Appendix B: Data Sources and Limitations

Introduction

This 2018 Alaska Housing Assessment presents many types of data from various sources, with varying degrees of resolution, reliability, time frames and methods of calculation. Understanding the limitations of the data's accuracy and generalizability are important for drawing conclusions from this report.

Scope and Data Sources

The researchers used data from a wide variety of sources to evaluate Alaska's housing characteristics and needs for this report. Primary sources of data used in this evaluation of housing include the U.S. Census Bureau's American Community Survey (ACS) and energy ratings obtained from AHFC's Alaska Retrofit Information System (ARIS) database. Older versions of these two data sources were used in the 2014 Housing Assessment produced for AHFC.

New data sources used in this 2018 Housing Assessment include housing and population data from Alaska Department of Labor's Research Division, Power Cost Equalization data obtained from the Alaska Energy Data Gateway, property tax assessment data from urban areas throughout the state, national energy usage from the U.S. Department of Energy's Residential Energy Consumptions Survey (RECS), and data from other regional and local housing assessments around Alaska.

Census and ACS data provide information on total population, total housing units, income, household size, home age, occupancy, overcrowding, housing costs and affordability. Alaska Department of Labor and Workforce Development data provide information about Alaska regional population trends and projected aging population. Where available, data are reported at the census area, regional and state level.

It should be noted that all of the data sources used in the assessment have shortcomings. The following sections detail the data limitations and caveats that readers should keep in mind when interpreting the data.

Alaska Retrofit Information System (ARIS)

ARIS contains energy ratings and assessments produced as homes are evaluated under AHFC's Home Energy Rebate Program or the Weatherization Assistance Program or receive a new construction certification through AHFC's Building Energy Efficiency Standard (BEES). Home evaluations include energy ratings using AHFC's AKWarm modeling software to characterize basic features and construction type in addition to energy performance. Data from ratings are uploaded into ARIS. Data for this study were retrieved from ARIS in April

2016. At that time, ARIS contained data from more than 112,800 home energy rebate ratings and weatherization assessments gathered from either pre- or post-energy retrofit homes or from new construction certifications (BEES). These cover more than 85,800 units at unique addresses. This number represents approximately 28 percent of Alaska's roughly 303,417 total housing units[1] and approximately 34 percent of Alaska's occupied housing stock. ARIS data provide information about energy use and efficiency, energy costs, air tightness, ventilation and rates of participation in energy programs.

While there are limitations and caveats to estimates derived from the ARIS database, it should be noted that these data are based on professional energy ratings, which are fairly objective and numerous, representing 34 percent of occupied housing in Alaska. In comparison, the national Residential Energy Consumption Survey (RECS) uses a computer-aided personal interview survey on 12,100 households in the U.S. (approximately 0.01 percent of occupied U.S. housing) to estimate energy use and consumption for the nation.

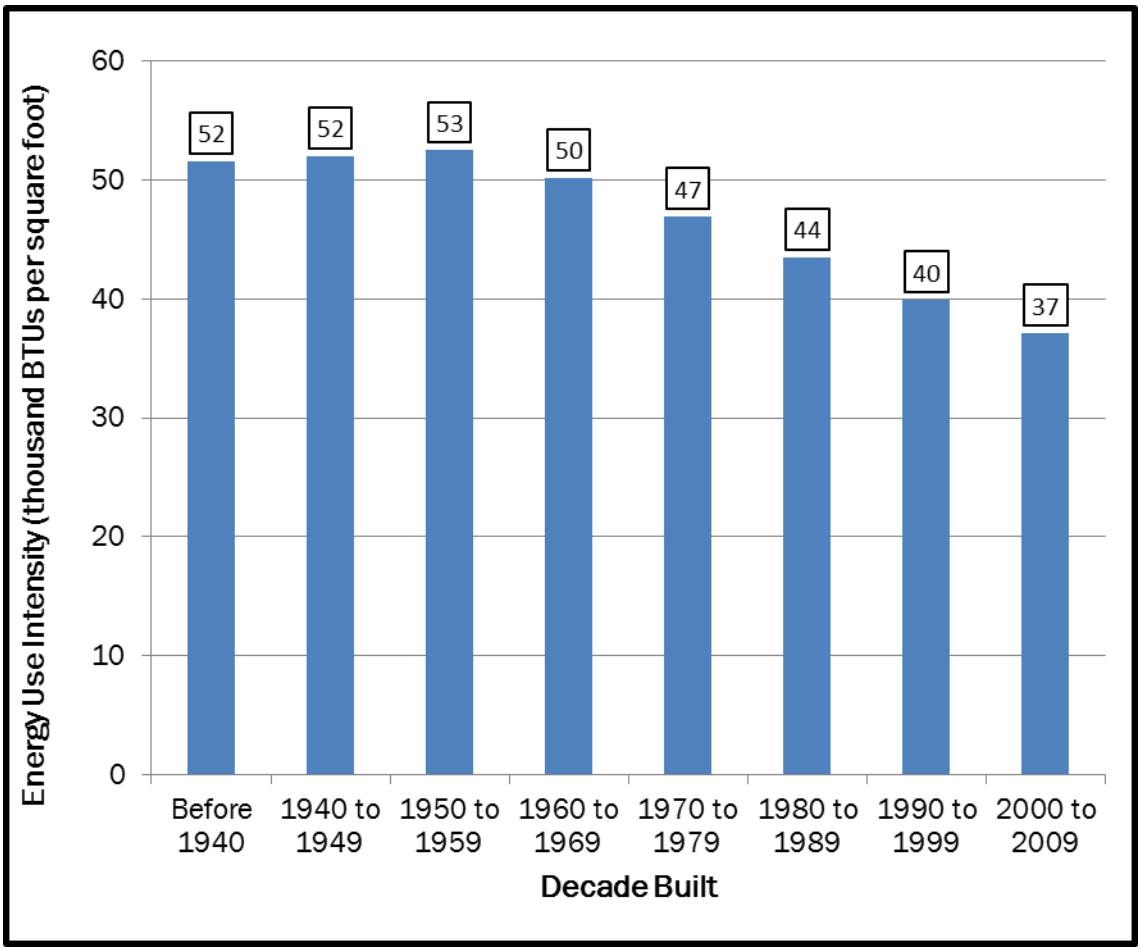
The energy rating information does have challenges, mostly notably sparse data in communities where energy-efficiency programs have not made inroads. Additionally, the energy information comes from AHFC's Weatherization Assistance Program, AHFC's Home Energy Rebate Program and AHFC's BEES certifications. Each of these sources have different requirements from AHFC and each tends to serve specific segments of the population rather than serving the whole population, which may make direct correlations with factors such as income, home age, etc. more difficult. The Weatherization Assistance Program typically serves a lower income population and serves a higher proportion of elderly and single-parent households. The Home Energy Rebate Program requires homeowners to fund energy retrofits upfront and thus will tend to serve a population with higher disposable income. The BEES certification is sought by two population segments. The first is those with higher income who value energy efficiency and can afford new construction. The second is those inhabiting housing that has been built with partial funding provided through the Alaska Housing Finance Corporation. Despite these issues, the data can still provide information about trends that can be used to create housing development and remediation plans and provide a basis for examining need.

While each program appears to serve a slightly different segment of the population, which could cause a self-selection or sampling bias error, the methodology used was intended to alleviate this bias. The methodology mapped the ARIS data to the ACS estimates of units built by decade in each area so that an oversampling of homes in one decade in one region or in one program did not bias the results. This methodology assumes that for homes that have not been retrofitted, energy efficiency is correlated with the decade in which a home

[1] Per the U.S. Census Bureau, "a housing unit is a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with other persons in the structure and which have direct access from the outside of the building or through a common hall."

was built. National data from the Department of Energy supports this correlation, as can be seen in Figure B-1, which is likely caused by building technologies improving over time and implementation of building energy codes.[2]

Figure B-1: U.S. residential energy use intensity by decade built



There may also be slight variations in the data due to software and database details. The AkWarm software and energy rating procedures have both changed since AkWarm's adoption by AHFC in 1996. However, care has been taken with updates and new features to minimize the impact to rating points and stars while increasing the functionality and accuracy of energy modeling. All estimates developed using ARIS data are based on the housing unit characteristic data that has been collected through these AkWarm ratings. The effects of home retrofits that were done but were not captured as part of an official energy rating would not be represented as a part of CCHRC's analysis. Further, some data that did

[2] U.S. Energy Information Administration, Independent Statistics and Analysis. (2016). Residential Energy Consumption Survey (RECS), 2009. Retrieved from https://www.eia.gov/consumption/residential/data/2009/index.php

not meet quality control was removed during analysis. Energy prices used by AkWarm, and stored in the ARIS database, are updated bi-annually based on the Alaska Department of Commerce, Community and Economic Development's survey of community fuel prices. Actual fuel prices may vary slightly from the January 2017 prices used in this report.

The energy information reported in the 2018 Housing Assessment is based on computer modeling of home characteristics. When compared to industry standard energy modeling software developed by the Department of Energy, AkWarm was within 5 percent on several metrics and within 10 percent overall. Like most modeling software, it does not take into account user behavior, which can be unpredictable. For a rated home, energy use estimates from AkWarm are divided into categories of space heating, domestic hot water (DHW) and appliances. User behavior can affect space heating estimates through variations in occupancy schedules, temperature set points, ventilation equipment and air leakage from opening windows and doors. Generally the estimates will be accurate as there are many user-independent details of the home such as insulation levels, natural air leakage and mechanical equipment types that are measured and input into the energy model. DHW usage estimates and energy costs are based on the installed equipment and national per person usage numbers, but the actual amount of DHW used per day varies based on occupant behavior. “Appliance” use and costs are estimates based on few inputs and can be highly variable based on installed equipment and user behavior.

Occupants are transient, whereas modeled energy use provides estimates based on physical characteristics of the house and standardized inputs. Comparing communities and regions based on modeled energy use eliminates the possibility of incentivizing regions that use more energy because of inefficient occupant behavior.

Occupant behavior will have a significant effect on whether housing units are at risk for moisture and indoor air quality issues. This housing assessment defines homes as being at "moderate risk" or “high risk" for air quality and moisture issues based on their air-tightness and lack of continuous mechanical ventilation. Homes with an estimated natural air change rate of between 0.3 and 0.5 air changes per hour are considered at moderate risk, and homes with less than 0.3 air changes per hour and no continuous mechanical ventilation are considered high risk, based on negative health outcomes associated with these levels.[3] While this is a good indicator of a housing unit at high risk, the occurrence of actual issues within the housing units depends heavily on user behavior and other factors, including operation of any intermittent fans, proper household drainage and water management and occupancy levels.

[3] Craven, C., Madden, D., & Garber-Slaught, R. (2017) *Indoor Air Quality: The Current State of Research.* Cold Climate Housing Research Center.

American Community Survey (ACS)

The ACS is conducted every year by the U.S. Census Bureau on a statistically representative random sample of households, intending to target 2.5 percent of the population. While the decennial census counts numbers of people, the ACS gathers data on demographic, social, economic and housing characteristics. Results are released in one-, three- and five-year period-averaged estimates. This report uses the 2010–2014 five-year estimates for Alaska, which is based on 42,574 randomly sampled surveys.[4] These surveys are conducted via questionnaires, telephone surveys, and in the case of rural Alaska, in-person interviews. While the data does have its drawbacks, it is the most reliable source for much of the demographic information reported in this version of the statewide housing assessment.

It should be noted that the ACS data are estimates based on statistical samples and thus have margins of error. The margins of error vary depending on the size of the area sampled and the number of households surveyed. The ACS data are reasonably reliable in larger urban areas but can have large margins of error in small communities due to the smaller sample sizes. For brevity, margins of error are not included with ACS data reported here, but researchers can use the American Fact Finder website[5] to find the margins of error for particular quantities or contact the Cold Climate Housing Research Center staff for details.

Alaska Department of Labor Data

Two primary sources of Alaska Department of Labor data were used in this housing assessment: new construction counts from 2000 to 2015 that have been collected using an annual survey conducted in each community in the state and population projections that were published in the document *Alaska Population Projections: 2015 to 2045*.

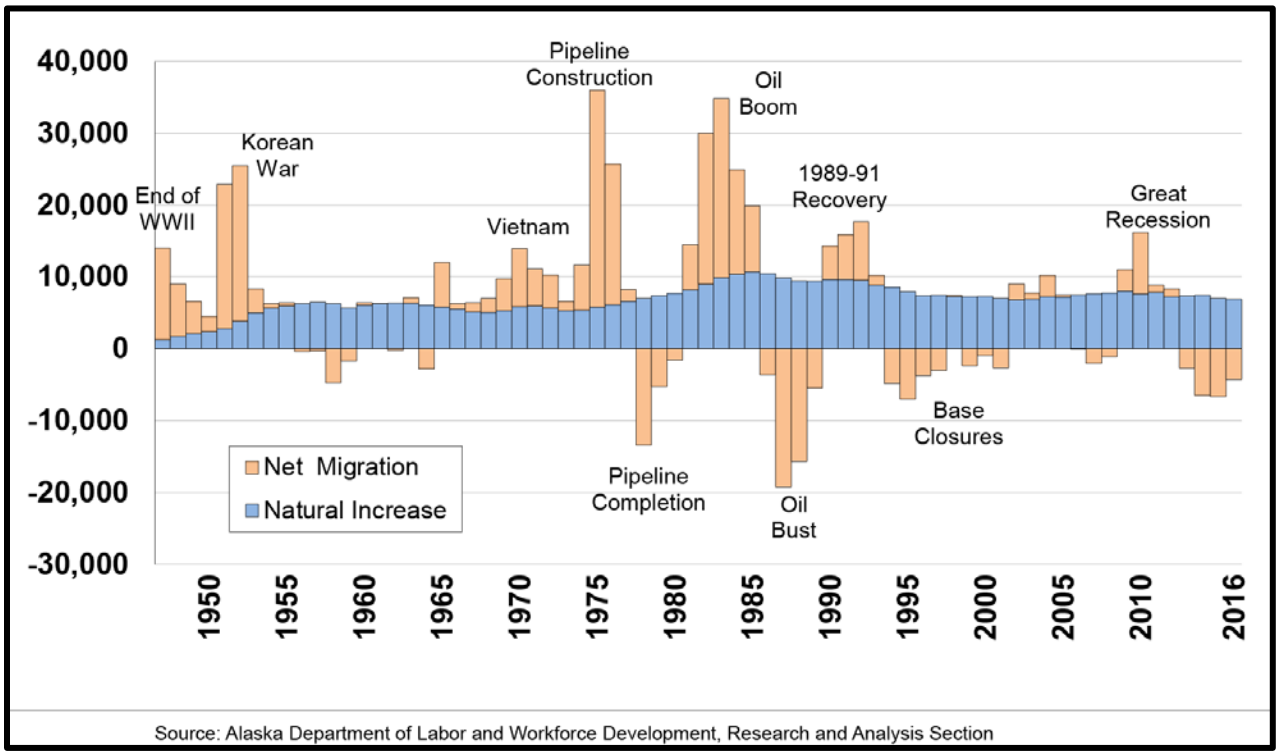
The new construction counts are collected and reported annually by the Alaska Department of Labor's Research and Analysis Section. Phone surveys in each community are used, along with additional data from building permitting and property databases, where available. While ideally there would be an official number based on building permits throughout the state, there is no statewide system in Alaska for requiring and collecting such data.

The population projections were created using a cohort-component technique, which looks separately at cohorts defined by age and gender in each region and then "ages" them forward, applying cohort-specific birth and death rates and also applying net migration rates. Net migration rates are the most difficult factors to predict in the future. The Department of Labor reported three separate scenarios with high, medium and low net migration rates; the medium case was used in the 2018 Statewide Housing Assessment. Historically, major

[4] U.S. Census Bureau. (2017). American Community Survey: Sample Size. Retrieved from https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/sample-size/index.php Accessed 8/24/2017.
[5] Available at http://factfinder2.census.gov

economic events have caused large changes in the net migration rates in Alaska, as can be seen in Figure B-2.

Figure B-2: Annual components of population change for Alaska, 1947 to 2016



Power Cost Equalization Data

Electricity data in the 2018 Statewide Housing Assessment comes from Power Cost Equalization Program data available from the Alaska Energy Data Gateway[6] where available and from the Institute of Social and Economic Research's Alaska Energy Statistics report for the remaining areas of the state.[7] Current cleaned data was not available from these sources, and so the majority of the historical data used in this report only goes to 2013. However, more recent electricity prices were applied to electricity usage data in order to better estimate energy costs; these electricity prices came from the January 2017 electricity rate schedules available in the AkWarm Residential Energy Modeling software library that is updated biannually.

[6] Available at: https://akenergygateway.alaska.edu/

[7] Fay, G., Villalobos, A., & West, C. (2013). Alas*ka Energy Statistics 1960-2011, Final Report*. (2014). Retrieved from: http://iser.uaa.alaska.edu/Publications/2013_12-AlaskaEnergyStatistics2011Report_Final_2014-04-30.pdf

Property Tax Assessment Data

Property tax data were obtained for several regions throughout Alaska, including the Municipality of Anchorage, the Mat-Su Borough, the Kenai Peninsula Borough and the North Slope Borough. This data was used to report on the housing condition / quality as identified by property tax appraisers in each region, which is available on the housing assessment profiles on AHFC's website.[8] These quality indicators are determined by municipal or borough appraisal staff, and so reflect their judgement of building quality. It should be noted that the different property appraisal databases have slightly different building quality definitions, and so the quality indicators between regions are not directly comparable. For additional information on these definitions, please contact Cold Climate Housing Research staff or the boroughs/municipalities directly.

Residential Energy Consumption Statistics Data

The most recent nationally representative data available on household energy characteristics is the U.S. Energy Information Administration's 2009 Residential Energy Consumption Survey[9] (RECS). It estimates household energy characteristics using a survey of approximately 12,100 randomly sampled housing units nationwide. These estimates provide context for Alaska's energy characteristics. RECS estimates are presented for a variety of different categories, including geographic location, climate zone and fuel type. In addition to the numbers for the nation as a whole, 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 Figures B-3 and B-4 below. Alaska is considered part of both sub-regions of the U.S. despite not being shown in the climate region map.

[8] https://ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment/
[9] The comparable data from the 2015 RECS is not scheduled to be released until 2017/2018.

Figure 3: 2009 residential energy consumption survey / Building America climate zones

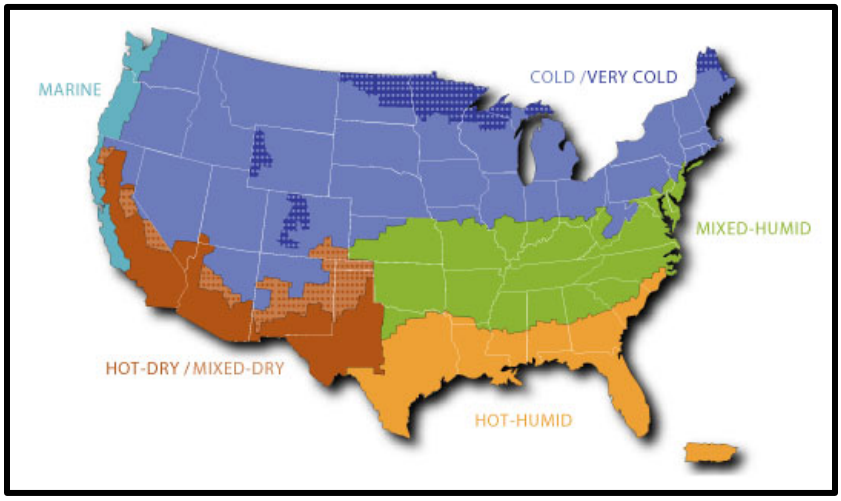
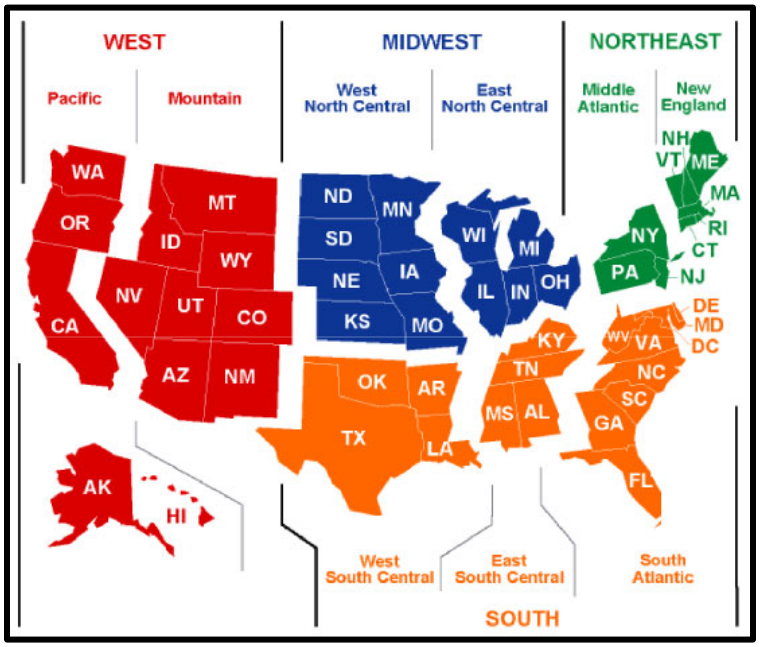


Figure 4: 2009 residential energy consumption survey regions[10]



Secondary Sources

The 2018 Statewide Housing Assessment also includes information from a variety of secondary sources that are cited throughout the report, including regional and local housing assessments conducted within Alaska. For the specific limitations of these secondary sources, please refer to the original reports and authors.

[10] Retrieved from https://www.eia.gov/consumption/residential/reports/2009/16-states.php