ALASKA HOUSING FINANCE CORPORATION

2014 Alaska Housing Assessment

April 1, 2014

Alaska Housing
FINANCE CORPORATION

My Fellow Alaskans:

Alaska Housing Finance Corporation (AHFC) is pleased to present the 2014 Alaska Housing Assessment.

The Assessment provides a statewide, regional and community look at major factors affecting housing benefiting policymakers, funding agencies, housing authorities and others interested. Factors such as overcrowding, affordability, energy use and how Alaskan communities compare with the rest of the U.S. are presented and analyzed.

Housing in Alaska is unique. Alaskans in rural communities face aging infrastructure, high energy costs, and transportation and accessibility concerns for new and existing buildings. Urban communities may benefit from economies of scale but still suffer from high mortgage and rents, overcrowding, and energy inefficient housing built when energy prices were low.

This Assessment tells us that nearly one in three households are spending more than the federally suggested maximum of 30 percent of their total income on housing costs, meaning more than 75,000 homes are cost-burdened. AHFC believes this number to be even higher when factoring energy cost estimates from more than 80,000 AkWarm ratings.

Housing needs in Alaska are significant:

- The rate of overcrowding is twice as high as the national average;
- The average housing unit uses more than twice the energy per year than an average housing unit located in cold climate regions in the lower United States;
- An energy rating of 1 Star, the lowest energy rating a home can have, is estimated to total 19,810 homes;
- Air tight homes lacking continuous ventilation are at a higher risk of moisture and indoor air quality-related problems, and an estimated 58 percent of occupied housing in Alaska have this issue.

AHFC is committed to providing Alaskans access to safe, quality and affordable housing. The 2014 Assessment should not be perceived as a complete report of our housing stock but instead provides a snapshot that enables evaluation of our progress and informs future decisions.

Thank you to our partners who critically reviewed this Assessment and especially to Cold Climate Housing Research Center for their research and authorship, and the Association of Alaska Housing Authorities for their review and valuable input.

I encourage you to read the following summaries and findings, and learn more about the 12 regions highlighting the quality and stock of the infrastructure located there. It is valuable information. With any comments or questions, please contact jord@ahfc.us or 330-8446.

Sincerely,

Bryan Butcher
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Executive Summary

The purpose of the 2014 Alaska Housing Assessment report is to provide an overview of the housing characteristics in Alaska so that housing authorities, policymakers, funding agencies and other interested parties can make informed decisions about resource allocation and housing program management. This current assessment follows several similar reports. The most recent was released in 2009.

The 2014 Alaska Housing Assessment uses information from the U.S. Census and American Community Survey (ACS), as did previous reports, but also presents data from professional energy audits conducted on approximately 30% of occupied housing in Alaska. This recent abundance of high quality energy data, in combination with Alaska's unique energy challenges, has led to a greater focus on housing energy characteristics than in previous years. Alaska's housing characteristics are presented from the perspectives of community, overcrowding, energy, and housing affordability—factors essential to understanding the state's housing stock. Data and analysis are reported for each of these four categories at the state, regional, and community level.

The key findings at the statewide level for these four categories and for housing needs are reported in the section below, with reference to national levels and trends. However, the bulk of this Housing Assessment resides in the sections that follow—written summaries of the ANCSA regions and Census Areas and detailed data profiles of regions and communities throughout Alaska. Key findings at smaller spatial scales can be found in the ANCSA region and Census Area summaries. Readers interested in particular areas of Alaska should refer to the individual summaries and profiles specific to their locale.

I. Community

The housing stock of Alaska is similar to nationwide averages in some respects. Levels of renters (36%) versus homeowners (64%) are equivalent, as are proportions of single-family homes (62%) and small multi-family buildings. However, Alaska's housing stock is unique in many ways: it is more rural, was mostly built during the 1970s and 1980s during the oil pipeline boom, and has smaller average housing unit size than the nation as a whole. Housing size within Alaska also varies greatly. In the mostly urban CIRI ANCSA region home size averages nearly 1,900 square feet per unit -- nearly twice the average found in the regions of Calista and NANA, where averages are less than 1,000 square feet.

II. Overcrowding

Alaska's overcrowding levels have gone down from very high historic levels[1], however, approximately 6% of occupied housing in Alaska still meets the U.S. Department of Housing and Urban Development's (HUD) criteria for overcrowded housing. This rate is roughly twice the national average of 3.1%. While "overcrowding" may vary based on cultural preference, the HUD definition of more than one person per room is based on the level at which health and childhood education of the occupants begins to be

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[1] See *Appendix B: Statewide Need Assessment* for a detailed historical comparison.

negatively affected.[2][3] Each ANCSA region within Alaska has higher levels of overcrowding than the nation as a whole and some regions have significantly higher levels. At the extreme end, overcrowding or severe overcrowding in the NANA and Calista regions occurs in 39% and 40% of occupied housing, respectively. This is more than 12 times the national average.

III. Energy

Alaska has unique challenges that lead to distinct housing energy characteristics. Extremely cold climates, remote communities, and high prices for imported fuels contribute to energy use and costs that differ from national averages. Alaska has several state-funded programs that have been successful in reducing the burden of high energy use and costs on participants, but many households, communities, and regions continue to face high average annual energy use and costs.

Energy use in Alaska is significantly higher than in the rest of the United States. On average, housing units in Alaska use more than twice the total amount of energy as homes in areas classified by the U.S. Energy Information Administration as "cold" / "very cold" climates and use nearly three times as much energy per square foot as the national average. This is even more extreme in some areas of Alaska, with households in the Bering Straits Native Corporation region using approximately four times as much energy per square foot as the national average for cold climates.

On average, Alaskans are burdened with energy costs that are higher than the rest of the nation. Annual residential energy costs in Alaska range from approximately 50% higher than the national "cold" / "very cold" climate average in the CIRI ANCSA region to nearly four times as high in the Doyon region. When viewed on a per-square-foot basis, some areas of Alaska stand out even more for their high energy costs. In the NANA region, average households spend $9.15 per square foot annually for home energy, which is more than nine times higher than the $0.97-per-square-foot national cold climate average.

While the Alaska Housing Finance Corporation (AHFC) Home Energy Rebate, Weatherization, and Alaska Building Energy Efficiency Standard (BEES) programs have demonstrated success in reducing energy usage and costs[4,5], participation has varied among regions. The highest Weatherization program participation has occurred in the Bristol Bay Native Corporation ANCSA region, with 21% of occupied housing receiving Weatherization retrofits. Participation in the Home Energy Rebate Program has been highest in the CIRI ANCSA region at 8% of occupied housing. CIRI also has the highest percentage of housing that has been certified to meet BEES, with approximately 13% of occupied housing BEES

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[2] The United Kingdom Office of the Deputy Prime Minister. (2004) *The Impact of Overcrowding on Health & Education: A Review of Evidence and Literature*. Office of the Deputy Prime Minister Publications. Retrieved from: http://dera.ioe.ac.uk/5073/1/138631.pdf

[3] Measuring Overcrowding in Housing, Prepared for U.S. Department of Housing and Urban Development, Office of Policy Development and Research, September 2007. Prepared by: Econometrica, Inc., Blake, Kevin S., and ICF International. Available at: http://www.huduser.org/publications/pdf/measuring_overcrowding_in_hsg.pdf

[4] Dodge, Kathryn, Wiltse, Nathan, and Valentine, By. (2012). *Home Energy Rebate Program Outcomes*. Cold Climate Housing Research Center. Retrieved from: http://www.cchrc.org/docs/reports/HERP_final.pdf

[5] Dodge, Kathryn, Wiltse, Nathan, and Valentine, By. (2012). *Weatherization Assistance Program Outcomes*. Cold Climate Housing Research Center. Retrieved from: http://www.cchrc.org/docs/reports/WX_final.pdf

certified. The lowest participation in AHFC energy programs has occurred in the Aleut region where 9% of occupied housing units have taken part in one of the three AHFC energy programs. While these programs are estimated to have touched more than 75,000 households throughout the state, many more still face energy cost burdens that are significantly higher than national averages.

Advances in building techniques in Alaska have increased air-tightness of housing significantly, which decreases draftiness and yields energy savings. At the same time, however, installation of continuous mechanical ventilation systems has not kept pace and significant portions of the existing Alaska housing stock are at high risk of moisture and indoor air quality problems. In fact, more than 50% of occupied housing in the Chugach, Ahtna, Doyon, and CIRI ANCSA regions faces high risk of moisture and indoor air quality related issues due to a lack of adequate mechanical ventilation.

IV. Affordability

A commonly accepted definition of affordability is for a household to spend no more than 30% of total household income on housing costs[6]. Households paying more than this for mortgages, rents, fees, utilities, taxes, and insurance are considered cost-burdened. By this definition, 31% of housing units in Alaska are cost-burdened. While slightly lower than the national rate of 37%, it shows that more than 75,000 households in Alaska may have difficulty affording necessities such as food, clothing, transportation and medical care[7].

According to ACS data, the highest cost-burdened areas are primarily urban: Anchorage, Fairbanks, and Sitka.   CCHRC's analysis of the ACS affordability estimates, however, shows that the energy costs included in these numbers are systematically underestimated in rural Alaska, meaning there are likely more cost-burdened households in rural areas than these data would suggest. Additionally, the household income used in these cost-burdened estimates includes public assistance. Thus, regions that receive more federal, state, or tribal dollars, have fewer cost-burdened households than they would without this assistance.

V. Housing Need

Alaska's housing needs have been assessed using several different methodologies since AHFC began conducting Housing Assessments in 1988. Data sources used in creating this report allow reporting on three distinct housing need metrics: overcrowded housing, cost-burdened housing, and "One Star" housing.[8]

Of Alaska's approximately 252,920 occupied housing units, an estimated 15,453 housing units are considered overcrowded or severely overcrowded. This estimate is based on housing units having more than one person per room, the standard HUD definition, which is slightly different than the 200-square-feet-per-person metric used in previous housing assessments. While these metrics are not directly

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[6] http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/ accessed Feb 21, 2014
[7] Ibid.
[8] See Appendix B - Statewide Need Assessment for a breakdown of the number of housing units in each ANCSA region that are overcrowded, cost-burdened, and "One Star."

comparable, the current estimate is higher than the 2009 housing assessment estimate of 9,946 and lower than the 2005 estimate of 22,392. Overcrowding conditions can be addressed with a combination of new construction, retrofits, and affordable housing incentive programs.

According to ACS estimates, nearly 1 in 3 households in Alaska are considered cost-burdened (31%) representing an estimated 78,646 households. Of these cost-burdened households, approximately 3,580 are estimated to be both overcrowded *and* cost-burdened. It should be noted that the ACS affordability numbers are likely underestimates, as CCHRC's analysis of the energy costs included within the housing costs showed that rural Alaska annual energy costs were systematically low.

Based on energy audit data from the ARIS database, the authors estimate that 19,810 homes in the state would receive an AKWarm One Star rating. Strictly speaking, a One Star rating in AKWarm means that a home uses at least four times as much energy as that same home would if built to AHFC's 2012 BEES. These homeowners and renters are spending more money than necessary on the energy needed to maintain a comfortable environment. Collectively, these inefficient structures also increase the capital investment required to store, produce, and deliver fuels to their communities. Energy efficiency retrofits could be completed on these housing units in order to reduce the burden of high energy costs for occupants and reduce the need for new capital investment in energy production and distribution.

Based on what CCHRC believes to be the best available data, Alaska's housing needs are significant: more than 15,000 homes are overcrowded or severely overcrowded, more than 75,000 homes are cost-burdened, and nearly 20,000 homes use large amounts of energy. While the specific causes of overcrowding, high housing costs and substandard homes are often intertwined and location-specific, new construction, energy efficiency retrofits, and housing affordability programs are appropriate tools to alleviate these problems facing Alaskans throughout the state.

Introduction

This 2014 Alaska Housing Assessment identifies characteristics of the existing housing stock in Alaska. The purpose of the study is to assist housing authorities, policymakers, and builders to determine the condition of that stock and make informed decisions about where to focus funding efforts. This study follows three similar studies done in 1991, 2005, and most recently in 2009.

Previous assessments presented data about overcrowding, housing condition, and costs. This assessment will feature overcrowding and housing costs but will also highlight energy consumption and costs, which sheds light on the issues of condition and affordability. Alaska has unique energy challenges not found elsewhere in the United States. Extremely cold climates, remote communities, and high prices for imported fuels all contribute to energy costs that are much higher than national averages. This report details housing energy characteristics, usage, and costs. Energy is only one facet of understanding the housing stock in Alaska. A more complete picture includes community characteristics, overcrowding, and housing affordability, each of which are also addressed throughout this report.

Throughout this housing assessment data about community, overcrowding, energy, and affordability are presented at a variety of spatial scales from statewide to individual communities. Alaska housing characteristics are compared with national numbers in order to put them in context and provide additional reference points. Statewide comparison graphs are also available at the Census Area level in Appendix C: Chart Folio. In this statewide section, the authors also compare the regions created by the Alaska Native Claims Settlement Act (ANCSA) shown in Figure 1. Accompanying this report are written summaries for each ANCSA region and Census Area as well as detailed data profiles at the ANCSA region, Census Area, and community levels that highlight characteristics of the housing.

Figure 1: ANCSA Regions
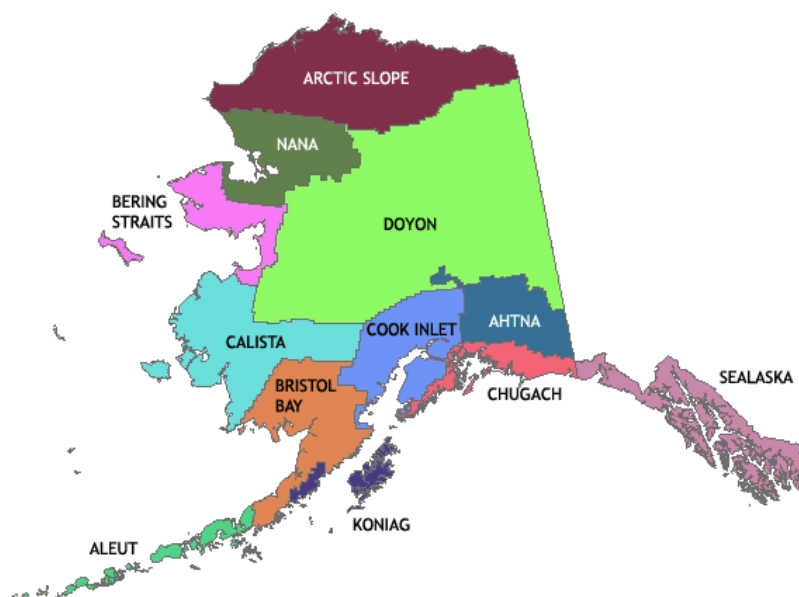
Data Sources

In 2005 and again in 2009, Alaska Housing Finance Corporation (AHFC) contracted with the Cold Climate Housing Research Center (CCHRC) to conduct an Alaska Housing Assessment. In both instances, CCHRC partnered with Information Insights. The research method was to conduct phone surveys and use census data to produce information about housing units and types, housing size, housing age, condition of the housing unit, number of occupants, occupant income level, construction costs, population trends, and overcrowding.

In 2012 AHFC contracted with CCHRC to generate another housing assessment. CCHRC's research method for the 2014 Housing Assessment combines information from the Census, American Community Survey (ACS), and Alaska Retrofit Information System (ARIS) to produce housing information relating to general housing and population characteristics, and characteristics of energy, affordability, and overcrowding. Each of these data are reported at the statewide level, ANCSA level, census area level, and, where available, at the community level. This methodology was reviewed by staff at the University of Alaska Anchorage Institute for Social and Economic Research.

ARIS contains the energy rating and assessment files produced as homes participate in AHFC's three home energy efficiency programs—the Home Energy Rebate Program (HERP), the Weatherization program, and the Building Energy Efficiency Standard (BEES) for new construction certification program. In these programs homes receive energy ratings using AHFC's AKWarm modeling software to characterize basic features and construction type in addition to their energy performance. Data from the ratings are uploaded into ARIS. In November of 2012 when the data for this study was retrieved, ARIS contained data from over 95,800 HERP ratings and Weatherization assessments gathered from either pre- or post-energy retrofit homes or from new construction certifications (BEES). These ratings and assessments are for more than 71,900 unique locations. This number represents approximately 25% of Alaska's roughly 300,000 total housing units and approximately 30% of Alaska's occupied housing stock. The combination of ARIS data and census information from the recently completed 2010 decennial census and 2007 - 2011 American Community Survey 5-year Estimates (ACS) provides a unique tool to assess Alaska's current housing stock.

Census and ACS data provide information on total population, total housing units, income, household size, home age, occupancy, overcrowding, housing costs, and affordability. ARIS rating data provide information about energy use and efficiency, energy costs, building envelope characteristics, air tightness, ventilation, and rates of participation in energy programs. Where available, data are reported at the community, census area, regional, and state level. In addition to Census and ACS data, 56 communities or census-designated places (CDPs) have sufficient data to display current information about housing and energy characteristics by decade built. A further 118 communities or CDPs have sufficient data to display current information on housing and energy characteristics by pre- or post-retrofit status or by new construction status. Finally, 114 communities or CDPs had insufficient data to protect homeowner confidentiality and to make statements about the housing and energy characteristics. This combination of information presented is not directly conclusive, with causal links

established between the data and outcomes or conclusions. Instead it is illustrative, providing foundational information to be cited elsewhere and providing suggestions for areas of future research.

The U.S. Energy Information Administration's "2009 Residential Energy Consumption Survey" (RECS) estimates household energy characteristics using a randomly sampled survey of approximately 12,100 housing units nationwide. RECS estimates are presented for a variety of different categories, including geographic location, climate zone, and fuel type, among others. The RECS estimates reported here are for the U.S. Western region and for "cold"/"very cold" climates; the boundaries of these regions can be found in Figure 2 and Figure 3 below.

Figure 2: 2009 Residential Energy Consumption Survey / Building America Climate Zones
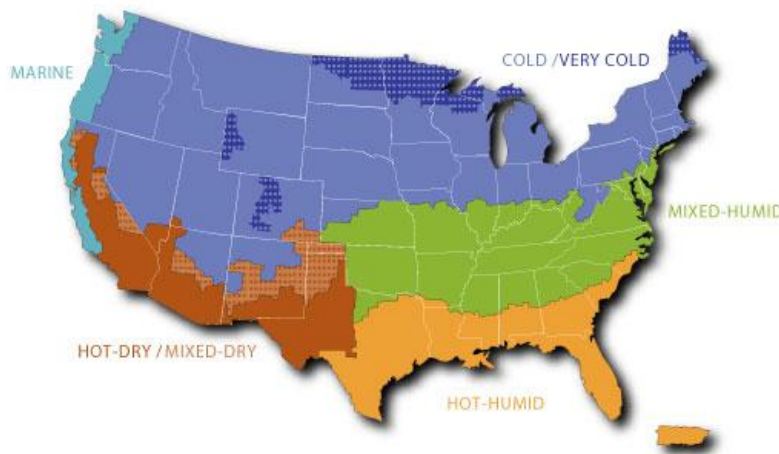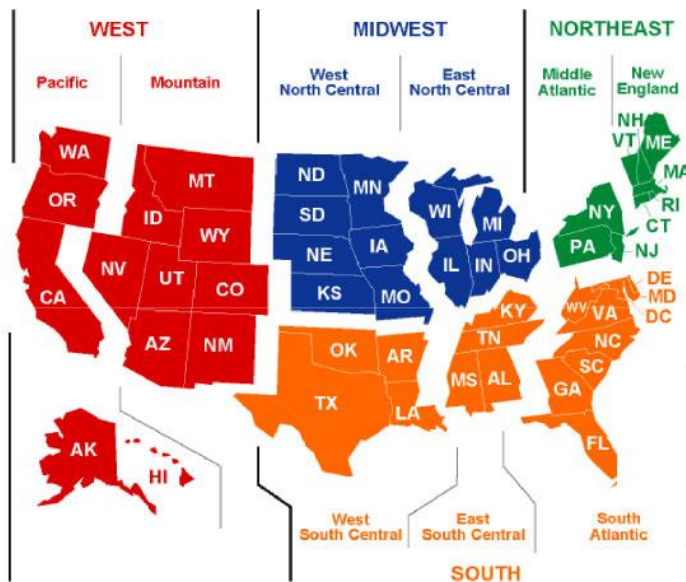

Figure 3: 2009 Residential Energy Consumption Survey Regions

It should be noted that all of the data sources used in the assessment have shortcomings. For a detailed discussion of these shortcomings, please see Appendix B: Data Limitations.

I. Community

Alaska's estimated population of 735,132 represents only 0.2% of the 316 million people living in the United States[9], yet Alaskan residents are scattered throughout a mostly road-less state that is roughly one-fifth the size of the contiguous United States. The majority of the population is concentrated in Southcentral Alaska, but the state has a higher percentage of people living outside of large urban areas, 55.5%, than the nationwide average of 28.8%.[10]

There are some similarities in the housing stocks of Alaska and the nation as a whole. There are comparable percentages of renters (36% and 34% for Alaska and the U.S., respectively) and homeowners (64% and 66%). Both the U.S. and Alaska have similar proportions of detached single-family homes, at 62%, and reasonably similar numbers of multi-family buildings with fewer than 10 units. Nationally there are more large multi-family buildings with 20 or more units, at 8.3%, than in Alaska, which has 4.8%.

The age of the housing stock in Alaska differs significantly from the nationwide average, with more than half (53%) of all housing units in Alaska estimated to be built in the oil pipeline boom days of the 1970s and 1980s. Nationally, 30% of the housing stock was built during the same period, with a larger percentage being older than that of Alaska.[11] The average size of housing in Alaska differs from the national average (Figure 4). While average home sizes were similar between Alaska and the nation in the 1970s, the U.S. average has increased each decade since then, outpacing the relatively more modest increases found in Alaska. For homes built in the 2000s, the average building size in the United States is estimated by RECS to be 2,465 square feet, which is 584 square feet larger than the average home size in Alaska of 1,881 square feet, estimated using ARIS data.

Figure 4: Trends in Building Size

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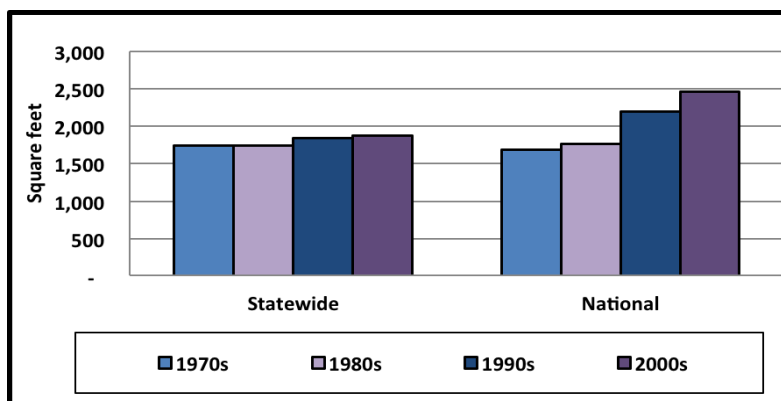
[9] 2013 estimate from: U.S. Census Bureau. "Alaska QuickFacts". Retrieved from http://quickfacts.census.gov/qfd/states/02000.html

[10] Defined as areas with more than 50,000 people. See http://www.census.gov/geo/reference/ua/urban-rural-2010.html for a more detailed definition.

[11] U.S. Census Bureau. (2007-2011). United States, DP04 Selected housing characteristics in the United States. *2011 American Community Survey 5-Year Estimates*. Retrieved from http://factfinder2.census.gov

Within Alaska, regional average house sizes vary by approximately 1,000 square feet (Figure 5). On average, the smallest homes are found in Western and Northern Alaska, with homes in the Calista and NANA regions averaging less than 1,000 square feet. The largest homes are found in the CIRI region and average nearly 1,900 square feet, or approximately two times the size of Calista and NANA homes. Despite having the largest average size, household energy costs in the CIRI region are the lowest in the state.

**Figure 5: Average Housing Unit Size by ANCSA Region**
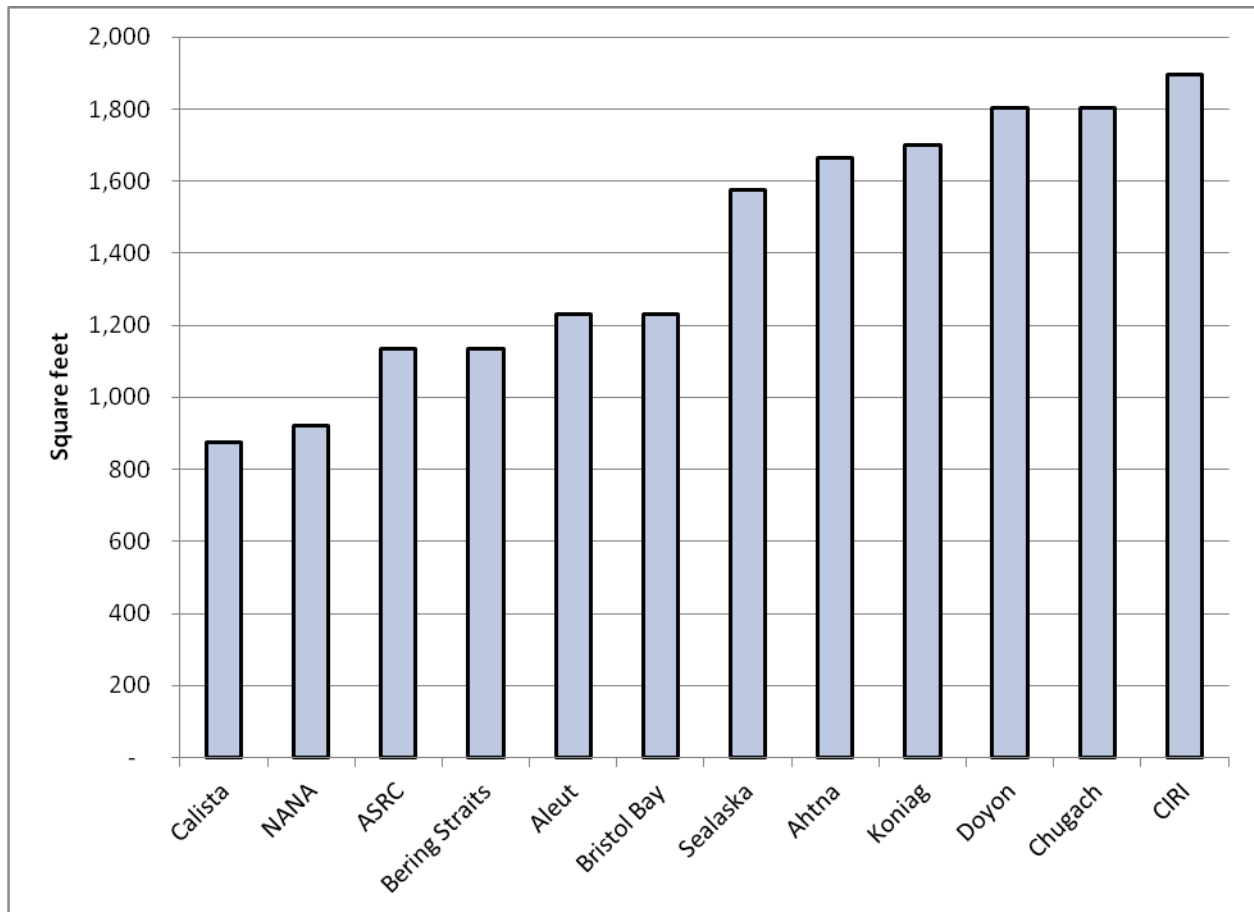
II. Overcrowding

Statewide the rate of overcrowding is twice as high as the national average (Figure 6). The least overcrowded ANCSA region, Sealaska, still has a higher overcrowding rate than the national average, and the most overcrowded region, Calista, has an overcrowding rate more than 12 times higher than the national average. While "overcrowding" is a subjective term, in this report it follows the U.S. Department of Housing and Urban Development's criteria, which are based on the level at which health and childhood education begins to suffer because of crowded conditions.[12,13] An "overcrowded" home

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[12] Blake, Kevin, Kellerson, Rebecca, and Simic, Aleksandra. "Measuring Overcrowding in Housing." U.S. Department of Housing and Urban Development Office of Policy Development and Research. Prepared by

is defined as having more than one person per room, and a "severely overcrowded" home as having more than 1.5 people per room. In this case, "rooms" are any space that is separated by a partial or complete wall, including kitchens, living rooms, dining rooms, bedrooms, etc., but not including bathrooms, porches, balconies, foyers, halls, or unfinished basements.

Figure 6: Percent of Overcrowded Housing in Alaska vs. Nation
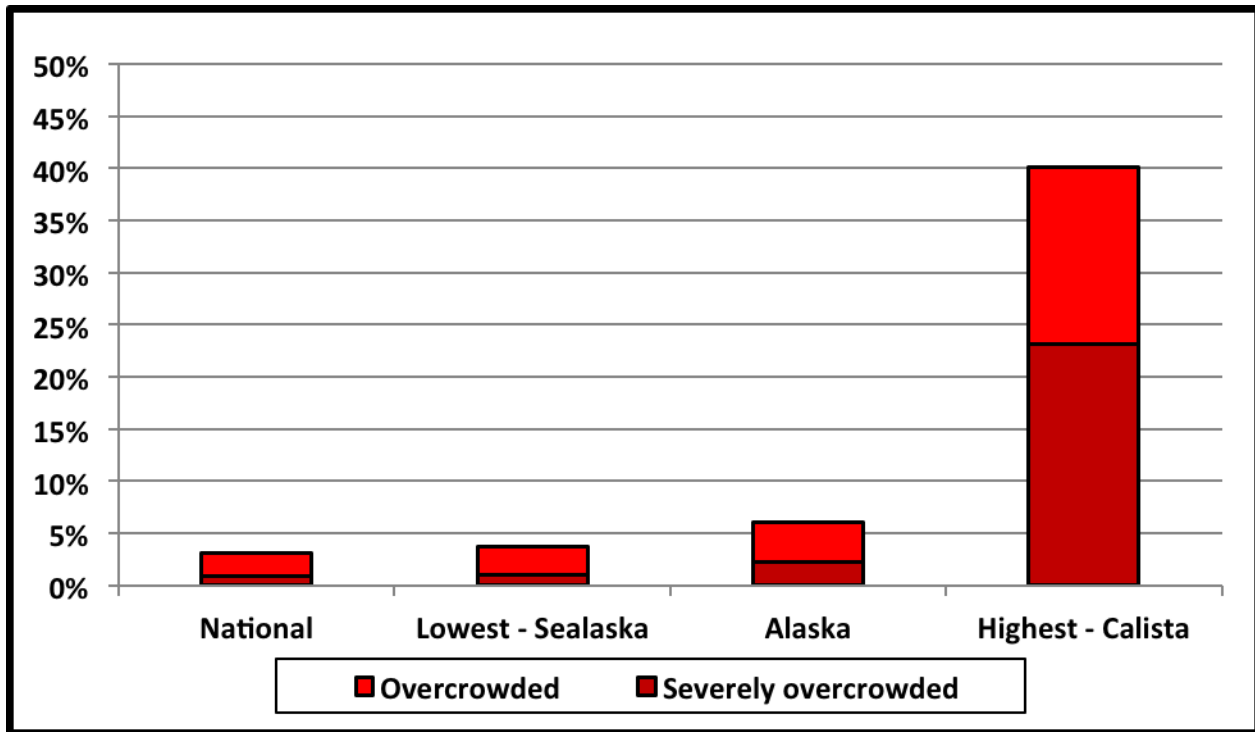
There is significant variation in overcrowding rates throughout Alaska (Figure 7). The three lowest rates of overcrowding are found in regions that include Alaska's largest population centers: Sealaska, CIRI, and Doyon. In contrast, rates are significantly higher in Western and Northern Alaska. Both the Arctic Slope and the Bering Straits regions have more than five times the overcrowding found in Sealaska and CIRI. The NANA and Calista region have more than 10 times the level of overcrowding found in these population centers. Both the NANA and Calista regions have very high rates of overcrowding, with an estimated 39% and 40%, respectively.
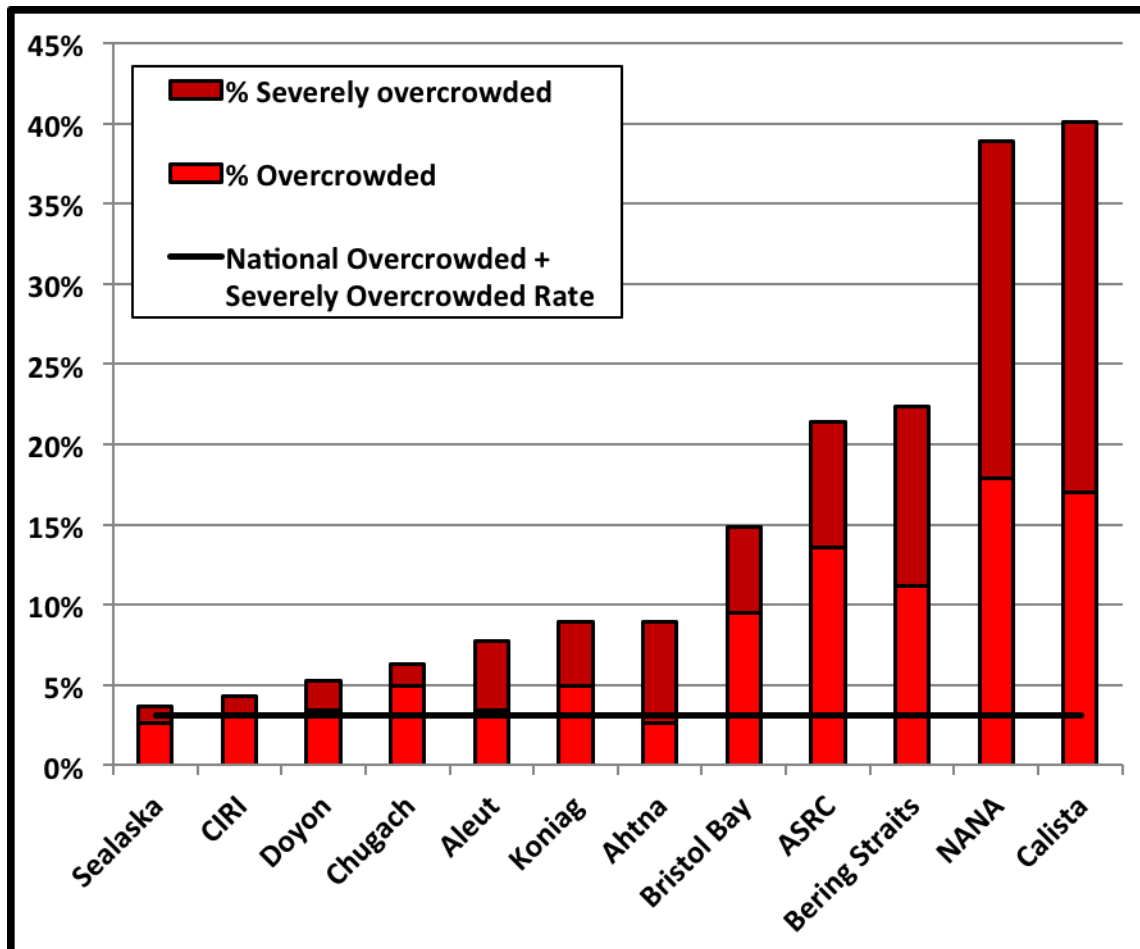
Figure 7: Overcrowding by ANCSA Region

III. Energy

Fuels

Housing stock in Alaska has pronounced differences with nationwide averages when it comes to energy, starting with primary heating fuel types. Statewide, fuel oil is used in approximately 33% of housing units versus less than 7% of housing units nationwide. Fuel oil prices in Alaska also differ from national numbers. The price per gallon of 100 surveyed communities in Alaska averaged $5.86/gallon in January of 2013, nearly $2 more than the national average of $3.98 at that time.[14] In the most remote Alaskan communities this price can be even higher, with regional maximum prices ranging from $5.83 in Southeast to $10.00 in the Interior.[15]

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[14] "Alaska Fuel Price Report: Current Community Conditions" Alaska Department of Commerce, Community, and Economic Development. January 2013. Available online at:
http://commerce.alaska.gov/dca/pub/Fuel_Report_2013_January.pdf
[15] Ibid. Excludes subsidized fuel in the North Slope region.

Energy Consumption

Based on data from the ARIS database, it is estimated that the average housing unit in Alaska uses more than twice the amount of energy per year than the average housing unit located in the "cold"/ "very cold" climate regions of the United States, and more than three times the energy of units in the Western region (Figure 8). Alaska's relatively high space heating energy consumption is largely due to climate. The Building America "cold" climate region[16] has between 5,400 and 9,000 heating degree days[17] per year and the "very cold" climate region has between 9,000 and 12,600 heating degree days per year. The average heating degree days in the southernmost portion of the Alaska Panhandle is approximately 7,000 heating degree days per year, while the average in Interior Alaska is approximately 14,000 heating degree days per year and the North Slope is approximately 20,000 per year.

Figure 8: Annual Energy Use in Alaska vs. National Residential Energy Consumption Survey Estimates
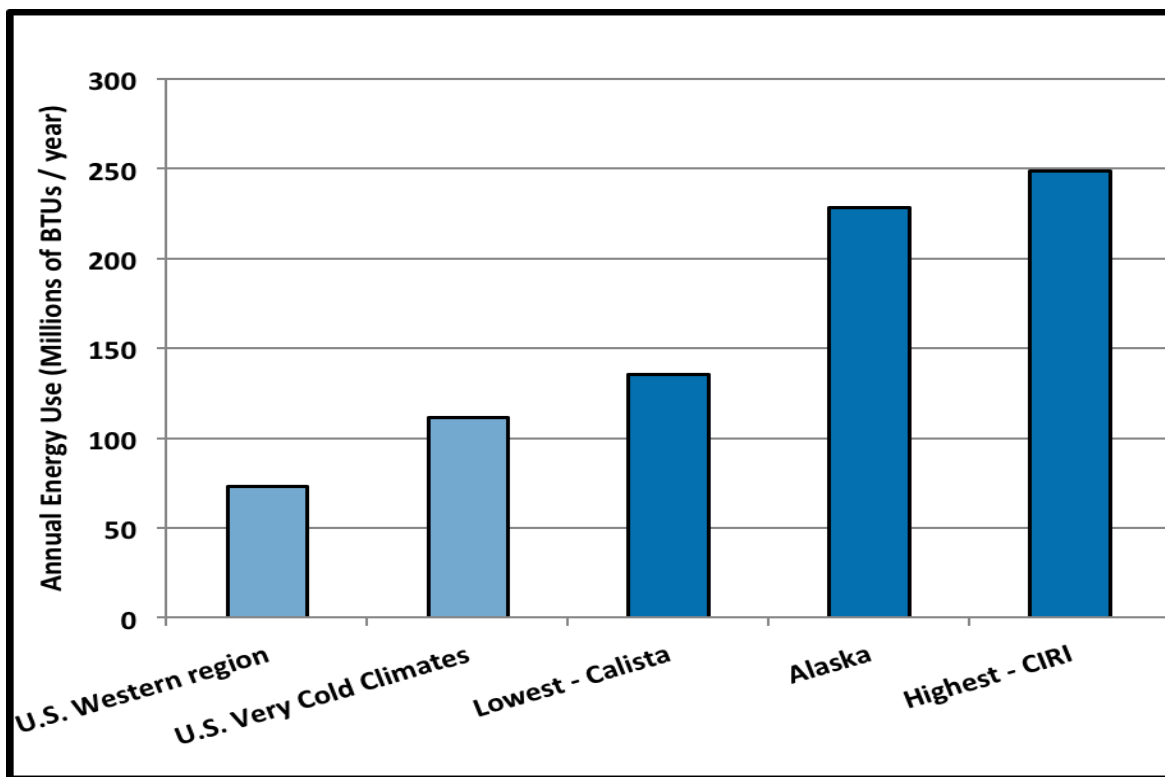
The ANCSA region with the highest average annual home energy usage, CIRI, uses approximately 2.2 times more energy than the national average. Calista is the ANCSA region with the lowest average annual home energy use and it uses 1.2 times more energy than the U.S. averages.[18]

[16] See Figure 2 for map.

[17] Heating Degree Days— A measure of the heating requirement for a geographic location that is calculated based on the time and magnitude that the temperature stays below a base temperature of 65-degrees Fahrenheit.

[18] Note that this is total consumption of a building, so the relatively small average building size plays a large part in Calista having the lowest energy use.

Energy consumption can also be analyzed using a quantity known as Energy Use Intensity, or EUI, that normalizes total energy use by square footage. Using this metric, Figure 9 shows that the average Alaska EUI is approximately 2.7 times the U.S. "cold" / "very cold" climate average, and 3.2 times the U.S. Western region average. The Bering Straits region has the highest EUI in Alaska, using more than four times the energy per square foot as an average home in the U.S. Western region. The lowest EUI in the state, found in the Aleut region, is more than twice the U.S. average for "cold" / "very cold" climates.

Figure 9: Annual Energy Use Per Square Foot (EUI) in Alaska vs. National Residential Energy Consumption Survey Estimates
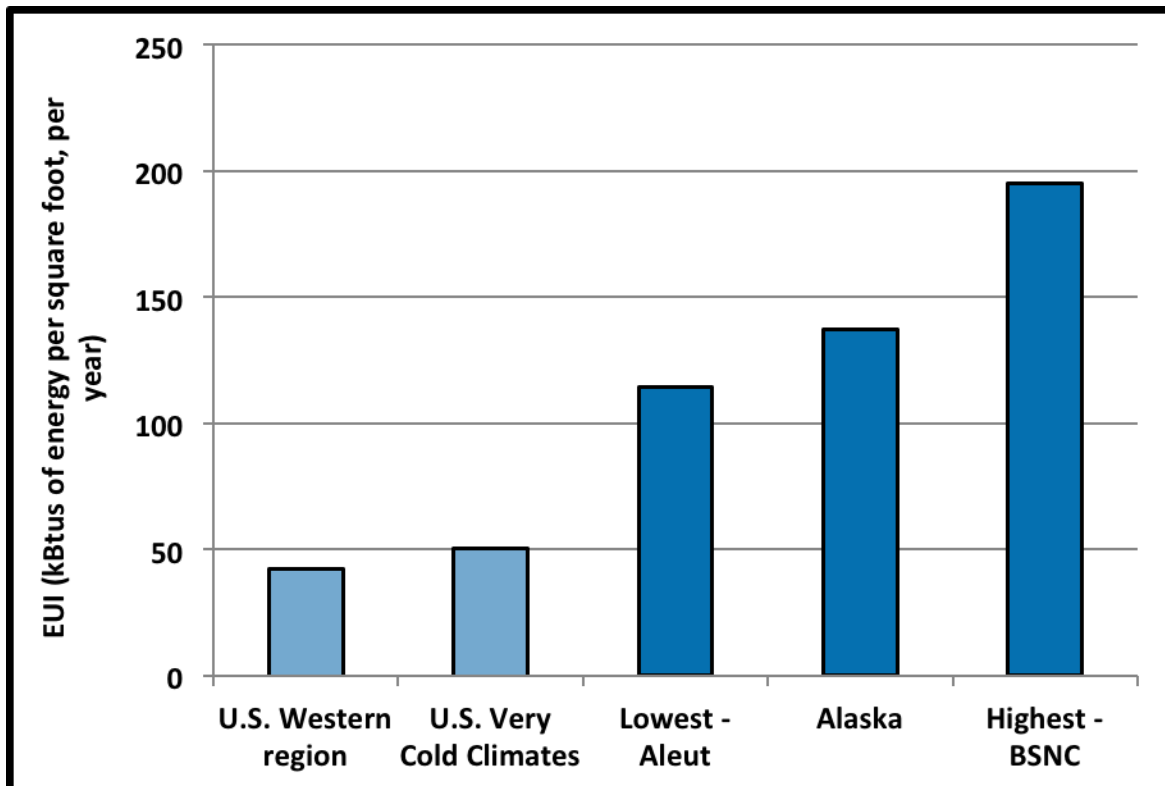
When comparing residential energy efficiency between regions with different climates, the home heating index is often used. The home heating index is a measure of the energy used for space heating in a building normalized by square footage and climate; thus it can be used to compare the energy efficiency of homes even when they have different sizes and are located in different climates. While there are no national estimates of average home heating index, Figure 10 shows the average home heating index for Alaska's ANCSA regions. A home heating index of greater than 10 is considered "very poor", meaning the homes are very energy inefficient and require significant fuel for space heating. Home heating indices of 7.5 to 10 are "poor", and home heating indices of 5 – 7.5 are considered "moderate". There are no ANCSA regions with average home heating indices better than the moderate range. In Alaska the ASRC and NANA regions have the lowest average home heating indices or interpreted another way are the most energy efficient homes in the state for space heating. The least

energy efficient homes are found in the Bering Straits and Sealaska regions, where average home heating indices are greater than 10.

Figure 10: Average Home Heating Index by ANCSA Region
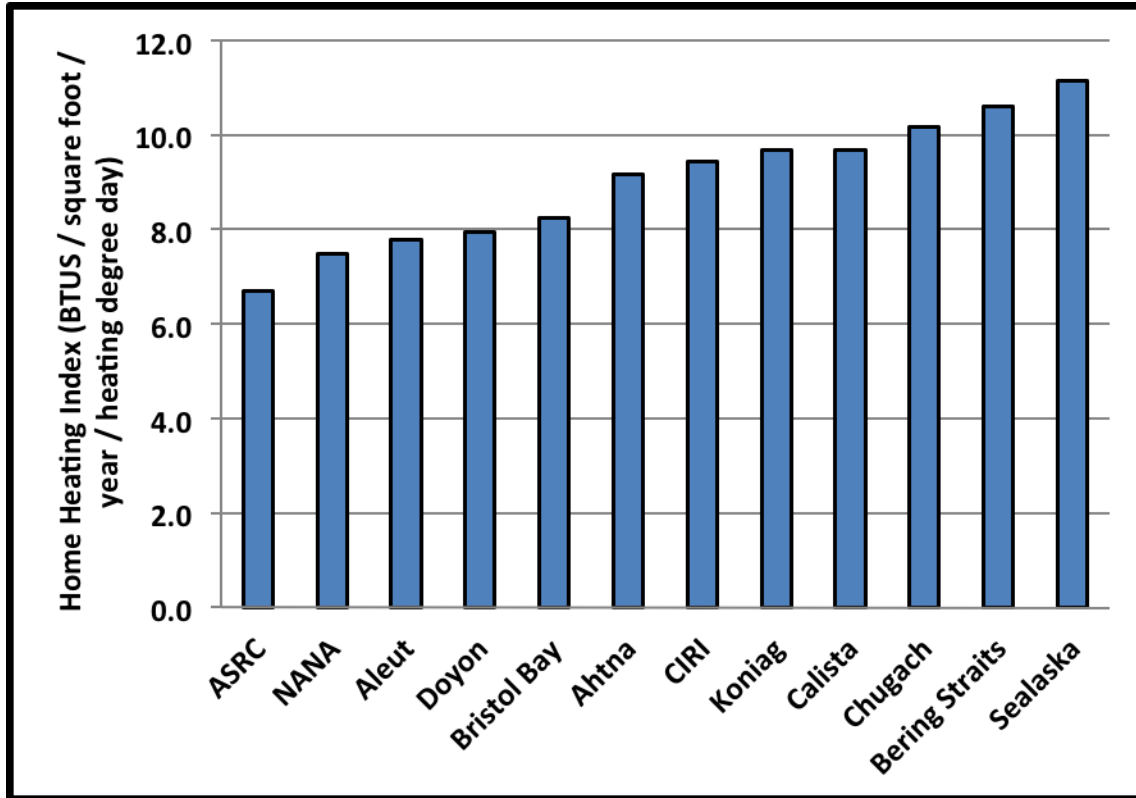
Energy Costs

Energy costs in Alaska are significantly higher than national averages (Figure 11). Alaska's statewide average annual energy costs ($4,681) are more than twice the national average. The statewide average is lower than that of all regions except CIRI and the Arctic Slope. The lowest costs in the state are found in the CIRI region ($3,123), where more than half of the state's population resides. This cost is still 50% higher than the national average. The highest annual energy costs in the state can be found in the Doyon region, where the average household is estimated to spend more than $8,000 on home energy per year, more than 5 times the average household cost of energy in the U.S. Western region.

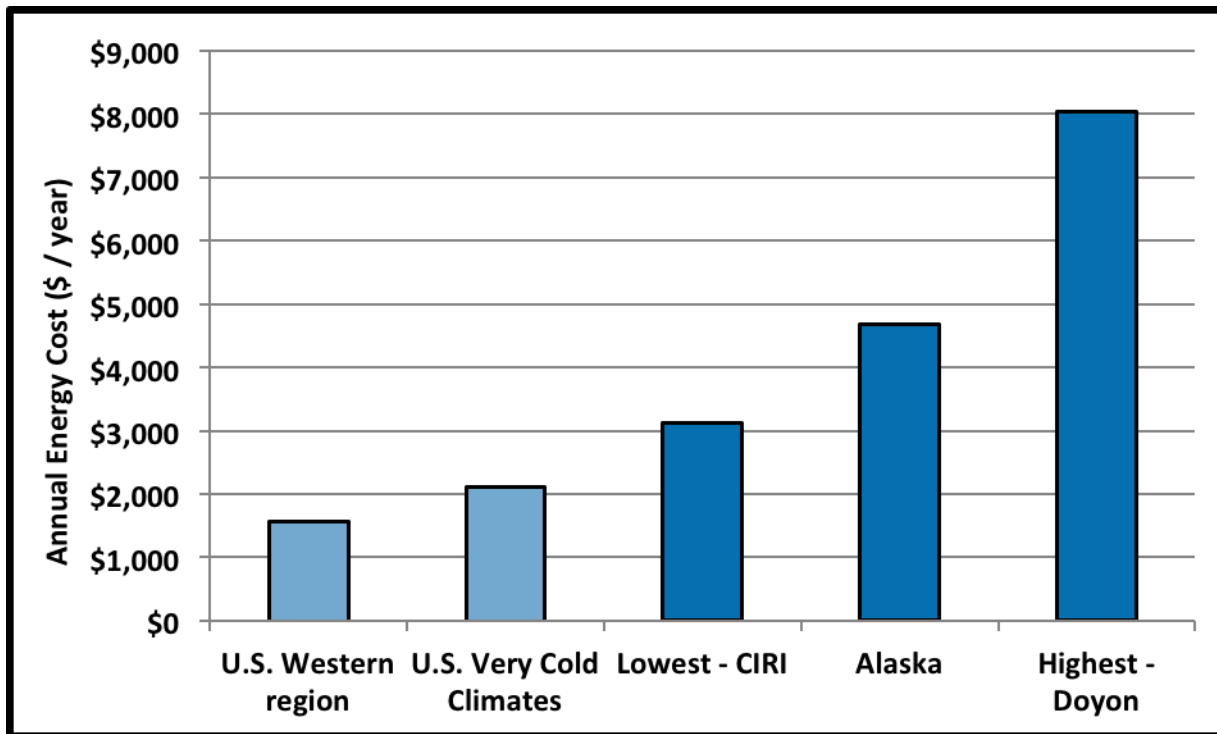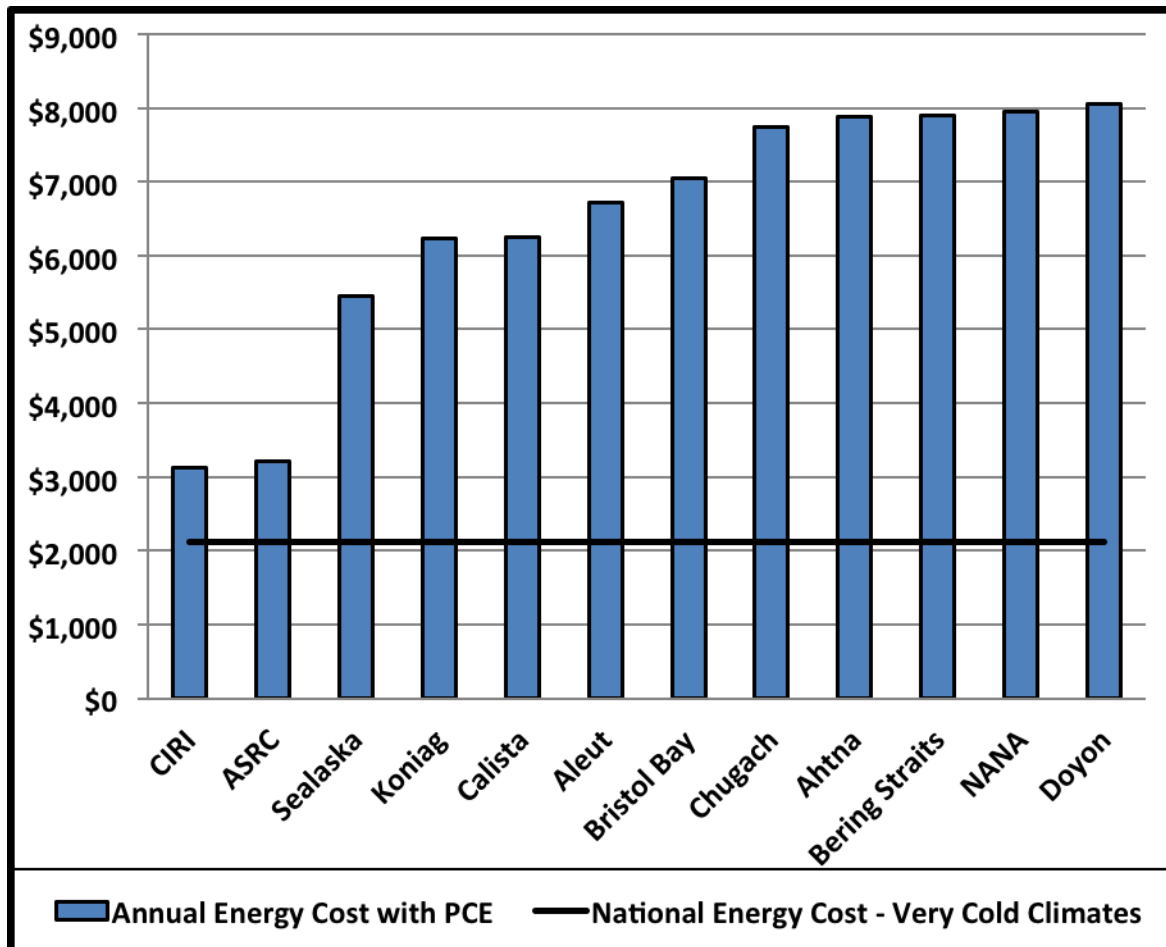**Figure 11: Annual Energy Cost in Alaska vs. National Residential Energy Consumption Survey Estimates**

Figure 12 shows the average ANCSA regional energy costs in Alaska, as compared to the national annual average energy cost of $2,129 for "cold" and "very cold" climates that is estimated by the Residential Energy Consumption Survey (RECS). Each region in Alaska has a higher estimated average annual energy cost than the "cold" / "very cold" region average. The highest costs in Alaska are found in Interior and Northwestern Alaska, as these areas have some of the highest heating loads and most expensive fuel oil prices in the state. The highest annual energy costs are found in the Doyon region, where the annual energy cost of $8,046 is nearly four times the national average. The NANA region has approximately the same average annual energy cost as the Doyon region, although the average house size is nearly half of the average house size in Doyon.

The lowest energy costs in Alaska are found in the CIRI and ASRC regions. These two regions feature annual energy costs that are at least $3,000 less than the majority of the other ANCSA regions in part because many have access to low-priced natural gas. Heating oil is also subsidized in areas of the ASRC region that do not have access to natural gas. Although CIRI and ASRC households have similar energy costs, there are regional differences with homes in CIRI being approximately 67% larger than homes in ASRC.

Figure 12: Average Annual Energy Cost by ANCSA Region

Legend: Annual Energy Cost with PCE — National Energy Cost - Very Cold Climates

The average energy cost index (ECI) normalizes energy use for home size by considering the energy cost per square foot of a home. Figure 13 shows that when comparing ECIs, Alaska spends even more on energy costs relative to national averages. At one extreme, the NANA region spends more than 9 times as much on energy per square foot than the U.S. average for "cold" / "very cold" climates. CIRI, the lowest cost region in Alaska, spends approximately 82% more on energy per square foot than the national average annually.

Figure 13: Annual Energy Cost Per Square Foot in Alaska vs. National Residential Energy Consumption Survey Estimates
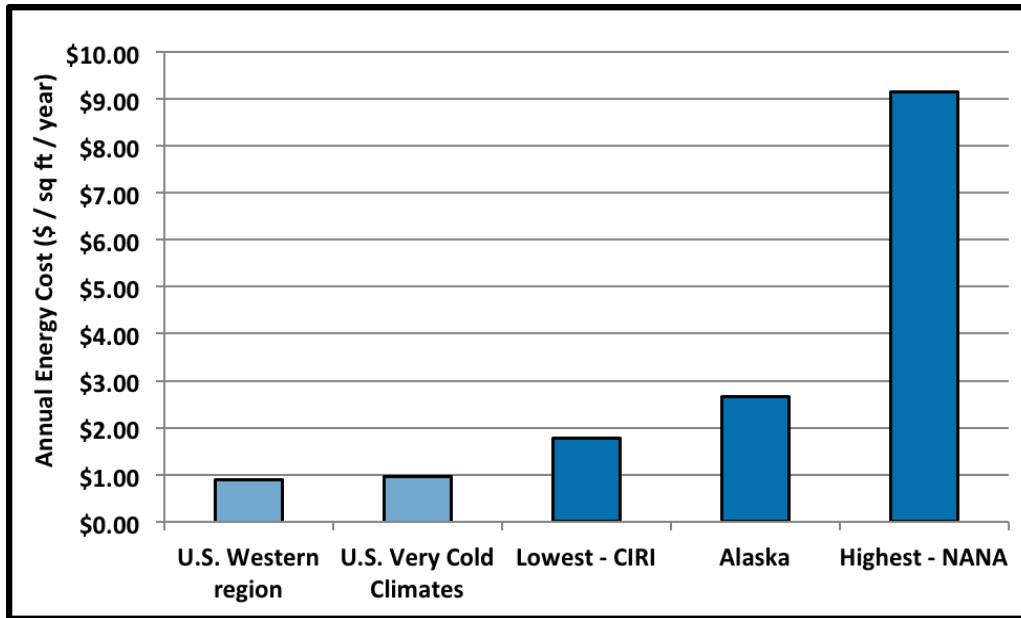
Figure 14 compares the average ECI for each of Alaska's regions, with the RECS national average ECI for "cold" and "very cold" climates as a reference point. Within Alaska, the highest average ECI is found in the NANA region, followed by the Bering Straits and Calista regions. These regions do not have the highest total annual energy cost because they have significantly smaller average housing unit sizes than the region with the highest total annual energy cost, Doyon. CIRI and Arctic Slope are the regions with the lowest annual energy costs and the lowest ECIs. They are also the two regions with the largest percentage of homes with access to natural gas.

Figure 14: Average Energy Cost Index by ANCSA Region
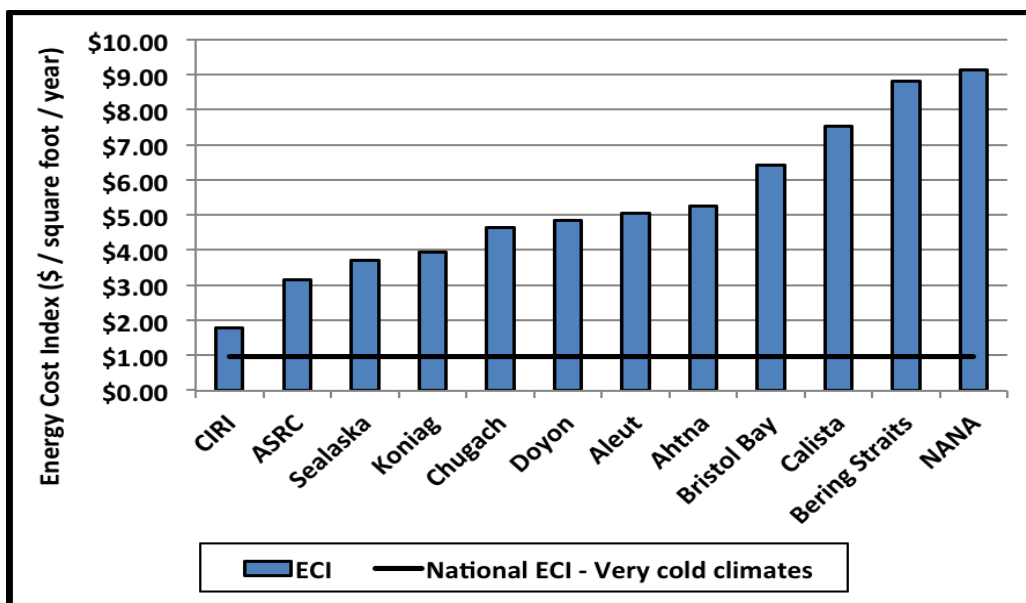
Energy Programs

Alaska is one of 12 states that do not have a mandatory building energy code that meets 2006 International Energy Conservation Code (IECC) (Figure 15).[19] Alaska does have the Building Energy Efficiency Standard (BEES) program that is administered by AHFC and is mandatory for buildings that receive financing from AHFC. CCHRC's analysis of the number of homes that were certified to meet BEES from 2005 to 2011 as compared to the number of buildings that were constructed in that same period shows that approximately 53% of constructed housing units were certified to meet the standard.
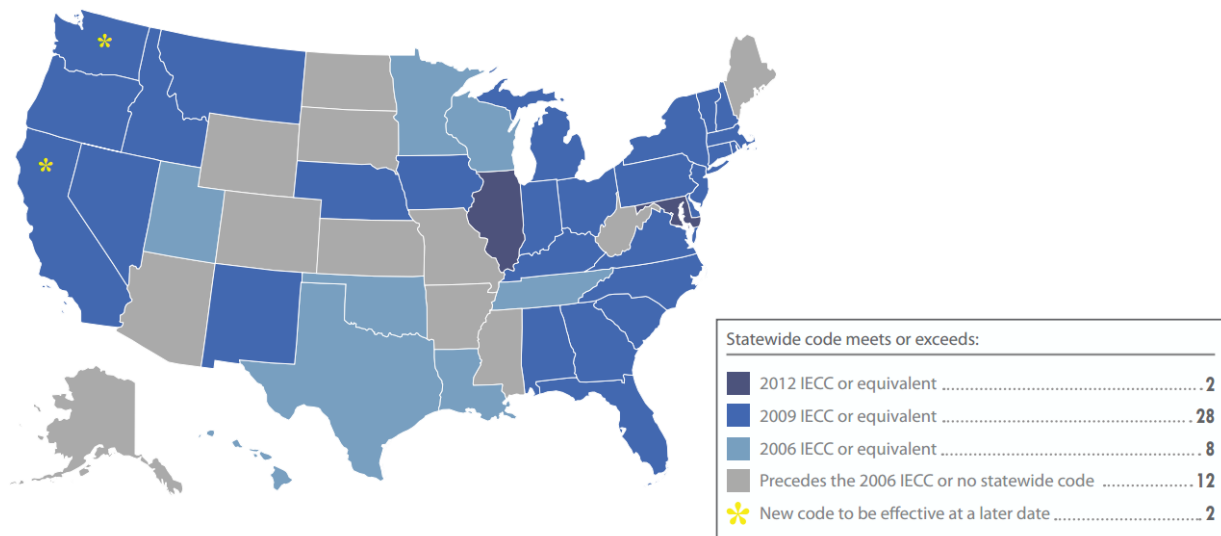
Figure 15: 2013 Residential Building Energy Code Status by State

In Alaska two retrofit programs focus specifically on residential space heating energy efficiency: the Home Energy Rebate Program and the Weatherization Assistance Program. These programs are administered by AHFC, and the data is tracked in ARIS. The Home Energy Rebate Program provides rebates to homeowners completing energy efficiency upgrades to their homes. The Weatherization Assistance Program provides energy retrofits for households with demonstrated need.[20] These two energy efficiency retrofit programs have been funded primarily by the state, and have been proven to be effective at reducing residential energy use and costs in older construction[21,22]. Nationwide, utilities sponsor or contribute to approximately 90% of the residential space heating/cooling energy efficiency

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[19] Downs, Annie, Chittum, Anna, Hayes, Sara, et. al. (November 2013). *The 2013 State Energy Efficiency Scorecard.* American Council for an Energy-Efficient Economy. Retrieved from: http://www.aceee.org/sites/default/files/publications/researchreports/e13k.pdf

[20] Burbage, Mimi, Flora, Stacy. (2013). Weatherization Operations Manual: 2013. Alaska Housing Finance Corporation. Retrieved from: http://www.ahfc.us/files/3513/6492/8425/wom2013.pdf

[21] Dodge, Kathryn, N. Wiltse, B. Valentine. (2012). Home Energy Rebate Program Outcomes. Cold Climate Housing Research Center. Retrieved from: http://www.cchrc.org/docs/reports/HERP_final.pdf.

[22] Dodge, Kathryn, N. Wiltse, B. Valentine. (2012). *Weatherization Assistance Program Outcomes*. Cold Climate Housing Research Center. Retrieved from: http://www.cchrc.org/docs/reports/WX_final.pdf.

programs available. In contrast, the primary funding for energy efficiency programs in Alaska comes from the State. Utilities are not required to contribute to them.[23]

Three primary residential energy efficiency programs are offered statewide. Participation in the Home Energy Rebate and Weatherization retrofit programs, and the BEES certification program varies by region (Figure 16). Understanding regional variations in participation is essential to targeting work and resource allocation. In general, the highest rates of participation in the Weatherization program are found in areas of rural Alaska, whereas the Home Energy Rebate and BEES programs are utilized more often by regions with large urban areas, such as the CIRI and Doyon regions. One possible factor contributing to differences in participation is that a higher percentage of rural households meet Weatherization eligibility requirements.[24] Secondly, the BEES program may have higher participation in urban areas because more homes are being built in fast growing areas such as the Matanuska-Susitna Borough.

In the Bristol Bay region 27% of occupied housing has participated in one of the programs, the highest percentage in the state. The majority of Bristol Bay's participation has been through Weatherization, with 21% of occupied homes having completed a Weatherization retrofit, the highest participation in the Weatherization program of any ANCSA region in the state. The other two efficiency programs, the BEES and Home Energy Rebate programs, have seen the highest participation in the CIRI region, with 13% and 8% of occupied homes completing those programs, respectively. Other areas of Alaska have seen lower participation in energy efficiency programs. The lowest participation occurs in the Aleut region, where 9% of occupied housing has completed one of the efficiency programs. At 2%, the Aleut region also has the lowest percentage of occupied housing that has been certified to meet BEES. The Koniag region has participated least in the Weatherization program, with 2% of occupied housing completing a retrofit. The Home Energy Rebate Program has seen the lowest participation in the Bering Straits region, where approximately 1% of housing units have completed the program.

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[23] LeBaron, Robin and Rinaldi, Kara Saul. (December 2010) "Residential Energy Efficiency Retrofit Programs in the U.S. *The National Home Performance Council.* Retrieved from:
http://www.nhpci.org/images/NHPC_WHRetrofitReport_201012.pdf
[24] Dodge, Kathryn, N. Wiltse, B. Valentine. (2012). *Weatherization Assistance Program Outcomes*. Cold Climate Housing Research Center. Retrieved from: http://www.cchrc.org/docs/reports/WX_final.pdf.

Figure 16: Percent of Occupied Housing Completing an AHFC Energy Program by ANCSA Region
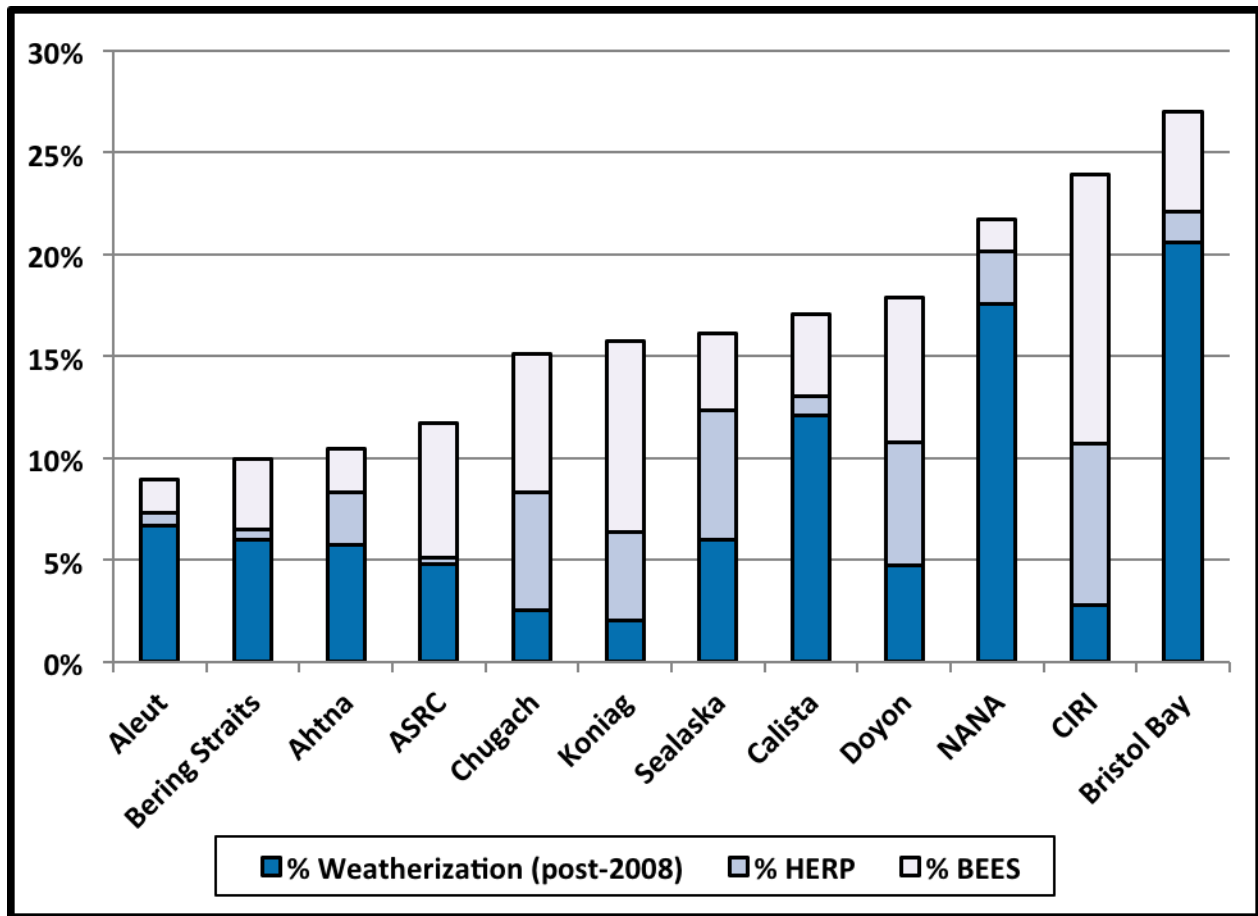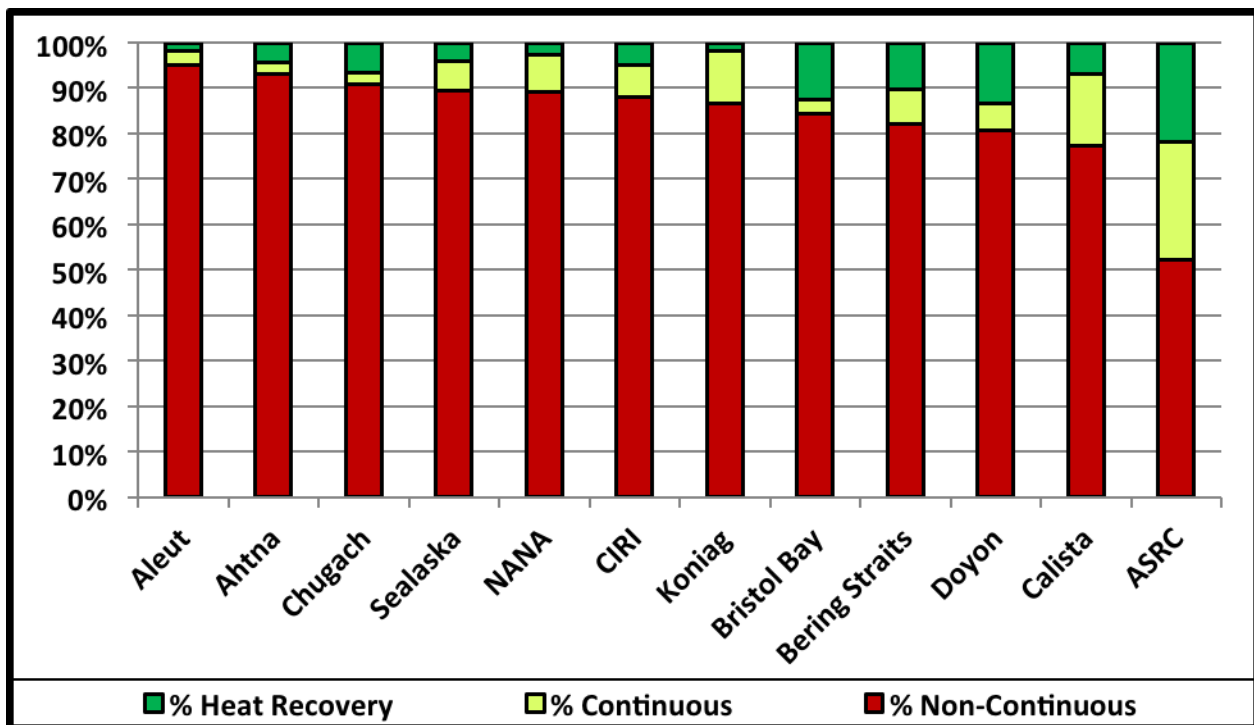

Ventilation

In Alaska's cold climate, an airtight, continuously ventilated home is essential for occupant health, comfort, and building durability. In homes built without modern air-sealing and ventilation systems, fresh air for occupants is provided haphazardly though leaks in the building. This uncontrolled leakage can cause a variety of problems: polluted air can be sucked in through attached garages, crawl spaces, etc.; the amount or location of fresh air may be insufficient to maintain good indoor air quality; and cold drafts can hinder occupant comfort. Additionally, air leakage can drive water vapor into unwanted places where, because of the potentially extreme temperature differences between indoor and outdoor air, it can condense and cause harmful mold and rot. Homes with a well-sealed air barrier and continuous mechanical ventilation system avoid these problems by reliably providing fresh air to occupants and minimizing drafts and water vapor movement.

For this report, ventilation systems are categorized into three main types: non-continuous, continuous, and heat recovery ventilation systems. Homes classified with "non-continuous" systems either have no ventilation system installed or have ventilation equipment such as bath and kitchen exhaust fans that do not run on a continuous basis. Continuous mechanical ventilation systems are either exhaust-only or balanced systems that run continuously, or based on sensors/timers that ensure that fresh air is being

introduced to the home at a regular rate. Heat recovery ventilation systems, or HRVs, are a type of continuous ventilation system that recovers the heat from exhaust air and transfers it to incoming fresh outdoor air, effectively saving energy while providing healthy indoor air quality. In many areas of Alaska the rate of installation of continuous mechanical ventilation or HRV systems has increased in recent years due in large part to efforts in the ongoing retrofit programs and through BEES certification. In some areas, the rate of installation of such systems has lagged behind the air-tightness improvements that have been made by homeowners and housing agencies.

Figure 17 shows the ventilation types found in housing units in Alaska's regions. The ASRC region has the highest adoption of both continuous mechanical ventilation and HRV systems, with an estimated 48% of homes having such a system installed. This is one reason that the ASRC region has the third lowest percentage of housing units at high risk for moisture and indoor air quality problems (see Figure 18). The lowest percentage of installed ventilation systems in housing units is found in the Aleut region, where 5% of homes have continuous mechanical ventilation or an HRV.

Figure 17: Ventilation Types by ANCSA Region

Homes that are relatively airtight but lacking a continuous mechanical ventilation system are at higher risk of moisture and indoor air quality problems than houses that have adequate ventilation from either a dedicated ventilation system or leaky building envelope. More than half of the homes in the Chugach, Ahtna, Doyon, and CIRI regions are at high risk of such problems (Figure 18). This metric does not mean that moisture or indoor air quality problems have been detected but indicates that data have shown the homes to be at risk. In the Doyon and CIRI regions the percentage of housing units at high risk for such problems reaches 64% and 65%, respectively. As these two regions are the most populous regions in

Alaska, accounting for more than 70% of the state's population, this suggests that a large percentage of Alaskans are at high risk for problems associated with high moisture levels and poor indoor air quality. The Calista region has the lowest percentage of housing units at high risk for problems associated with inadequate ventilation. One factor influencing this is that the Calista region has the second highest adoption of continuous mechanical ventilation and HRV systems in Alaska, with approximately 23% of homes having such a system installed.

Figure 18: Percent of Housing Stock at High Risk of Moisture and Indoor Air Quality Issues
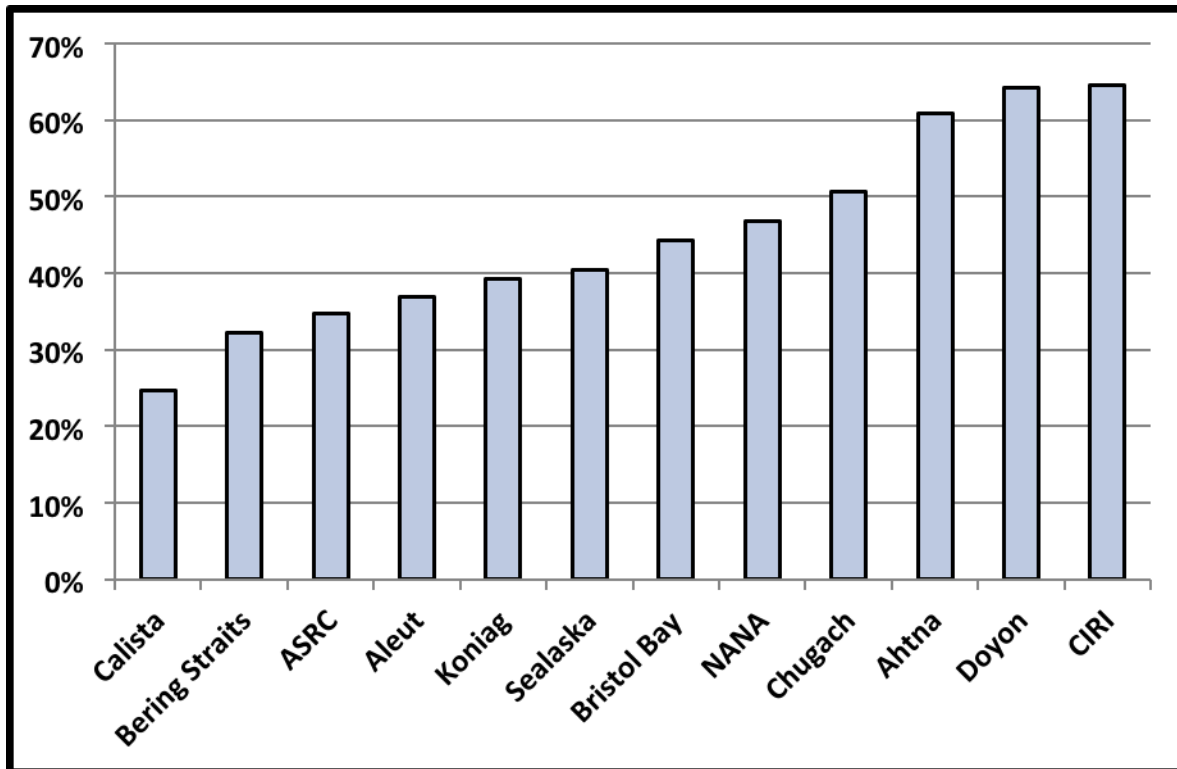
IV. Affordability

Housing affordability is the one area of housing need in this report where the Alaska averages do not exceed the nationwide numbers (Figure 19). Nationwide, approximately 37% of housing units are considered cost-burdened[25]. Statewide approximately 32% of housing units are cost-burdened, with the highest rates found in the CIRI region (34%) and the lowest rates found in the ASRC region (13%). Roughly 1 in 3 Alaskan households are potentially unable to afford basic necessities because of high housing costs. ACS estimates are the most comprehensive data available for cost-burdened housing, but CCHRC's analysis has found that energy costs are systematically underestimated in areas outside of Anchorage. Thus, the actual number of cost-burdened housing units is likely to be higher than this estimate, especially in rural Alaska. For more information about the analysis of ACS energy costs, see Appendix A, "American Community Survey Energy Cost Estimates".

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[25] Households are considered cost-burdened if reported housing costs are 30% or more of total household income.

Figure 19: Percent Cost-Burdened Housing in Alaska vs. Nationwide
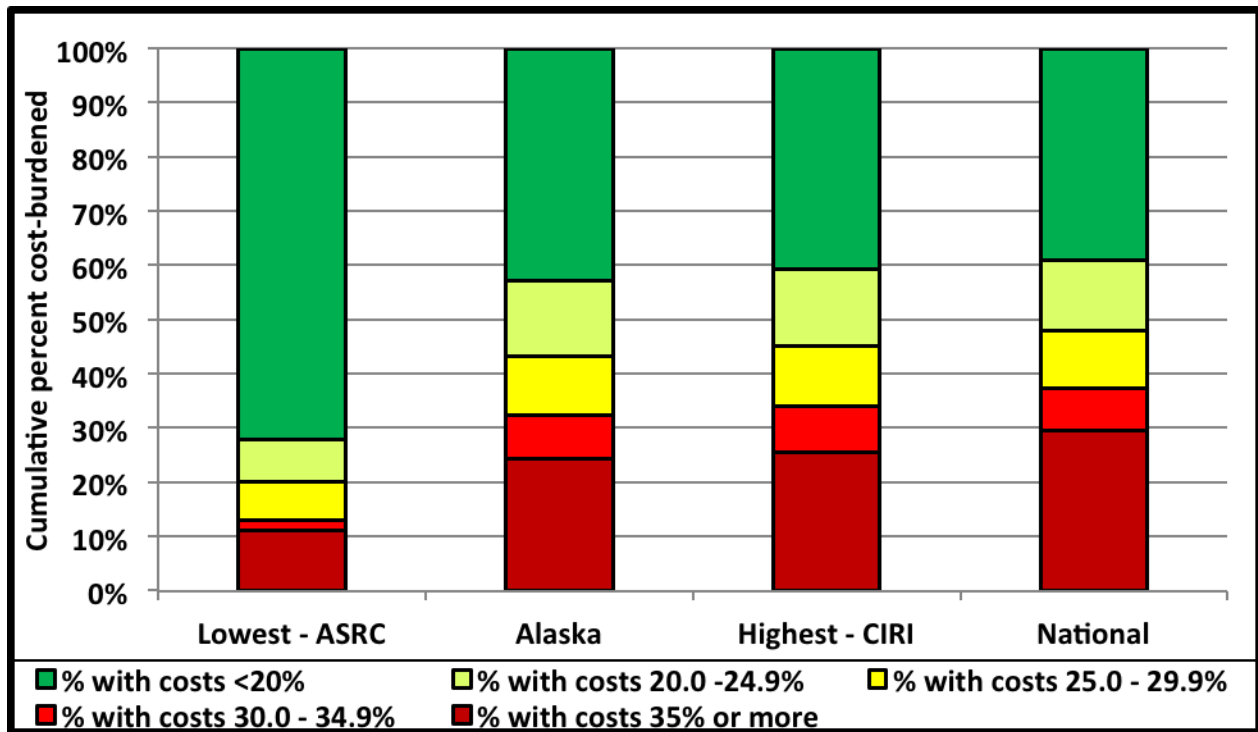
According to ACS estimates, the percentage of cost-burdened housing varies within Alaska (Figure 20). The CIRI region has the highest percentage of cost-burdened households among ANCSA regions. It is joined by the Sealaska, Doyon, and Koniag regions in having more than one third of households paying 30% or more of household income for housing costs. These regions are among the most urban regions in Alaska, implying that areas with dense urban populations have less affordable housing, but as mentioned previously, analysis has shown that ACS energy cost estimates in rural areas are systematically low. This systematic error may lead to an underreporting of cost-burdening levels in rural areas. For instance, the Calista region has an unemployment rate among the highest in the state[26], as well as one of the lowest median incomes but it is shown here as being the second most affordable ANCSA region. In the most affordable region, ASRC, fewer than 15% of households are considered cost-burdened. This may be due in part to the region's subsidized fuel prices that lead to low energy costs, as well as the subsidized rents and lease-to-own contracts which also lower housing costs.

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[26] Alaska Department of Labor and Workforce Development: Research & Analysis Section. (October 2013). October 2013 Unemployment Rate, Not Seasonally Adjusted. Retrieved from: http://laborstats.alaska.gov/.

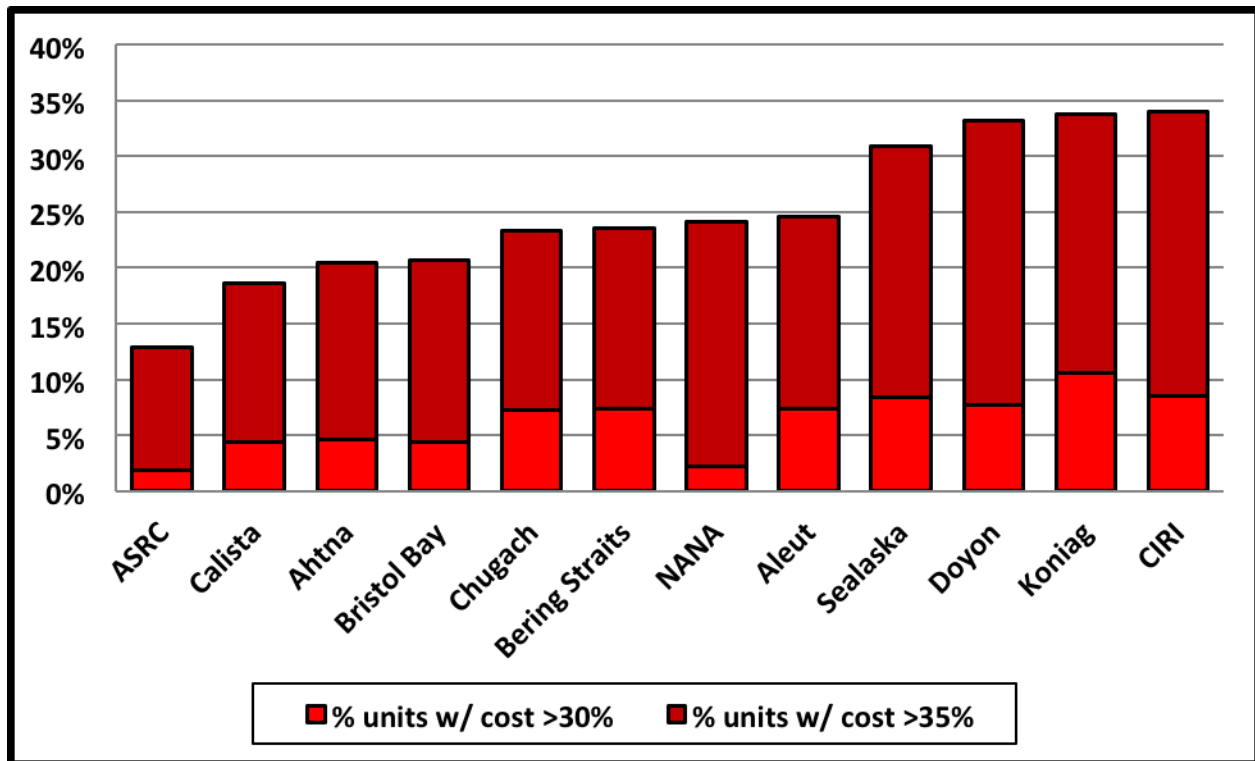**Figure 20: Percent of Cost-Burdened Households by ANCSA Region**

Figure 21 shows the median income for each of Alaska's ANCSA regions, as well as the ACS reported annual housing costs and the AKWarm estimated annual energy costs. ACS housing costs include energy costs. Thus, in theory annual housing costs should be higher than annual energy costs. This is not the case for the Ahtna region, where the AKWarm energy cost estimate is higher than the ACS housing cost estimate. Other regions, including Calista, Bering Straits, Bristol Bay, and NANA have energy costs equivalent to 75% or greater of the ACS total housing costs. As mentioned previously, this indicates that the ACS energy cost estimates that contribute to the annual housing cost may be systemically low in rural areas. For example, the Calista and Ahtna regions have the second and third lowest percentages of cost-burdened households (Figure 20) despite being the two ANCSA regions with the lowest median incomes in Alaska. For more urban areas, including the Koniag, Sealaska, CIRI, and ASRC regions, AKWarm energy costs are equivalent to less than 50% of the ACS housing cost estimate, indicating that the housing cost estimates in these regions may be closer to actual costs.

Figure 21: Annual ACS Median Income and Housing Costs vs. AKWarm Energy Costs by ANCSA Region
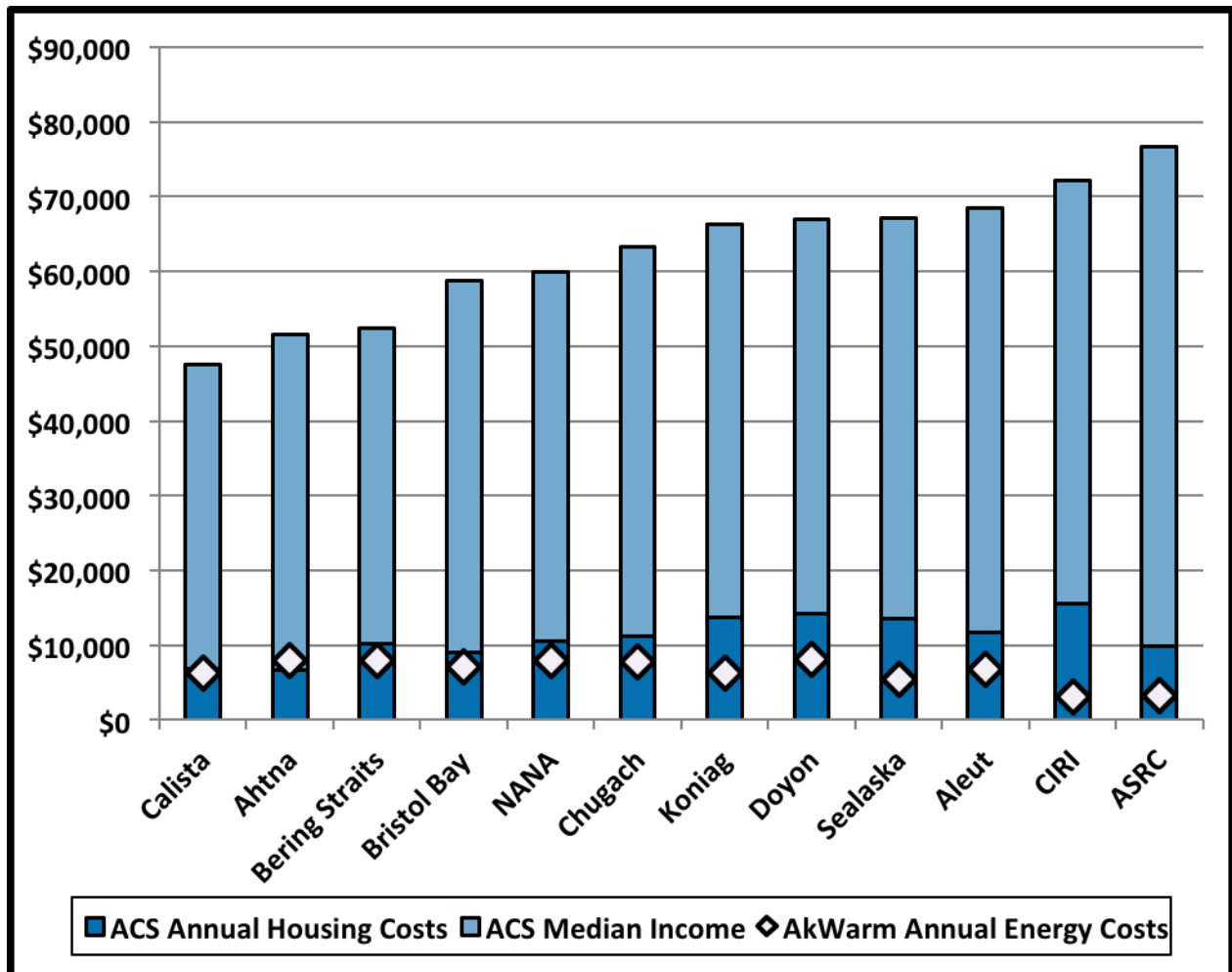
Regional and Community Housing Characteristics

This statewide section covers information and analysis only at the national and statewide level. For a detailed discussion of estimating housing need and comparison of methods to previous Housing Assessments, see Appendix B, "Statewide Need Assessment." Additionally, a significant amount of data and analysis are available in the summaries and data profiles of this assessment at smaller spatial scales within Alaska. These written summaries are available for each individual ANCSA region and Census Area characterizing the housing stock from the perspective of community, overcrowding, energy, and affordability. The data profiles contain charts and tables for ANCSA regions, Census Areas, and communities throughout Alaska. These multiple tiers of information and analysis allow researchers, housing authorities, policy makers, and others to answer questions ranging from the micro to the macro level.

Glossary

ANCSA Alaska Native Claims Settlement Act – A federal law passed in 1971 that created 13 Alaska Native Regional Corporations covering the entirety of the state[27]

Building Science Terms

ACH50 Air changes per hour at 50 pascals of pressure. A measure of a building's air-tightness calculated by a blower door test which creates a 50 pascal pressure differential and then measures the airflow to estimate the rate at which the entire volume of the house is exchanged per hour.

BTU British Thermal Unit – A measurement of energy equivalent to the amount of energy needed to heat one pound of water by one degree Fahrenheit. BTUs are often expressed in millions of BTUS (MMBTU), thousands of BTUS (kBTU) or as BTUs.

Continuous mechanical ventilation A system in which fresh air is supplied continuously or at regular intervals using a humidistat, timer, or other control system. These systems may be exhaust only or balanced.

DHW Domestic Hot Water

ECI Energy Cost Index—The total amount of money spent on energy in a year divided by the square footage of the conditioned space in the building

EUI Energy Use Intensity - The annual energy consumption of BTUS divided by the structure's conditioned square feet. EUI is often expressed in thousands of BTUs per square foot per year or kBTU/SF/YR.

HDD Heating Degree Days— A measure of the heating requirement for a geographic location that is calculated based on the time and magnitude that the temperature stays below a base temperature of 65-degrees Fahrenheit. The HDD used in this report are 30-year averages for the 1960-1990 period and come from the AKWarm energy library.

HHI Home Heating Index – The annual space heating energy consumption in BTUs divided by the structure's conditioned square feet, and by the location's heating degree days. Thermal HHI is often expressed in BTUs per square foot per degree day per year or BTU/SF/HDD/YR.

HRV Heat Recovery Ventilation System - A balanced ventilation system that recovers heat from warm outgoing air by passing it through a heat exchanger next to the cool incoming ventilation air.

kWh Kilowatt hour - a measure of electricity consumed

MMBTU 1 million BTUs

Non-continuous ventilation A house that lacks a continuous ventilation system. Note that such a house may include bathroom and kitchen fans that operate only on a switch.

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[27] See http://ancsaregional.com/resources/ for a list of resources focusing on the Alaska Native Claims Settlement Act.

State of Alaska Terms

AHFC Alaska Housing Finance Corporation

AKWarm An energy modeling software program developed by AHFC to conduct home energy ratings for various energy efficiency programs. The software is free and available to the public.

AKWarm Energy Costs AKWarm energy costs are estimated based on the modeled energy use of a home and the energy prices

AKWarm Rating Points The AKWarm home energy rating produces a rating point score which is based on how much more or less efficient a home is in comparison to a reference home that is based on the 2012 Alaska Building Energy Efficiency Standard. A home that uses the same amount of energy as this reference home will score 85 points; more efficient homes will score up to 100 points, and less efficient homes may receive a score as low as 0 points.

AKWarm Rating Stars The star rating of a home is based on the number of rating points it receives, a measure of how much energy the home is estimated to use relative to a reference home in compliance with the 2012 Alaska Building Energy Efficiency Standard. The star rating ranges are shown in the following table:

Points	Rating	Points	Rating
0-39.9	1 Star	78-82.9	4 Star
40-49.9	1 Star +	83-88.9	4 Star+
50-59.9	2 Star	89-91.9	5 Star
60-67.9	2 Star +	92-94.9	5 Star+
68-72.9	3 Star	95-100+	6 Star
73-77.9	3 Star +		

ARIS Alaska Retrofit Information System. An AHFC database that stores detailed information from every energy audit conducted using the AKWarm software. The database now houses information for housing units accounting for approximately 30% of occupied housing in Alaska.

BEES The Alaska Building Energy Efficiency Standard. This standard for energy efficiency in new construction was developed in 1992 by AHFC, and is updated approximately every three years based on the International Energy Conservation Code and Alaska-specific amendments.

DCCED The Alaska Department of Commerce, Community, and Economic Development

Home Energy Rebate Program This AHFC program is funded by the state legislature and provides up to $10,000 in rebates for homeowners who choose to make energy efficiency improvements to their house.

One Star Homes	Homes that receive an AKWarm Rating score of less than 40 points. This rating point level indicates that a household uses at least four times as much energy as a comparable house that is built to the 2012 Building Energy Efficiency Standard established by AHFC.
Weatherizati on	The AHFC Weatherization Assistance program. This program is funded by the state legislature with some federal money and provides energy efficiency and health and safety retrofits to housing that qualifies based on income eligibility at no cost to the homeowner/tenant.

Census and HUD Terms

ACS	American Community Survey. A five-year survey conducted from 2007-2011 by the U.S. Census Bureau. This is a stratified, random sampling survey that was conducted via telephone and mail in road-connected areas of Alaska and in person in Rural Alaska.
"cold" / "very cold" climates	These are the Building America climate zones. "Cold" climates are defined as having 5,400 - 9,000 heating degree days. "Very cold" climates are defined as having 9,000 - 12,600 heating degree days. "Cold" climates are equivalent to the International Energy Conservation Code climate zones 5 and 6, and "very cold" climates are equivalent to the International Energy Conservation Code climate zone 7.
Complete Kitchen	A kitchen is considered "complete" when it has a sink with a faucet, a stove or range, and a refrigerator.
Complete Plumbing	Complete plumbing facilities include: (a) hot and cold running water, (b) a flush toilet, and (c) a bathtub or shower. All facilities must be located inside the housing unit but not necessarily in the same room.
Cost-burden	Housing units are considered cost-burdened if they spend 30% or more of total household income on housing expenses. Households that are cost-burdened may have trouble affording basic necessities such as food, transportation, health-care, etc.
Gross rent	Gross rent is the contract rent plus the estimated average monthly cost of utilities and fuels if paid by the renter. This metric is used to eliminate differences in rent cost by differing practices of including/excluding utilities.
Housing costs / household expenses	For homeowners monthly housing costs include mortgage payments, taxes, insurance, utilities, and fuels. Gross rent is equivalent to "housing costs" for renters.
HUD	United States Department of Housing and Urban Development
Median income	Median income includes wages/salary, self-employment income, interest/dividends, and all forms of social security / public assistance income.
Overcrowded and severely overcrowded	Households are considered "overcrowded" if occupancy is more than one person per room. Households with more than 1.5 people per room are considered severely overcrowded. 'Rooms' include living rooms, dining rooms, kitchens, bedrooms, finished recreation rooms, and lodger's rooms. Excluded are bathrooms, halls, unfinished basements, etc.

PCE   Power Cost Equalization. An Alaska Energy Authority program funded by the State of Alaska which subsidizes the cost of electricity for rural communities that are approved by the Regulatory Commission of Alaska. This program provides a subsidy for the first 500 kWh of electricity used by a residential household.

RECS   Residential Energy Consumption Survey: Produced by the U.S. Department of Energy's Energy Information Administration, this survey reports energy end uses and statistics that describe national residential energy use and costs.

Vacancy   Vacant units include those that are for sale and for rent as well as units for seasonal, recreational, or occasional use, units that are for migratory workers, and "other" vacant units.