Methodology

The Alaska Statewide Housing Assessments provide information that is used by stakeholders in Alaska's housing sector to document conditions, identify need, and guide investment. In particular, Alaska Housing Authorities use the Statewide Housing Assessment in their planning process and to appeal to funding partners. These plans include identifying the need for replacement, retrofit, or new construction within the organization's area of responsibility.

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 2012 Housing Assessment combines information from the U.S. 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 is reported at the community level (where information is available), census area level, ANSCA level, and statewide level.

ARIS contains the energy rating and assessment files produced as homes pass through 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 the basic features and construction 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 cover more than 71,900 unique locations, 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.

Data from the 2010 decennial census, the 2007-2011 ACS, and the ARIS database form the basis of the 2013 Housing Assessment. 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 it is available, data are reported at the community, census area, regional, and state level.

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While the ACS dataset of the U.S. Bureau of the Census already contained estimates for all housing units in Alaska on a number of metrics, it was necessary to use the ARIS data to derive meaningful energy metrics. This required using data on audited housing units to derive energy data for the housing units that had not received an audit. This process included the following general steps: 1) download and clean the data, 2) calculate energy metrics, 3) stratify the data by audit type and by decade built by community, 4) create weighted averages for each community and region, and 5) apply criteria to determine what level of data can be reliably reported for each community.

Data was first downloaded from the ARIS database and cleaned. The cleaning process consisted of three parts: 1) removing duplicate records, 2) removing records for which essential data fields were missing and 3) removing records where data was outside of reasonable upper or lower limits. For example, records with zero energy use data were removed, as were records for single-family buildings with more than 12 bedrooms, as these generally can be attributed to incorrect data input.

Then energy metrics were calculated for each energy audit conducted. Total annual energy use, energy use per square foot (EUI), the home heating index, and area-weighted R-values were calculated from available data. Additionally, energy costs for the modeled energy usage were estimated using January 2013 fuel prices. Using this method, total annual energy costs and energy costs per square foot were calculated for each housing unit with an audit.

Data was then stratified both by audit type and decade built. Due to the differences in the programs, Home Energy Rebate Program audits, Weatherization audits, and audits conducted for BEES certification were separated. Additionally, the pre- and post-retrofit audits for both the Home Energy Rebate and Weatherization programs were separated. Within each of these five audit types data was stratified into categories by decade built. This was done as the energy use of residential buildings is correlated with the decade in which the home was built, as building energy efficiency technology has changed over time.[1]

Weighted averages for each energy metric were then calculated using the stratified data. BEES audits, Home Energy Rebate post audits, and Weatherization post audits were all assumed to represent buildings in existence today, as the vast majority of these audits have been completed since 2008. The energy characteristics for the remainder of the housing stock in Alaska were estimated using the Home Energy Rebate and Weatherization pre-retrofit audits. The average of these audits was assumed to be representative of homes built in the same decade in the same community. Finally, a weighted average for each energy metric for homes built in each decade was calculated by taking the units with a BEES or post-retrofit audit, adding the extrapolated pre-retrofit audits and then dividing by the total number of units. This process was repeated for every community, census area, and ANCSA region in Alaska.

Criteria were applied to determine what level of data could be released for each community. This was necessary due to variation in the number and percentage of energy audits for each community. Communities were classified as "High Data" and energy characteristics were reported by decade built if

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[1] Residential Energy Consumption Statistics (2009). *U.S. Energy Information Administration.*

they met the following two criteria: 1)There were 50 or more records or records on at least 20% of total housing units, and 2) There were records for housing units in at least 7 out of the 9 possible decades analyzed. Communities which did not meet these criteria but had at least 3 records of one rating category (pre-retrofit, post-retrofit, new construction) in the ARIS database were classified as "Medium Data" and had energy characteristics reported only for pre-retrofit, post-retrofit, and/or new construction. Communities with fewer than three records in a single category were classified as "Low Data" and had no energy characteristics reported in order to maintain confidentiality. In all, 56 communities or census-designated places (CDPs) have sufficient data to display current information on housing and energy characteristics by decade built; 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; and 114 communities or CDPs had insufficient data to protect homeowner confidentiality and make statements about housing and energy characteristics.

It should be noted that all of the data sources used in the assessment have shortcomings. As such, this information 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. For a detailed discussion of these, please see the section titled "Data Limitations." For a more detailed description of the steps and methods taken to move census, ACS, and ARIS data from raw form to numbers compiled at the community, census area, regional, and state level, please see the "Detailed Methodology." Finally, a methodology flowchart follows this section, visually representing the major steps taken to complete the 2013 Housing Assessment.

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