2013 Alaska Housing Assessment Statewide Report

January 28th, 2014

Nathan Wiltse | By Valentine | Dustin Madden | Vanessa Stevens

Prepared by:

COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

Project Team:

Nathan Wiltse | Dustin Madden | By Valentine | Vanessa Stevens

Prepared for:

Alaska Housing Finance Corporation
www.ahfc.us
P.O. Box 101020
Anchorage, AK 99510
Phone: (907)-338-6100

Prepared by:

Cold Climate Housing Research Center
http://www.cchrc.org
P.O. Box 82489
Fairbanks, AK 99708
Phone: (907)-457-3454
Fax: (907)-457-3456

Acknowledgements:

Special thanks to: the Association of Alaska Housing Authorities (AAHA), the Institute of Social and Economic Research (ISER), the Research and Analysis section of the Department of Labor and Workforce Development (DoL&WD), and Kathryn Dodge.

Table of Contents

Table of Figures:

Executive Summary

The purpose of the 2013 Alaska Housing Assessment report is to provide an overview of the housing characteristics in Alaska so that housing authorities, policy makers, 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 of which was released in 2009.

The 2013 Alaska Housing Assessment uses information from the U.S. Census and American Community Survey, 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. In addition to energy, Alaska's housing characteristics are presented from the perspectives of community, overcrowding, 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 this 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

Compared to nationwide averages, the housing stock of Alaska is similar in some respects. Levels of renters (36%) versus homeowners (64%) are equivalent, as are the 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 differs significantly, with housing in the mostly urban CIRI ANCSA region averaging nearly 1,900 square feet per unit, which is nearly twice the average found in the Western and Northwestern regions of Calista and NANA, where the home size averages less than 1,000 square feet.

II. Overcrowding

While Alaska's overcrowding levels have gone down from very high historic levels[1], 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

[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. While Alaska has several state-funded programs that have been successful in reducing the burden of high energy use and costs on participants, many households, communities, and regions still face very 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 as "Cold / Very Cold Climates," and use nearly three times as much energy per square foot. 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, such as the NANA region, where on 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 Assistance, and Alaska Building Energy Efficiency Standard (BEES) programs have been demonstrated to be successful 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

---

[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 US 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

occupied housing BEES certified. On the other hand, 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 households 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 over time, decreasing draftiness and yielding significant energy savings. However, installation of continuous mechanical ventilation systems has not kept pace, and currently significant portions of the Alaska housing stock are at high risk of moisture and indoor air quality problems. In fact, over 50% of occupied housing in the Chugach, Ahtna, Doyon, and CIRI ANCSA regions face 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 over 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. However, analysis of the ACS affordability estimates 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, it should be noted that the household income used in these cost-burdened estimates includes public assistance. Thus if some regions receive more federal, state, or tribal dollars for housing, they will appear to have fewer cost-burdened households.

V. Housing Need

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

An estimated 15,453 housing units in Alaska are considered overcrowded or severely overcrowded. This estimate is based on housing units having more than 1 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 comparable, the current estimate is higher than the 2009 housing assessment estimate of 9,946, but lower than the 2005 estimate of 22,392. Overcrowding

[6] http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/ accessed Feb 21, 2014
[7] Ibid.

conditions can be addressed with a combination of new construction, retrofits, and affordable housing programs.

Nearly 1 in 3 households in Alaska potentially are not able to afford basic necessities such as food, transportation, and health care because they are spending 30% or more of total household income on housing costs. This represents a clear need for Alaska to develop more affordable housing across the state to address the estimated 78,646 households that are cost-burdened. 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 an 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, we 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 Building Energy Efficiency Standard. These homes are spending more money than necessary on the energy needed to maintain a comfortable environment. Collectively, these inefficient households also needlessly 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 the occupants and reduce the need for new capital investment in energy production and distribution.

Based on what we believe to be the best available data, Alaska's housing needs are significant: more than 15,000 homes are overcrowded or severely overcrowded, over 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 ameliorate these problems facing Alaskans throughout the state.

Introduction

This 2013 Alaska Housing Assessment provides an overview of the existing housing stock in Alaska. The purpose of the study is to assist in determining the condition of that stock so that housing authorities, policy makers, and builders can make informed decisions about where to focus their efforts. This study follows three similar studies done in 1990, 2005, and most recently in 2009.

The previous assessments presented data on overcrowding, housing condition, and costs. This assessment will feature overcrowding and housing costs, but will also highlight energy, 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 housing energy costs that are much higher than national averages. This report details housing energy characteristics, usage, and costs in order to provide a strong foundation of knowledge to help address these unique housing and energy needs in Alaska. Yet while energy is important, it is only one facet of understanding the housing stock in Alaska. To provide a more complete picture, community characteristics, overcrowding, and housing affordability are each addressed throughout this report.

Throughout this current housing assessment, we present data from the perspectives of community, overcrowding, energy, and affordability at a variety of spatial scales from statewide to individual communities. We compare Alaska housing characteristics with national numbers in order to put them in context and provide an additional set of reference points. Statewide comparison graphs are also available at the Census Area level in Appendix C: Chart Folio. In this statewide section, we 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 stock viewed from the lenses of community, overcrowding, energy, and affordability.

Figure 1: ANCSA Regions

Data Sources

In 2005 and again in 2009, the 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 2013 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 characteristics are reported at the community (where information is available), census area level, ANCSA level, and statewide 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 Assistance program (Wx), and the Building Energy Efficiency Standard (BEES) for new construction certification program. In these programs homes receive energy ratings using the AKWarm modeling software to characterize basic features and construction type in addition to their energy performance.

Data from the ratings are uploaded into ARIS. At the time of this study, ARIS contained data from over 95,800 ratings and assessments gathered from either pre- or post-energy retrofit homes or from new construction certifications. These ratings and assessments are for over 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 on 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 on 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 provides suggestions for areas of future research.

The national energy numbers come from the U.S. Energy Information Administration's "2009 Residential Energy Consumption Survey" (RECS), which estimates household energy characteristics using a randomly sampled survey of approximately 12,100 housing units nationwide. The 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

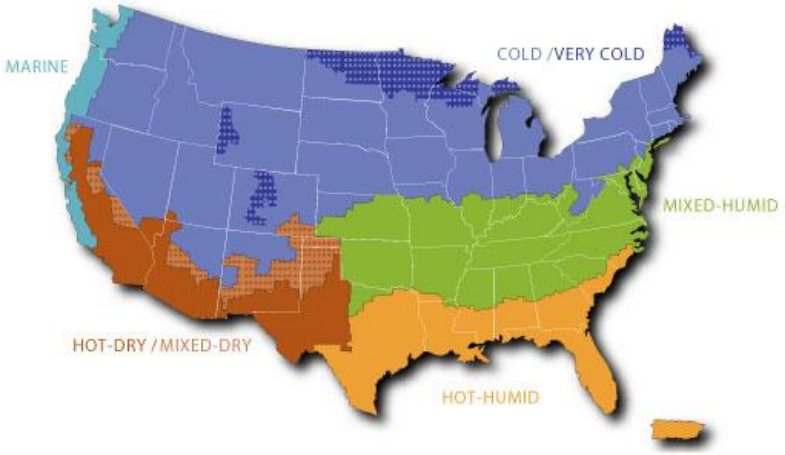
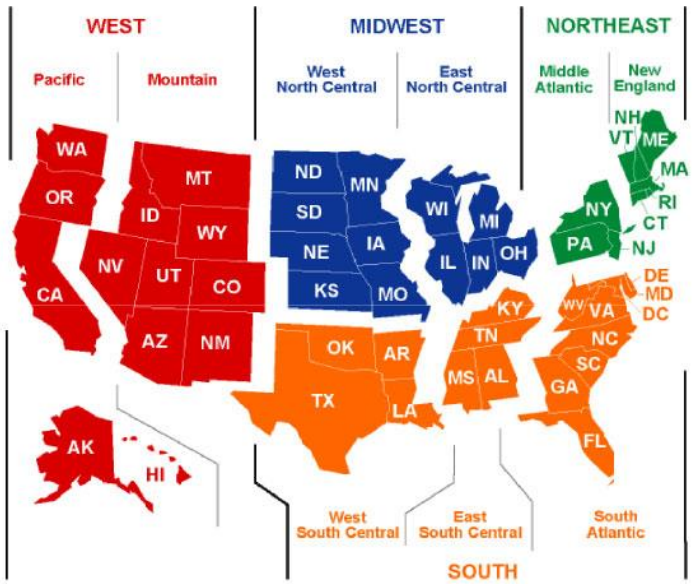


Figure 3: 2009 Residential Energy Consumption Survey Regions



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 population of 735,132 represents only 0.2% of the 316 million people[8] living in the United States, yet Alaskan residents are scattered throughout a mostly road-less state that is roughly one-fifth the size of the contiguous United States. While the majority of the population is concentrated in

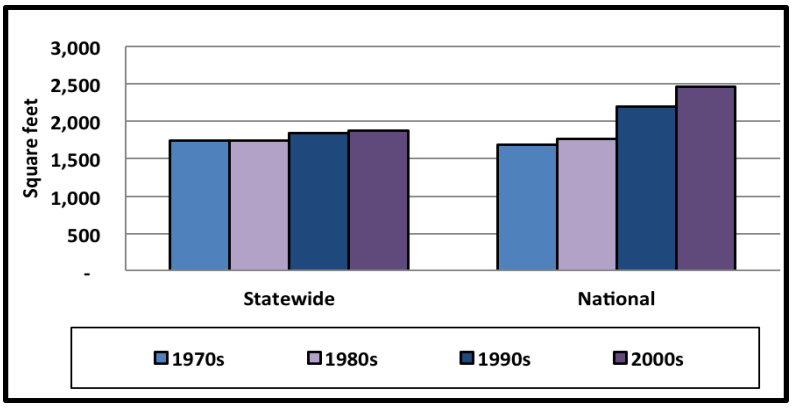
[8] 2013 estimate from: U.S. Census Bureau. "Alaska QuickFacts". Retrieved from http://quickfacts.census.gov/qfd/states/02000.html

Southcentral Alaska, the state still has a higher percentage of people living outside of large urban areas[9], 55.5%, than the nationwide average of 28.8%.

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%). Further, both have similar proportions of detached single-family homes, at 62%, and reasonably similar numbers of multi-family buildings with less than 10 units. However, 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 over 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.[10] The average size of housing in Alaska differs from the national average, as can be seen in 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

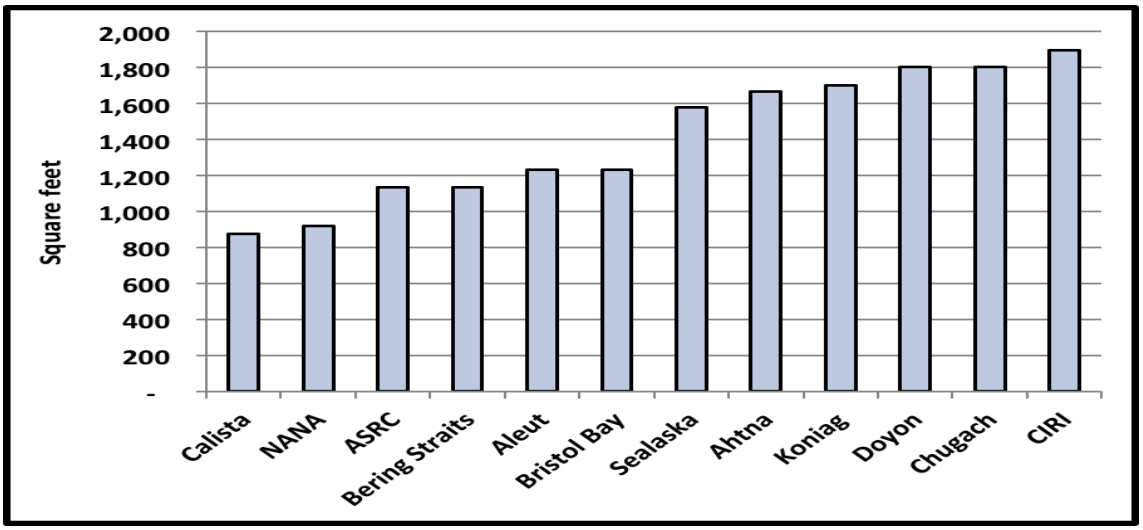


Within Alaska, regional average house sizes vary by approximately 1,000 square feet, as seen in Figure 5. The smallest homes on average are found in Western and Northern Alaska, with homes in the Calista and NANA regions averaging less than 1,000 square feet. The largest homes on average are found in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

[9] 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.

[10] 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

Figure 5: Average Housing Unit Size by ANCSA Region

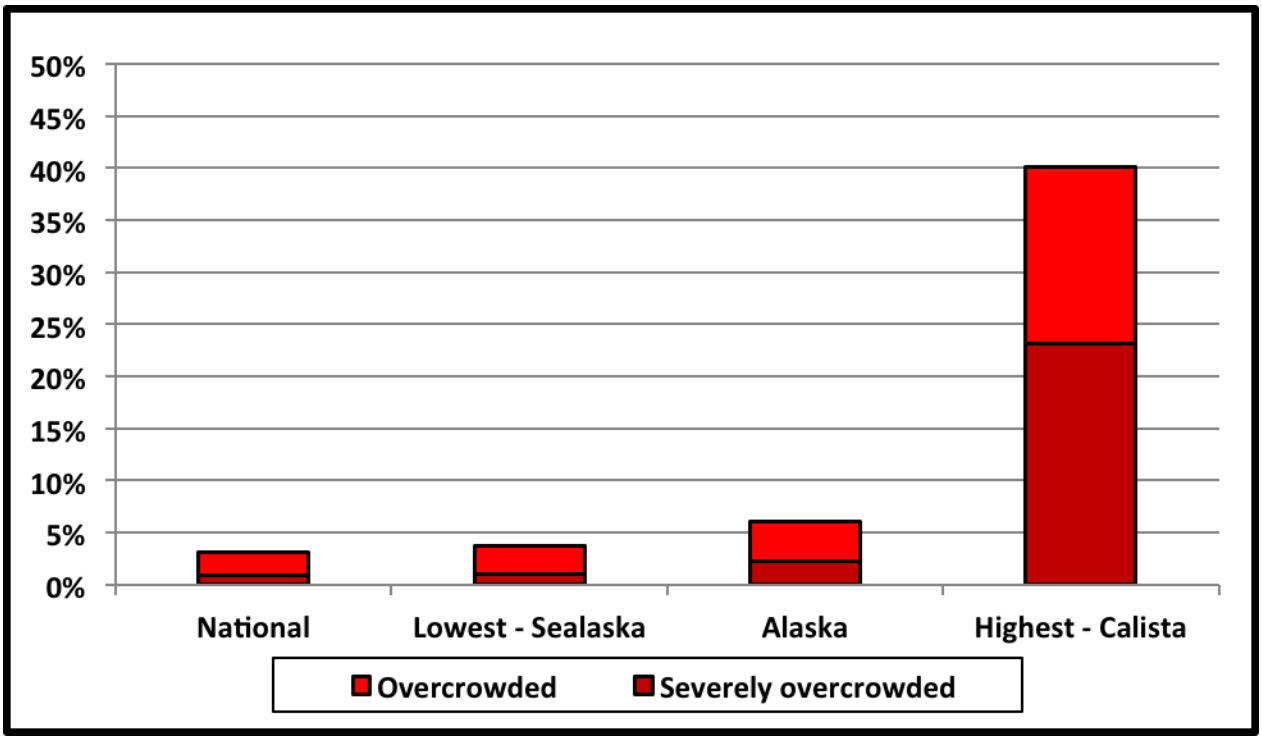


II. Overcrowding

As a whole, the rate of overcrowding in Alaska is twice as high as the national average, as can be seen in 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 *twelve times* higher than the national average. While 'overcrowding' is a subjective term, in this report we use 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.[11] An "overcrowded" home 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.

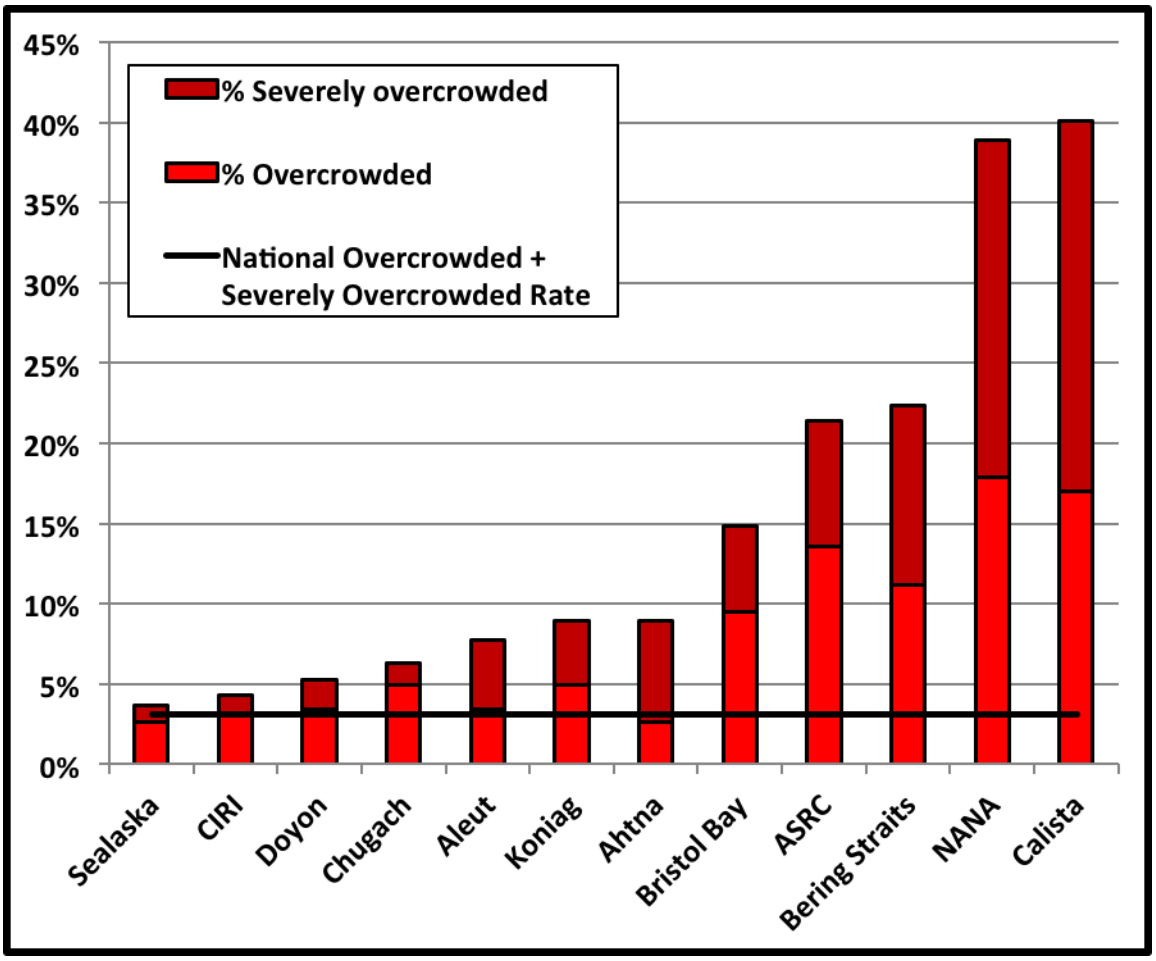
[11] The United Kingdom Office of the Deputy Prime Minister. "The Impact of Overcrowding on Health & Education: A Review of Evidence and Literature." Office of the Deputy Prime Minister Publications, 2004. Available at: http://dera.ioe.ac.uk/5073/1/138631.pdf

Figure 6: Percent of Overcrowded Housing in Alaska vs. Nation



There is significant variation in overcrowding rates throughout Alaska, as can be seen in 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 Regional Corporation and the Bering Straits Native Corporation regions have more than five times the overcrowding found in Sealaska and CIRI, and the NANA and Calista region have more than 10 times the level of overcrowding found in these population centers. These two regions have very high rates of overcrowding, with an estimated 39% (NANA) and 40% (Calista) of all occupied housing units having more than 1 person per room in the home.

Figure 7: Overcrowding by ANCSA Region



III. Energy

Fuels

The housing stock in Alaska has pronounced differences with nationwide averages when it comes to energy, starting with primary heating fuel types. Fuel oil is used in approximately 33% of housing units in Alaska, whereas it accounts for 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, which is nearly $2 more than the national average of $3.98 at that time.[12] In the most remote communities in Alaska this price can be even higher, with regional maximum prices ranging from $5.83 in Southeast Alaska to $10.00 in Interior Alaska.[13]

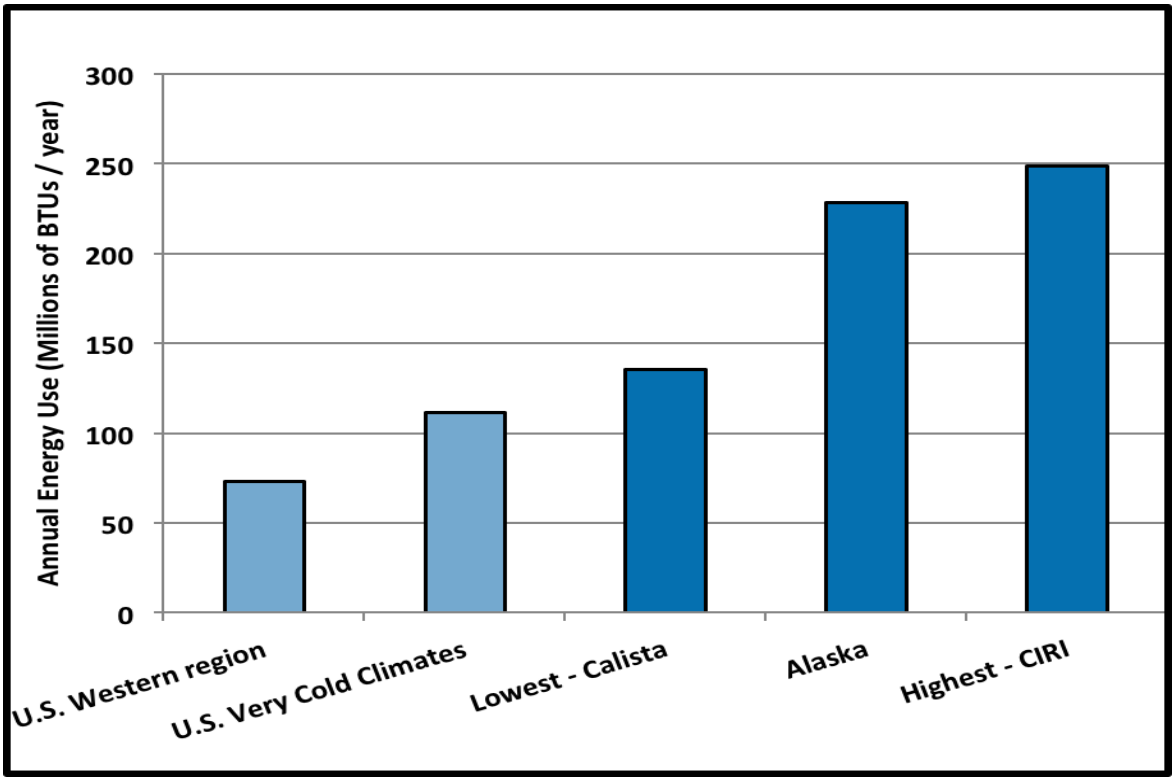
[12] "Alaska Fuel Price Report: Current Community Conditions" Alaska Department of Commerce, Community, and Economic Development. January 2013. Available online at: http://commerce.alaska.gov/dca/pub/Fuel_Report_2013_January.pdf

[13] Ibid. Excludes subsidized fuel in the North Slope region.

Energy Consumption

Based on data from the ARIS database, we estimate 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 region of the United States, and more than three times the energy of units in the Western region, as can be seen in Figure 8. Alaska's relatively high energy consumption is largely due to climate. The Building America Cold climate region[14] has between 5,400 and 9,000 heating degree days per year and the Very Cold climate region is a region that 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



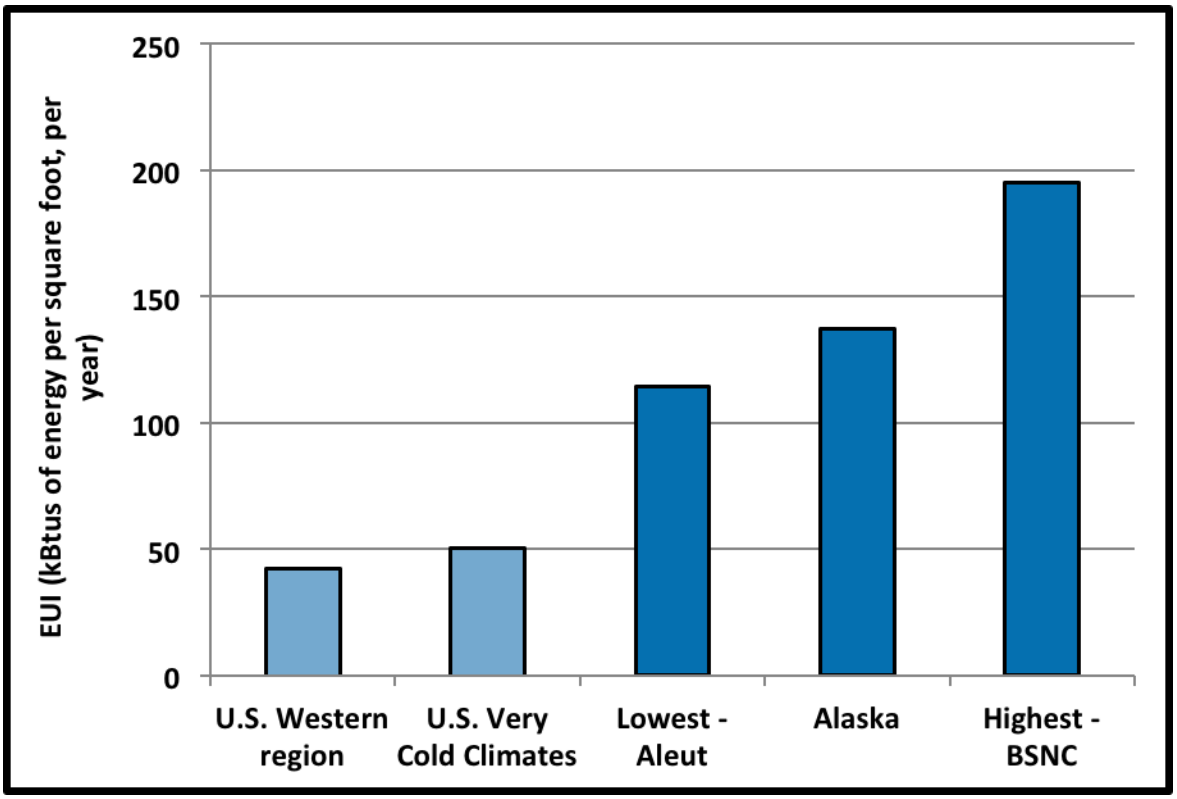
The ANCSA region with the highest average annual home energy usage, CIRI, uses approximately 2.2 times more energy than the national average. Even though Calista is the ANCSA region with the lowest average annual home energy use, it still manages to use 1.23 times more energy on average than the U.S. averages. 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, which normalizes total energy use by square footage. Using this metric, we can see in Figure 9 that the

[14] See Figure 2 for map.

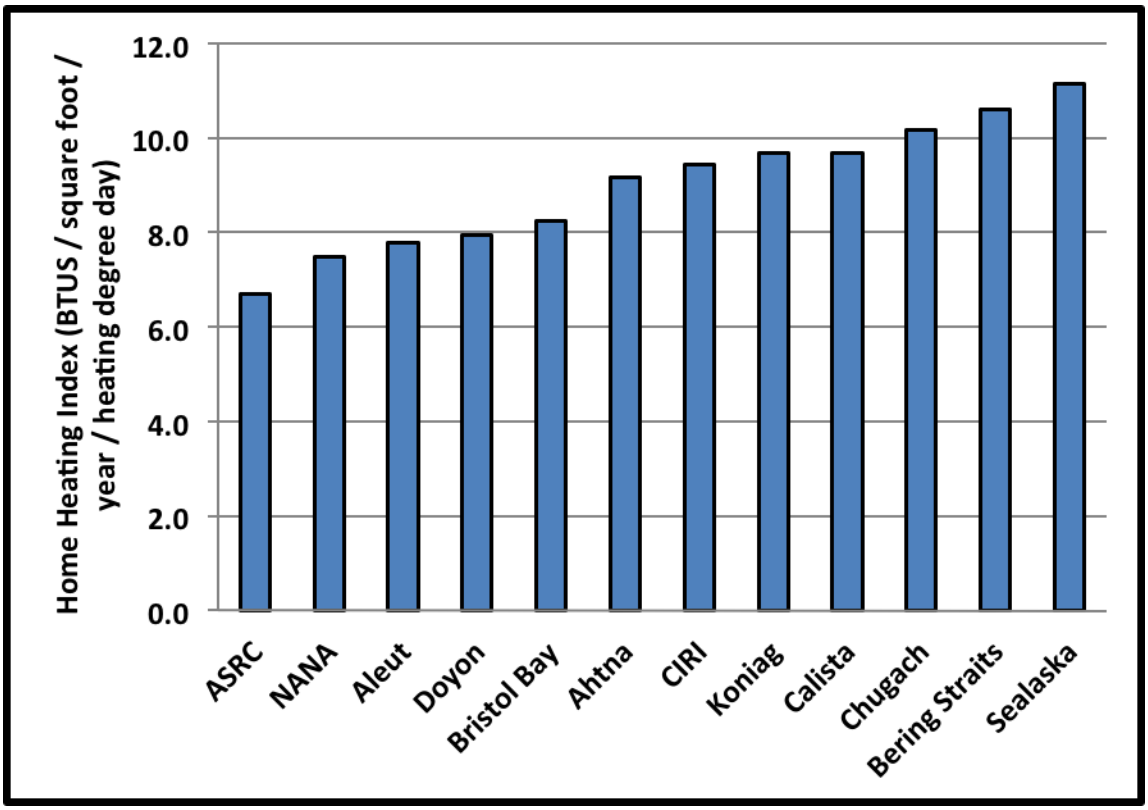
average Alaska EUI is approximately 2.7 times the U.S. cold/very cold climate average, and 3.2 times the U.S. Western region average. The Bering Straits Native Corporation (BSNC) region has the highest EUI in Alaska, using more than four times the energy per square foot as an average home in the U.S. Western region. Even 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 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, which both have average home heating indices greater than 10.

Figure 10: Average Home Heating Index by ANCSA Region



Energy Costs

Energy costs in Alaska are significantly higher than national averages, as can be seen in Figure 11. The lowest costs in the state are found in the CIRI region, which at an average of $3,123 are still roughly 50% higher than the national average. At an estimated $4,681, Alaska's statewide average annual energy costs are more than twice the national average. With more than half of the state's population living in the CIRI ANCSA region, the statewide average is actually lower than all but two regions: CIRI and the heavily subsidized energy costs of the ASRC region. 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, which is more than 5 times the average cost of energy in the U.S. Western region.

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

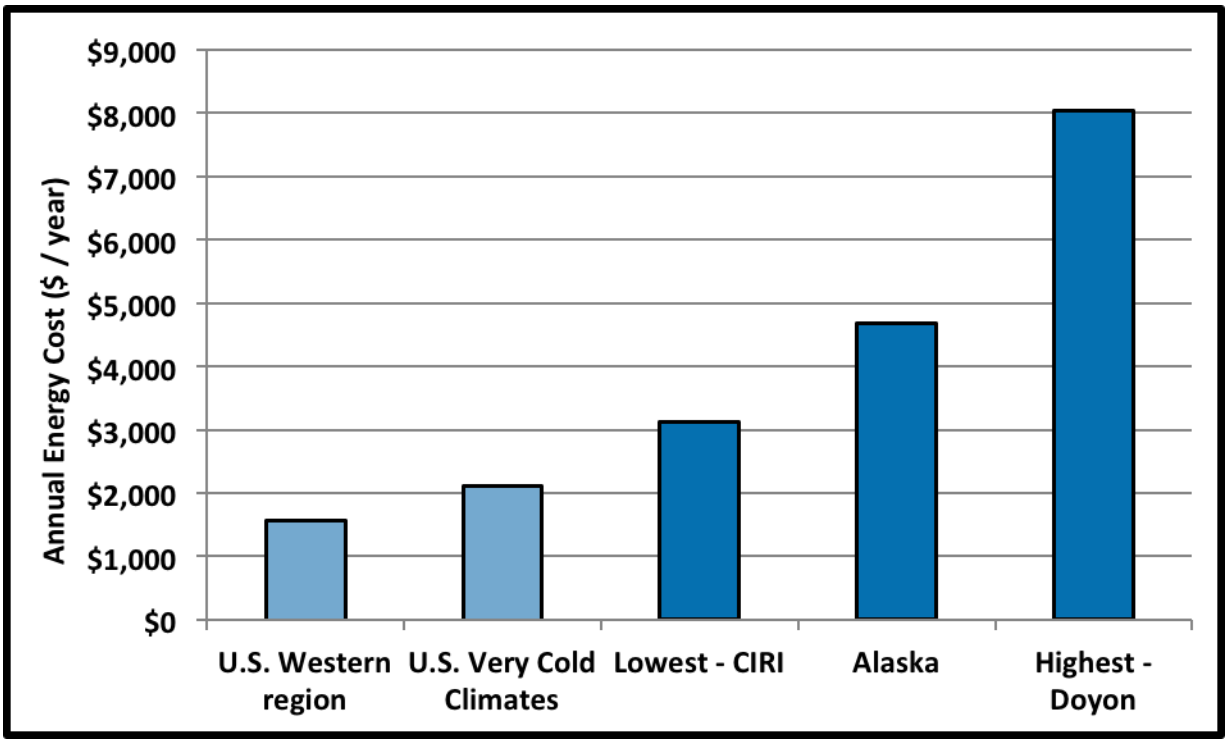
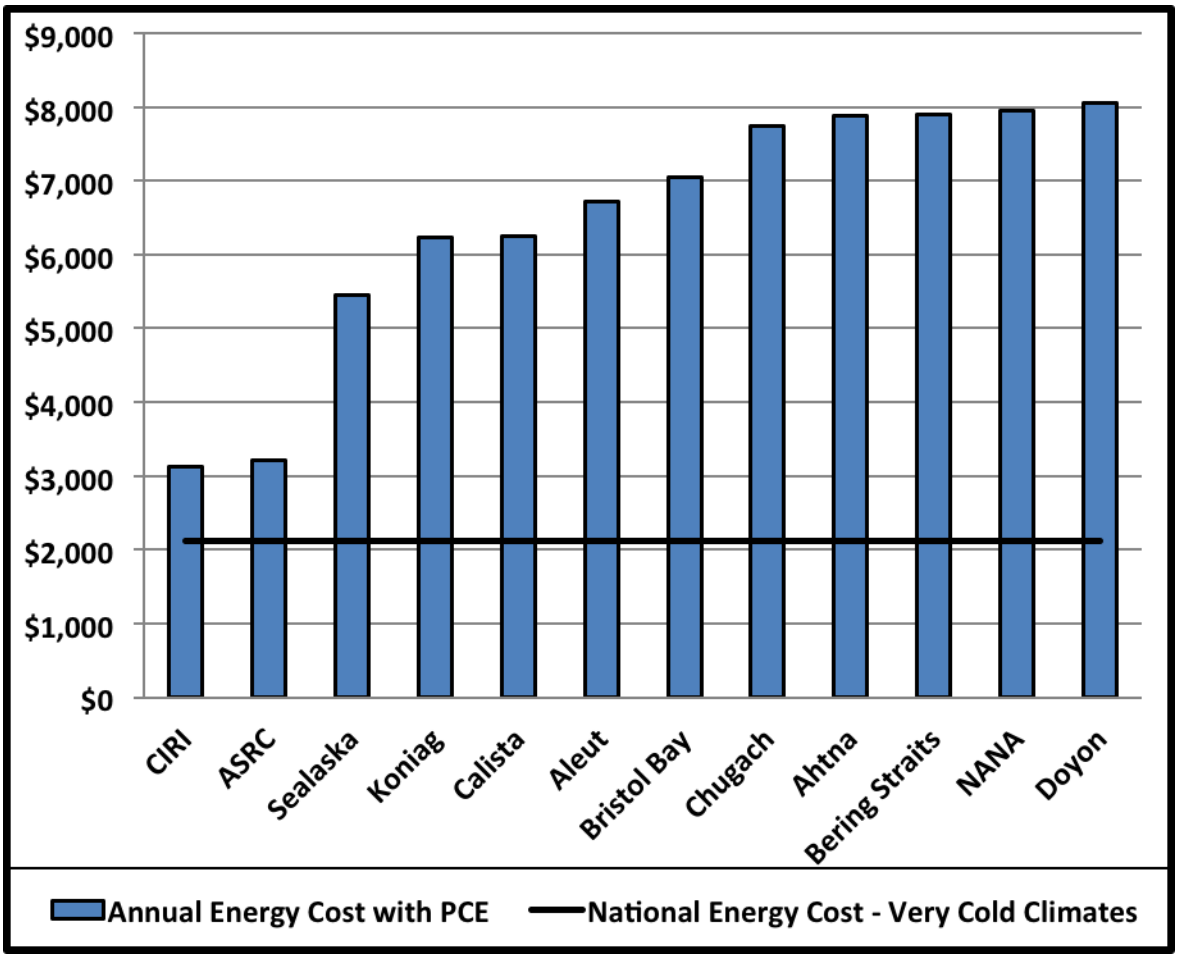


Figure 12 shows the average ANCSA regional energy costs in Alaska, as compared to the national annual average energy cost of $2,129 for cold and very cold climates, which is estimated by the Residential Energy Consumption Survey (RECS). Each region in Alaska has a higher estimated average annual energy 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, in spite of having an average house size 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 a significant portion of homes in CIRI and ASRC have access to low-priced natural gas, unlike other regions. Also, heating oil is 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



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. Even 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

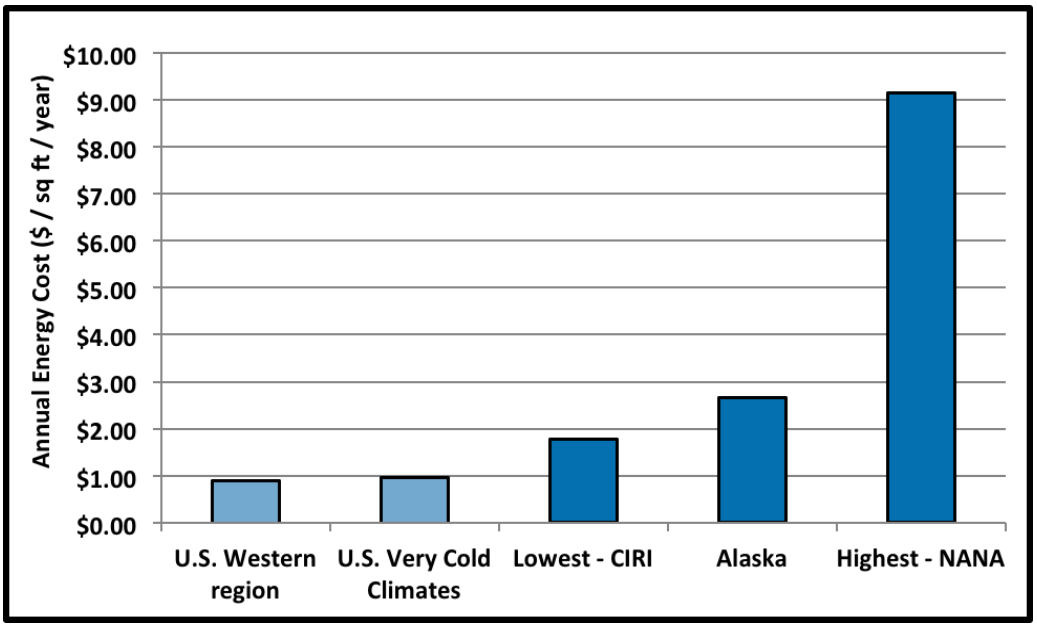
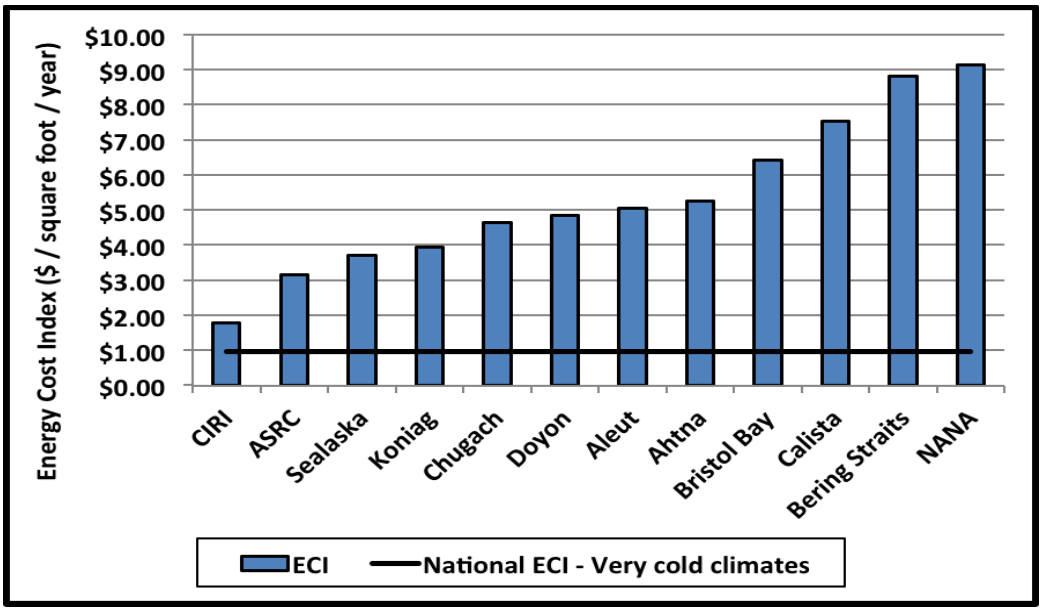


Figure 14 compares the average ECI for each of Alaska's regions, with the RECS national average ECI for cold and very cold climates as a reference point. Within Alaska, the highest average ECI is found in the NANA region, followed by the Bering Straits and Calista regions. These regions do not have the 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. In contrast, the regions with the lowest annual energy costs also have the lowest ECIs. These two regions, CIRI and ASRC, are the two regions in Alaska with the largest percentage of homes with access to natural gas.

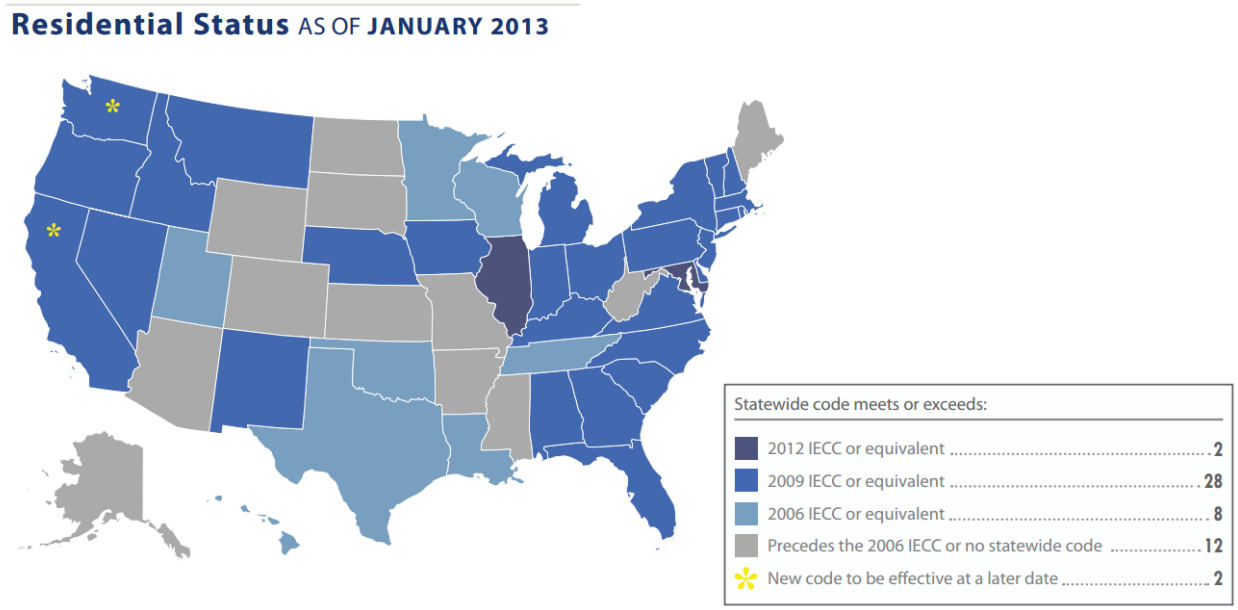
Figure 14: Average Energy Cost Index by ANCSA Region



Energy Programs

Alaska is one of only 12 states that either do not have a mandatory building energy code or have a building energy code that does not meet the 2006 International Energy Conservation Code (IECC), as can be seen in Figure 15.[15] However, Alaska does have the Building Energy Efficiency Standard (BEES) program administered by AHFC. While this standard is only mandatory for buildings that receive financing from AHFC, an analysis of the number of homes that were certified to meet BEES in the period 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



There are two retrofit programs in Alaska that focus specifically on residential space heating energy efficiency: the Home Energy Rebate Program and the Weatherization Assistance Program. These programs are administered by the Alaska Housing Finance Corporation and the data is tracked in the Alaska Retrofit Information System (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 low-income households. 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[16,17]. Nationwide, utilities sponsor or contribute to approximately 90% of the residential space heating/cooling energy efficiency programs available. In

[15] 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

[16] 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.

[17] 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.

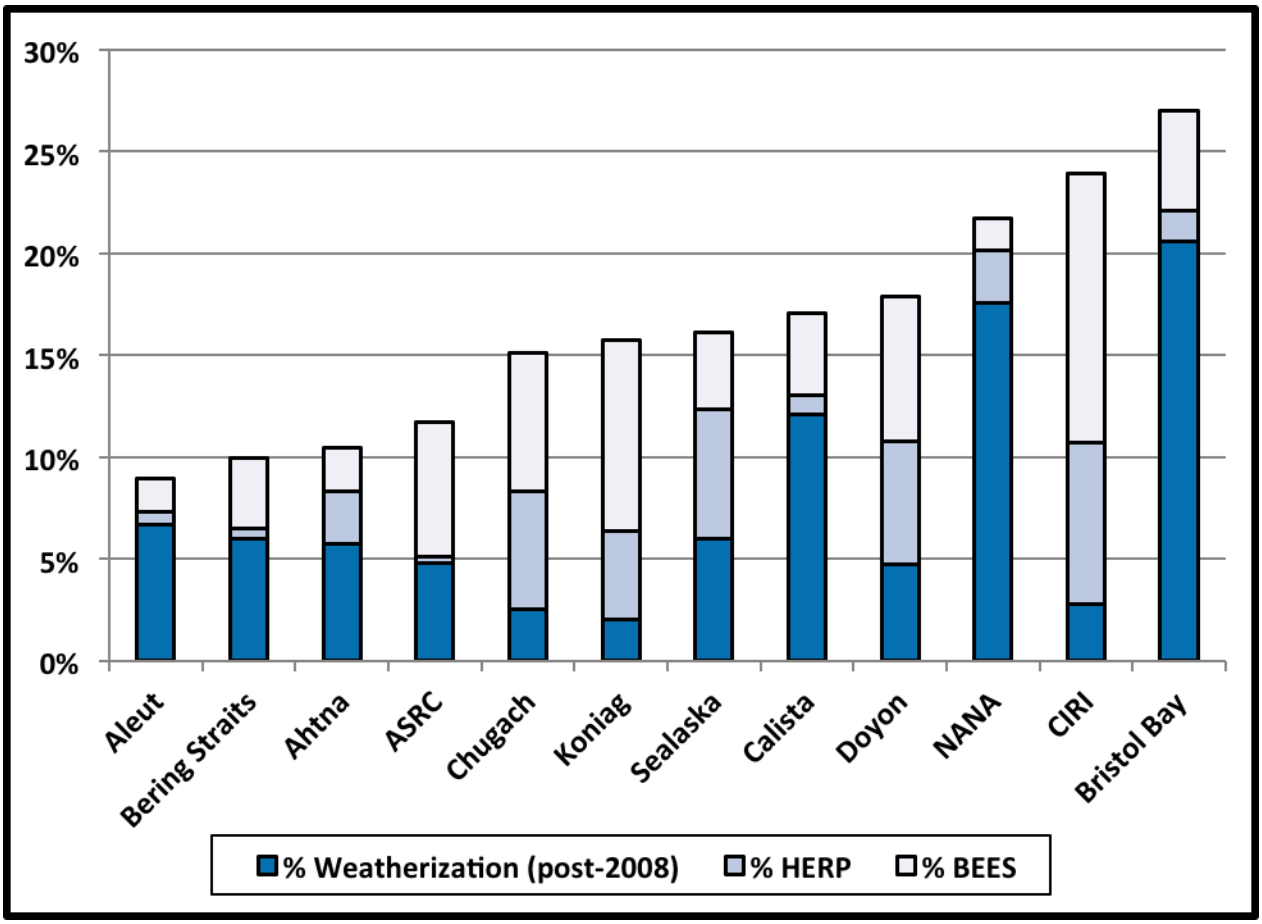
contrast, the primary funding for energy efficiency programs in Alaska comes from the State and utilities are not required to contribute to them.[18]

While the 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, as shown in Figure 16. Understanding these regional variations is essential to targeting future 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. There are several possible reasons for these differences; median incomes are typically lower in rural Alaska, which may lead to higher utilization of the Weatherization program, and the BEES program may have higher participation in urban areas simply because more homes are being built in fast growing areas such as the Matanuska-Susitna Borough.

The Bristol Bay Native Corporation has the highest percentage of occupied housing, 27%, which has participated in one of the programs. The majority of Bristol Bay's participation has been through Weatherization, with the 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, with the lowest participation occurring in the Aleut region, where 9% of occupied housing has completed one of the efficiency programs. The Aleut region also has the lowest percentage of occupied housing, 2%, which has been certified to meet BEES. The Weatherization program has seen the lowest participation in the Koniag region, with 2% of occupied housing completing a retrofit, and 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.

[18] 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

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



Ventilation

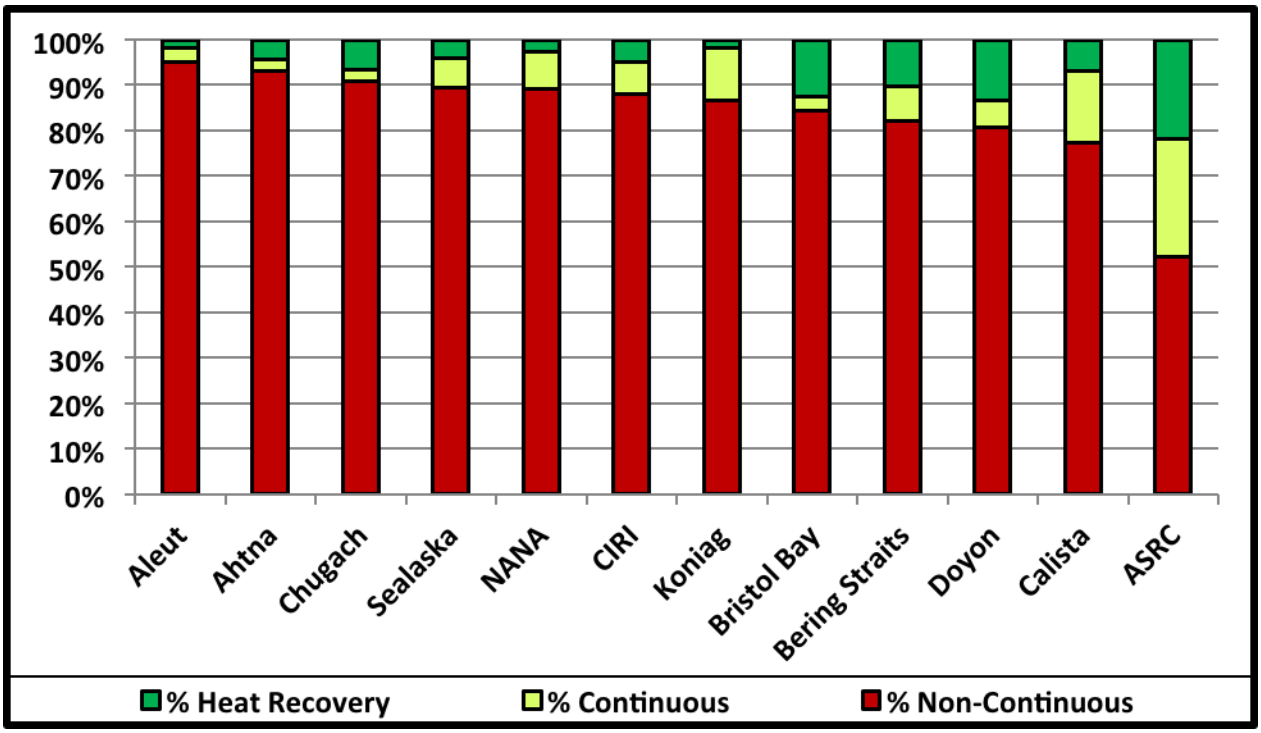
In a cold climate such as Alaska, an airtight, continuously ventilated home is essential for occupant health, comfort, and building durability. In homes built without modern air-sealing and ventilation systems, fresh air for occupants is provided haphazardly though leaks in the building. This can cause 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 large 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 the places where occupants spend their time and minimizing drafts and water vapor movement elsewhere in the house.

For this analysis, ventilation systems were categorized into three main types: non-continuous, continuous, and heat recovery ventilation systems. Homes classified as "non-continuous" either had no ventilation system installed, or had ventilation equipment such as bath and kitchen exhaust fans that did 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. However, 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 throughout the state.

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.

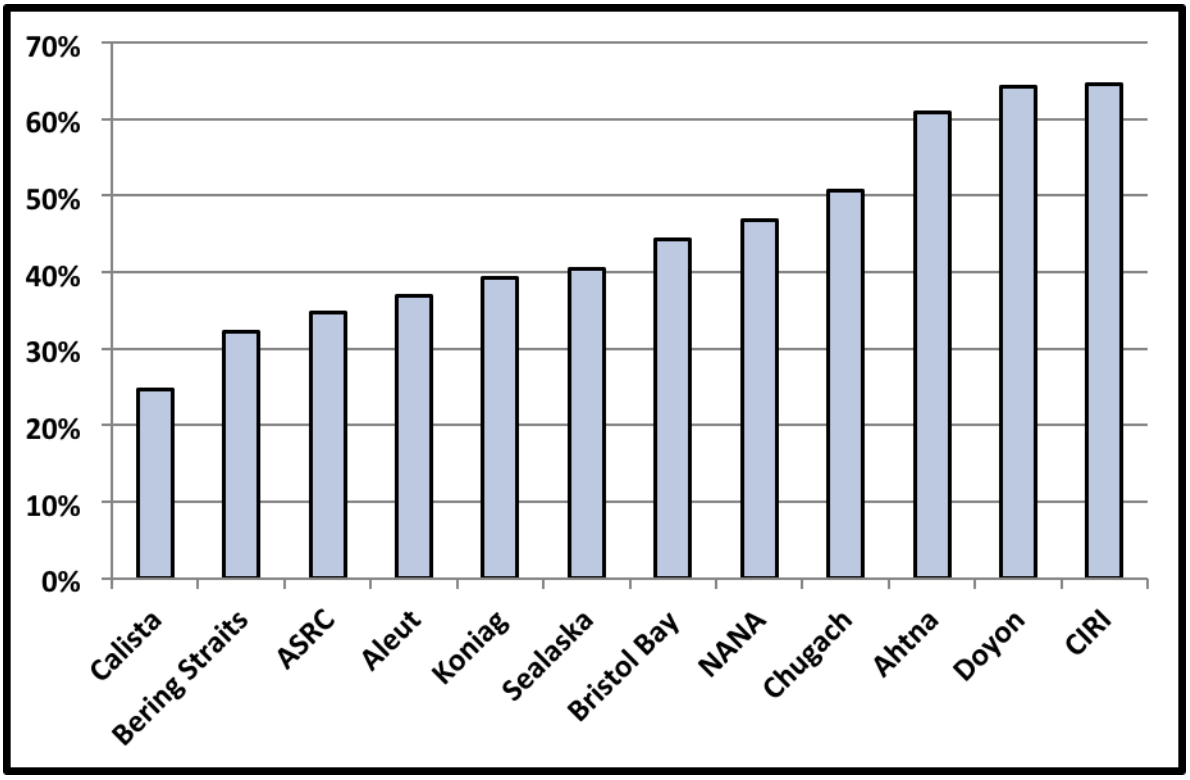
Figure 17: Ventilation Types by ANCSA Region



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. Over half of the homes in the Chugach, Ahtna, Doyon, and CIRI regions are at high risk of such problems, as shown in Figure 18. This metric does not mean that moisture or indoor air quality problems have been detected in these homes, but indicates that data has shown the homes to be at risk for these issues. 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 over 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

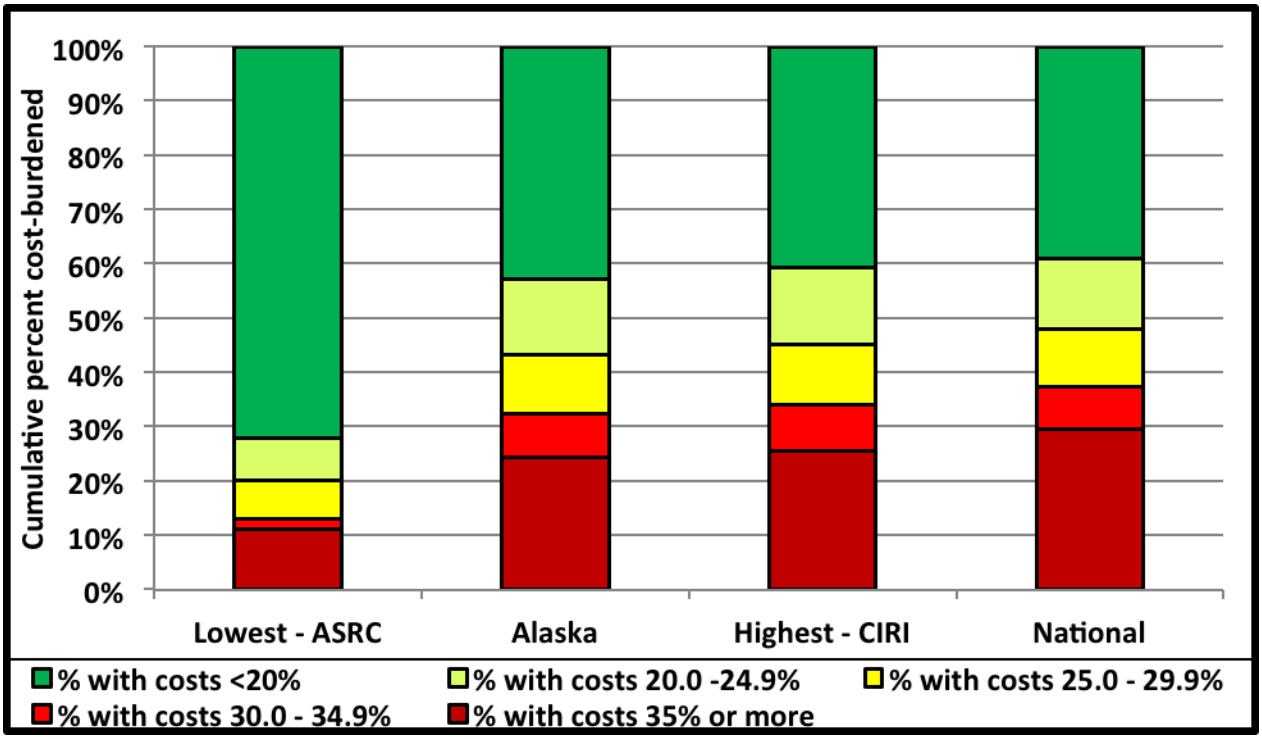


IV. Affordability

Housing affordability is the one area of housing need in this report where the Alaska averages do not exceed the nationwide numbers, as can be seen in Figure 19. Nationwide, approximately 37% of housing units are considered cost-burdened, meaning that reported housing costs are 30% or more of total household income. As a whole, approximately 32% of housing units in Alaska are cost-burdened, with the highest rates found in the CIRI region at 34%, and the lowest rates found in the ASRC region, at 13%. While Alaska may have a slightly lower rate than the nation, having roughly 1 in 3 households potentially unable to afford basic necessities such as food and medical care because of high housing costs still represents a significant housing need that should be addressed. It should be noted that while the ACS estimates are the most comprehensive available for cost-burdened housing, our analysis has found that energy costs are systematically underestimated in areas outside of Anchorage, meaning that the actual number of cost-burdened housing units is likely to be higher than this estimate, especially in

rural Alaska. For more information on the analysis of ACS energy costs, please see Appendix A, "American Community Survey Energy Cost Estimates" for more details.

Figure 19: Percent Cost-Burdened Housing in Alaska vs. Nationwide



The rate of cost-burdened housing varies within Alaska, as can be seen in Figure 20. The CIRI region has the highest percentage of cost-burdened households among ANCSA regions in Alaska. 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 on housing costs. As these regions are among the most urban regions in Alaska, it appears that regions with dense urban areas have less affordable housing than regions with more rural populations. However, analysis has shown that ACS energy cost estimates in rural areas are systematically low, which leads to rural areas being considered more affordable when they may in fact contain higher percentages of cost-burdened households than estimated. For instance, the Calista region has an unemployment rate among the highest in the state[19], as well as one of the lowest median incomes, but 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, which lead to low energy costs, as well as the subsidized rents and lease-to-own contracts that also lower housing costs.

[19] 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

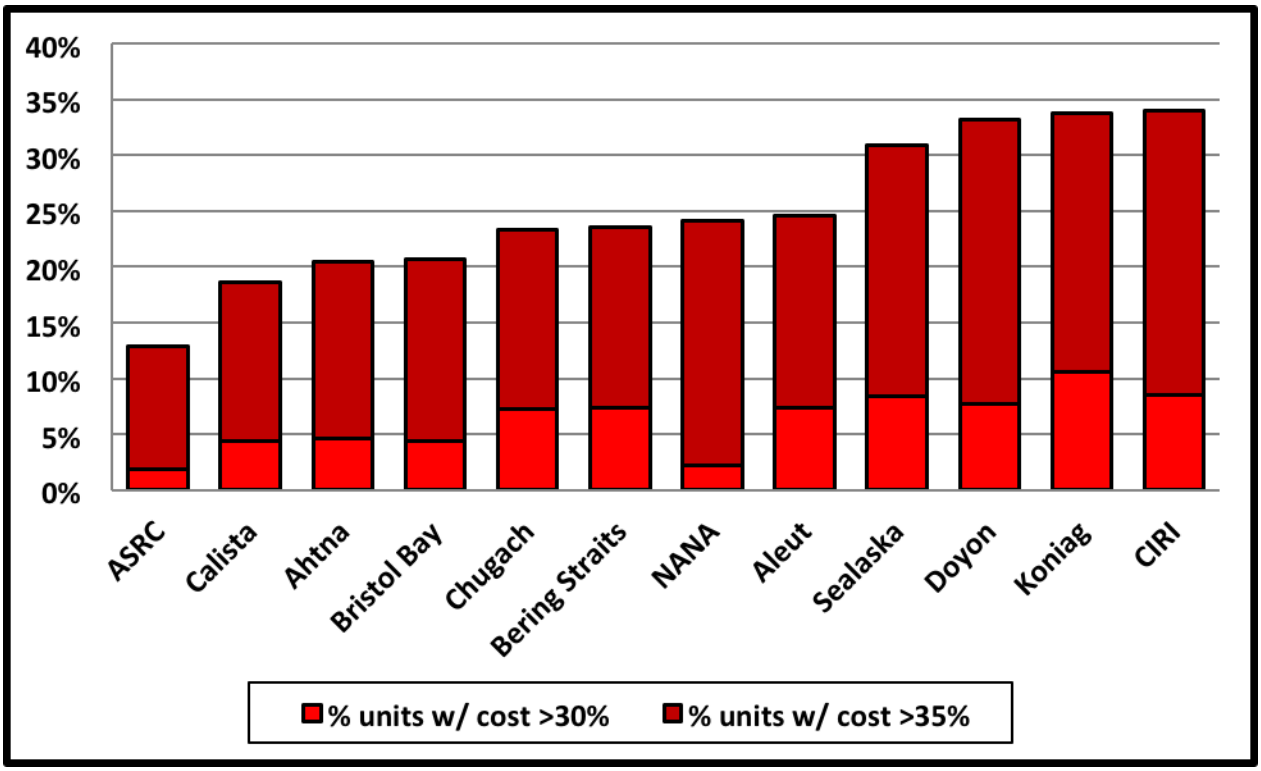
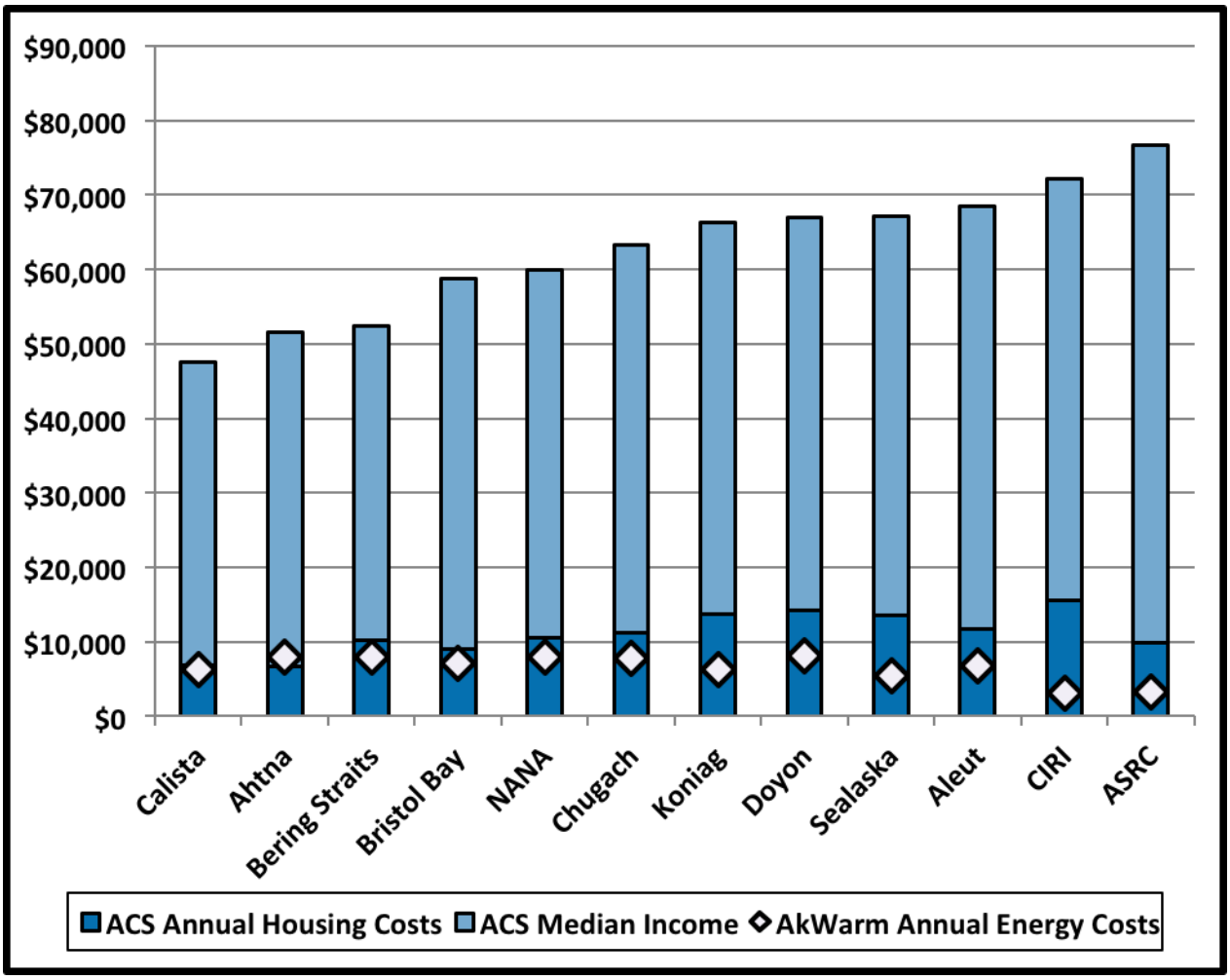


Figure 21 shows the median income for each of Alaska's ANCSA regions, as well as the ACS reported annual housing costs and the AKWarm estimated annual energy costs. As ACS housing costs include energy costs, annual housing costs should, in theory, be higher than annual energy costs. This is not the case 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, indicating that the ACS energy cost estimates that contribute to the annual housing cost may be systemically low in rural areas. This underestimation may be a necessary factor to consider in the regions with the two lowest median incomes in Alaska; the Calista and Ahtna regions have the second and third lowest percentages of cost-burdened households (see Figure 20) in spite of their low median incomes. 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 comparisons to previous Housing Assessments, please see the section "Statewide Housing Need." Additionally, a significant amount of data and analysis is available at smaller spatial scales within Alaska. Within this assessment, written summaries are available for each individual ANCSA region and Census Area in Alaska characterizing the housing stock from the perspective of community, overcrowding, energy, and affordability. Data profiles containing charts and tables are also available for ANCSA regions, Census Areas, and communities throughout Alaska. These multiple tiers of information and analysis allow researchers, housing authorities, policy makers, and the public to zoom in and out to answer questions from the local to the statewide level.

Glossary

ANCSA Regional Corporations

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

ASRC Arctic Slope Regional Corporation - Located on the North Slope of Alaska

Aleut Aleut Corporation - The regional corporation for the Aleutian Islands, Alaska Peninsula, Pribilof, and Shumagin Islands

Ahtna Ahtna, Inc. - The regional corporation located primarily in the Copper River basin

BSNC Bering Straits Native Corporation – Located on the Seward Peninsula, Eastern Norton Sound, and St. Lawrence Island

BBNC Bristol Bay Native Corporation – The Native Corporation for the Bristol Bay and Northern Alaska Peninsula region

Calista Calista Native Corporation – Located in the region spanning the Yukon-Kuskokwim delta

Chugach Chugach Alaska Corporation – Located in Prince William Sound and some coastal areas of Southcentral Alaska

CIRI Cook Inlet Region, Inc. – Located in Southcentral Alaska surrounding Cook Inlet

Doyon Doyon, Inc. – The region comprising most of interior Alaska

Koniag Koniag, Inc. – The region comprised of Kodiak Island and surrounding islands

NANA NANA Regional Corporation – The region encompassing the Northwest Arctic east of Kotzebue Sound.

Sealaska Sealaska Corporation - The Native Corporation for Southeast Alaska

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.

Ccf 100 cubic feet, typically used to measure a volume of natural gas

Conditioned space The area of a structure that is heated to a normal living temperature

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.

Cord A volume of wood equal to 4' by 4' by 8'

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.

R-Value The capacity to resist heat flow. The higher the value, the better the insulator

U-Value The conductance to heat flow. The lower the value, the better the insulator

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 2009 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 will receive a score down to 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 2009 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

HERP The 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 2013 Building Energy Efficiency Standard established by AHFC.

Weatherization / Wx The AHFC Weatherization Assistance program. This program is funded by the state legislature and provides energy efficiency and health and safety retrofits to housing that qualifies based on income eligibility at no cost.

Census and HUD Terms

ACS American Community Survey. A 5-year survey conducted from 2007-2011 by the U.S. Census Bureau. This is a stratified, random sampling survey that is 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 1 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 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 Department of Energy's Energy Information Administration, this survey looks at 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.