Testimony for the Record
Prepared For the U.S. Senate Committee on Energy & Natural Resources

For a Hearing to
Examine Opportunities to Advance Renewable Energy and Energy Efficiency Efforts in the United States.

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May 21, 2019

Introduction

Thank you, Chairman Murkowski, Ranking Member Manchin, and the Members of the Committee on Energy and Natural Resources for the opportunity to have a voice and to contribute to advancing renewable energy and energy efficiency in the United States.

The Cold Climate Housing Research Center (CCHRC) was founded 20 years ago as a 501(c)(3) not-for-profit organization by members of the Alaska State Home Building Association, professionals in the home building industry statewide. The mission of the organization is, "promoting and advancing the development of healthy, durable, and sustainable shelter for Alaskans and other circumpolar people." Applied research that addresses the myriad challenges of building in Alaska are prioritized through research advisory groups statewide, from Ketchikan to Utqiagvik (formerly Barrow). The advances in building science over CCHRC's history have improved the energy efficiency, mechanical systems, foundations, material selection and development of buildings well beyond Alaska. Our contribution to the building industry is recognized nationwide and globally.

Alaska: A proving ground for Energy Efficiency

Alaska presents some of the most extreme and varied environments on earth, from the arctic tundra to the Bering Sea, with hundreds of villages that are inaccessible by road and located far away from energy resources. In this environment, shelter literally means the difference between life and death. Compounding these challenges is the fact that Alaskans face the highest energy costs in the nation. These challenges have helped make Alaska a world leader in energy efficient building and building technology. We would like to share several of the lessons we have learned in the world's most challenging environments.

Good housing is essential to a safe and healthy life. Yet in Alaska, tens of thousands of homes are cold, under-ventilated, and extremely inefficient. Rather than providing refuge from the elements, a large portion of the housing stock has become a financial burden and an actual health hazard to occupants. Unfortunately, people with the fewest resources are impacted the most, including Alaska Native infants and elderly, who suffer from the highest rates of upper respiratory disease in the country due to unhealthy housing.

Throughout Alaska, CCHRC has established a holistic approach with communities to design and build energy efficient, affordable demonstration homes using local labor and traditional knowledge. Thoughtful design informed by indigenous populations with deep knowledge of their local environments has resulted in energy efficient, healthy homes with lower construction costs. These homes use less than half the energy of typical homes in the same communities and are healthier and more durable.

CCHRC's deep experience working in both urban and rural Alaska has shown that building healthy, efficient homes is one of the best investments we can make. Using proven building science and rigorously tested materials, we can dramatically reduce energy use while ensuring healthy indoor air quality for residents, with little or no additional upfront cost. This applies not only to homes but to commercial and public buildings as well. For instance, CCHRC's facility in Fairbanks is the farthest-north LEED Platinum building on earth. It was designed and built to meet these standards at a cost equivalent to other commercial buildings in the region through close collaboration with the builders, designers and engineers, creating a cohesive team approach.

Cold Climate Housing Research Center Research Test Facility, 2018.

How has CCHRC advanced Energy Efficiency & Renewables in Alaska?

CCHRC works in all regions of the state to ensure that homes are affordable to build and to live in. This begins with research that focuses on testing and vetting viable building technologies. In

the lab, we study everything from foundation and walls to heating and ventilation systems. The lessons learned are applied to homes CCHRC designs in all regions of Alaska.

On average, CCHRC demonstration homes use 80% less energy while also reducing construction costs. These results are achieved through community engagement, thoughtful design, careful selection of materials and shipping options, and utilization of local labor and workforce training. This "holistic approach" to design and construction incorporates the latest building science with the invaluable knowledge of First Alaskans accumulated over thousands of years of successful adaptation. All building designs have mechanical heating and ventilation systems that ensure healthy indoor air quality without sacrificing energy efficiency, resulting in healthier families and communities.

In addition to testing and design, economic and policy research helps us understand the housing challenges and focus on data-driven solutions. Every four years, CCHRC conducts a housing assessment looking at size, cost, energy use, and condition of more than one-third of all homes in Alaska. From this work, we know that 40% of Alaska's housing stock is aging and in need of a retrofit, and more than half of homes are under-ventilated and at risk of poor indoor air quality.[1] This informs policy makers, funders, and planners who set priorities for the state. We also measure the impact of energy efficiency on homeowners and the economy as a whole. For example, a $242 million state-funded program that incentivized Alaskans to make energy efficiency improvements resulted in $260 million in energy savings for homeowners over 10 years, an estimated 1.6 million tons of reduced carbon dioxide emissions, nearly 7,000 annual jobs, and $912 million in economic impact.[2] Through this program, the average household cut energy use by 34%, savings that will continue for the life of the house. This type of research shows not just the exceptional economic impact of energy efficiency but also the public demand for it.

Working with federal agencies to advance Energy Efficiency in Alaska

CCHRC has longstanding partnerships with federal agencies to ensure the dollars spent in Alaska provide the most benefit to Alaskans. While housing issues span the state, the needs are most acute in rural villages, where there is a legacy of failing structures built by outside entities that have become a burden to heat and maintain. The typical rural household spends over $5,000 per year on energy, with some regions averaging $6,427, nearly three times the national

[1] Wiltse, Nathan, et al. "2018 Housing Assessment." Alaska Housing Finance Corporation, Mar. 2018, https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment.

[2] Wiltse, Nathan, et al. "State of Alaska - 2019 State of the State." State of Alaska | Cold Climate Housing Research Center, Jan. 2019, www.cchrc.org/soa.

average.[3] Overcrowding rates in some rural regions are as high as 40%, and unhealthy indoor air quality is a widespread problem.

The goal of every CCHRC project is to make communities stronger, more resilient, and more affordable. Because many rural residents depend on subsistence activities more than conventional jobs, they have limited access to traditional financing options for energy and housing projects. These basic services are typically provided by public programs and often via competitive grants, which are difficult to navigate and understand for people with a different culture and sometimes a different language. CCHRC partners with rural communities to overcome these obstacles. Thanks to capacity-building programs such as those supported through the Department of Energy's Office of Indian Energy or through the Alaska HUD Office of Native American Programs, we provide technical assistance to these communities in applying for grants, developing energy action plans, and providing expertise on energy efficiency and housing projects.

CCHRC has designed more than 20 super-efficient demonstration homes in communities throughout Alaska, working directly with local people to ensure they are appropriate for the climate and the culture. Through funding from U.S. HUD and others, we have developed these homes in Quinhagak, Buckland, Anaktuvuk Pass, Venetie, and others using indigenous wisdom and 21st century building science. For example, a demonstration home on the North Slope slashed energy use from over 1,000 gallons of heating oil to less than 200 gallons per year, and incorporated a standalone sewage treatment plant that saved roughly $50,000. The home's efficient envelope and building systems were repeated by the regional housing authority and stimulated $12 million in new construction to provide much needed housing in North Slope villages.

Since 2011, CCHRC has partnered with the Federal Emergency Management Agency (FEMA) and other emergency responders to create quick, deployable homes that are appropriate for the region. These designs leverage the best building science with an understanding of the logistical challenges of rural construction. When the village of Galena was devastated by Yukon River flooding in 2013, CCHRC worked with FEMA to design a home that could be built rapidly by unskilled labor and developed a staged training program for volunteers. Five super-efficient homes were created to replace those lost in flooding. These permanent homes were built within 20% of the value of the temporary homes originally planned which also saved the required federal cleanup cost to remove the temporary homes.

[3] Wiltse, Nathan, et al. "2018 Housing Assessment." Alaska Housing Finance Corporation, Mar. 2018, https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment.

Yukon River Flood, Galena, 2013. Photo Courtesy National Weather Service.

CCHRC supports U.S. Department of Energy's efforts to lower energy costs in rural Alaska. Through a tribal lands grant, we are helping four communities improve the energy efficiency of their buildings through energy planning, training, and retrofit measures. This program, which was funded by the DOE's Office of Energy Efficiency and Renewable Energy, not only produces actionable plans but also helps communities understand long-term ways to lower their overall energy use. Once energy efficiency and conservation steps are taken, communities can move on to possible renewable energy systems.

The U.S. Department of Defense uses CCHRC as a resource for its military bases and Arctic infrastructure. With billions of dollars of infrastructure in America's coldest region, Army officials are collaborating with CCHRC to improve energy efficiency and reduce operating costs. Working with the Alaska Center for Energy and Power at the University of Alaska Fairbanks and the Cold Regions Research and Engineering Laboratory, CCHRC is evaluating energy efficiency and energy conservation measures on Fort Wainwright in Fairbanks. This includes testing and

developing heat pump and heat recovery ventilation technologies to see how they can be used at military sites and other cold climate applications.

A Changing Arctic

One of the most pressing national security issues is climate change. With Alaska warming much faster than the rest of the U.S., our military sites are facing increased flooding, wildfires, and degrading permafrost while our communities face threats to their security and subsistence lifestyles. In some cases entire villages are being forced to relocate due to thawing permafrost and erosion. Newtok in southwest Alaska is disappearing faster than any other. For over a decade, CCHRC has been helping the community in the difficult process of moving to a nearby island. The challenges of relocation are daunting: there are no roads or airstrips on the island; no barge landing or staging area; no power; no school, store, or post office. The wet, windy climate is very hard on building structures. Questions of funding and local politics only add to the complexity.

This type of project is the norm in Alaska, and it is the reason CCHRC exists. Our building scientists and architects are designing homes and utilities for the new village using a holistic approach that engages the community. The first step was a Housing Master Plan where we conducted interviews with every Newtok household to determine number of homes needed, floor plan preferences, fuel preferences, options for accommodating elders, and more. Following multiple community meetings, the team designed a three-bedroom house with thick walls and fiberglass insulation that can resist the Bering Sea weather. It has ample food storage to meet the hunting and fishing lifestyle. A waterless toilet and gravity-fed water system was developed by CCHRC and the Alaska Native Health Consortium for villages like Newtok that currently rely on hauling water and going to the bathroom in 5-gallon buckets. The home's integrated heating and ventilation system was also developed by CCHRC to ensure airtight homes like this one receive adequate fresh air.

The challenges facing Alaska and the United States require a truly holistic approach. CCHRC works on a foundation of community engagement, leading-edge building science, and an instinct to learn from the past and try new things. As communities across the nation are forced to adapt to changing times, CCHRC is poised to help.

Mertarvik: the New Home Site for the Community of Newtok, 2018.

Transition to Renewables

It is clear that energy efficiency offers the greatest return on investment for governments and individuals, and spreads benefits to consumers, communities, and the planet. Once we have addressed the energy demand of buildings, the next step is thinking about intelligent supply. Alaskans rely heavily on diesel, coal, and natural gas for heat and power, and the environment poses unique challenges for renewable energy. Technologies that are well established in much of the country still face barriers in the north. For example, the extreme angle of the sun and the short winter days provide additional obstacles for solar energy, while cold ground temperatures reduce efficiencies of geothermal systems. As renewable power generation capacity increases for these Alaskan communities, advancements in microgrids and smart-grid technologies are essential to balance variable renewable power sources with less variable fossil-fuel power generation systems.

CCHRC tests these technologies in Alaska's various regions to find opportunities for homeowners to save money. In Southeast Alaska, for example, our research shows that the average household with electric heat can save $5,000-$10,000 by installing an air source heat pump (over the life of the equipment). In Interior Alaska, we know solar photovoltaic systems pay back in 7 to 9 years through offsetting expensive electricity. And we are testing ways to use thermal storage technology coupled with solar and biomass systems to bridge time periods without sun, improve air quality, and use our resources more efficiently.

The Path Forward

The Cold Climate Housing Research Center is dedicated to advancing energy efficiency and affordable energy solutions for people of Alaska and the circumpolar north. What we've learned the past 20 years in the world's harshest climate can be applied to the diverse climates of the continental United States.

It is obvious to all sectors of the building industry that energy efficiency is the "low-hanging fruit." It is important that research to improve building performance, building longevity, and occupant health be prioritized in any national energy plan. Science has shown that mechanical systems, foundations, glazing, and the development of advanced materials has dramatic results. Incorporating renewable energy systems as part of the whole building envelope to actually create structures that generate as much energy as they use has been shown in other countries to be practical and affordable.

It is the task of the Senate Energy and Natural Resources Committee to find a clear direction forward in addressing urgent needs in the built environment. We feel that our organization has consistently demonstrated that success is attainable, affordable, and practical. We are honored to be a part of the discussion and hope each of you will remember that the progress being made in your farthest-north state (Alaska) is something we sincerely want to share.