homes each use different combinations of foundations, wall assemblies, and heating and ventilation systems. They have provided a wealth of data on fuel and water efficiency, user behavior, and the effect of building on frozen ground.

A new collaboration between NREL and CCHRC represents the combination of NREL's wealth of knowledge and experience in the building technology space with decades of experience researching building technologies in extreme climates by CCHRC. The collaboration generates potential for creative, new ideas, creates opportunities for researchers on both ends, and rapidly expands NREL's mission impact on a global scale by granting it access to Arctic climates, research facilities at CCHRC, and new insight into the local landscape and challenges.

With Arctic winter minimum temperatures in Fairbanks, Alaska, dipping as low as -50 degrees Fahrenheit and maximum summer temperatures climbing to 90 degrees Fahrenheit, Alaska presents an opportunity to study and understand the unique requirements of energy infrastructure and built environments of the Arctic. In addition, Alaska's indigenous people are a rich resource for learning how humans have adapted and thrived in the most extreme conditions on earth. Through collaborating with First Alaskans, CCHRC's research blends traditional knowledge with twenty-first-century technology to develop solutions to today's housing challenges.

Currently, CCHRC has approximately 17 full-time employees as well as an established research collaboration with the University of Alaska, Fairbanks. The collaboration with NREL leverages the complementary strengths of the two organizations, amplifies impact in NREL's mission space, as well as the Department of Energy's (DOE's) investment, and keeps NREL's research agenda at the forefront of science. It provides an opportunity to advance the DOE mission and fulfills an urgent need.



Anaktuvuk Pass, Alaska: A local crew builds an energy-efficient home in 2008 in the Inupiaq village of Anaktuvuk Pass. Designed by the CCHRC, the home blends innovative technologies such as a foam raft foundation and super-insulated envelope with traditional techniques like earth-berming to stay warm.

Beyond harsh weather conditions and limited winter daylight hours, residents of Alaska's remote villages and people throughout the Arctic face extremely high costs for food, electricity, heating, and freight, as well as low levels of employment, all adding to the hardships of people throughout the region.

NREL has partnered on renewable energy and sustainability projects throughout the region in the past, but this new layer of access, including the ability to station NREL employees physically in Alaska, enables a faster response to addressing critical issues and helps NREL keep its finger on the pulse of challenges facing vulnerable villages and tribes.

Innovative research in integrated building energy efficiency, connectedness, and energy systems integration will yield vital energy security and energy savings for at-risk indigenous communities. Cost reductions in renewable energy, coupled with advances in energy storage technologies and smart energy management systems, could offset cost-prohibitive diesel generation and provide a path to economic development, as well as greater energy independence and increased sustainability in rural villages.

Addressing the unique environmental, economic, and energy challenges of the Arctic requires creative new directions for Arctic-related research, workforce development, and leveraging of science, engineering, and technology advances from outside the Arctic. The collaboration demonstrates complementary capabilities in energy technology design, seasonal energy storage, and deployment in extreme and rural environments to include an Arctic technology validation facility, remote siting, on-site manufacturing, and whole-building energy use (including envelope and foundation), and building-energy system integration.

The opportunity for NREL aligns perfectly with its 10-year strategy, which, in-part, includes a focus on integrating the energy pathways of the future and fastens well to EERE's Advanced Research on Integrated Energy Systems initiative as well. DOE and NREL can play an important role in meeting Arctic challenges because scalable, sustainable, affordable, and local advanced energy solutions are needed both for remote villages and mainstream applications. A research collaboration with CCHRC facilitates the development, use, and validation of energy-efficient, durable,

healthy, and cost-effective building technologies for people living in circumpolar regions. Moreover, the lessons learned in the Arctic can be applied around the world to make communities more sustainable and resilient.

NREL is already engaged with several activities and partners extensively across Alaska. These activities include:

- Capacity building and technical assistance for Alaska Native villages and corporations through DOE's Office of Indian Energy
- Work on remote microgrid design and high-renewable contribution grids through the Grid Modernization Lab Call and Alaska Microgrid Program
- Support for the Alaska Energy Authority and Solarize Alaska initiatives
- Collaboration and support of Launch Alaska's energy-water-food-transportation innovation incubator
- The pan-Arctic research collaboration with the Alaska Center for Energy and Power based at the University of Alaska, Fairbanks
- Direct support (funded by communities) for energy efficiency and renewable energy system evaluation, marine hydrokinetic demonstration, and microgrid assessment and demonstration in Cordova, Alaska.

NREL also serves as a resource to numerous state and local agencies seeking expertise related to energy challenges in rural areas and integration of EERE technologies. NREL partners in Alaska include:

- The Alaska Energy Authority
- Alaska Center for Energy and Power based at the University of Alaska, Fairbanks
- DOE Office of Indian Energy
- Renewable Energy Alaska Project
- Alaska Native Tribal Health Consortium
- Multiple Alaska Native corporations, housing authorities, and electric cooperatives.



Atmautluak, Alaska: CCHRC trained a Yup'ik crew to build two super-energy-efficient homes in this southwest Alaska village in 2013. With no heavy equipment or trained carpenters in the village, the home was designed to be lightweight and simple to assemble. The adjustable foundation can move with the highly active ground.