Alaska Energy Authority
Energy Efficiency Program Evaluation and Financing Needs Assessment

Final Report

Prepared by:

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In Collaboration with:

Cold Climate Housing Research Center

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Acknowledgments

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This report was written on behalf of the Alaska Energy Authority, but the views expressed in this report are those of the study authors, consistent with the commissioning of this work as an independent study.

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1. Executive Summary

In September 2015, the Alaska Energy Authority (AEA) retained the Vermont Energy Investment Corporation (VEIC), in partnership with the Cold Climate Housing Research Center (CCHRC), to conduct independent research and analysis of the potential need, barriers, and opportunities for improvements for financing and funding strategies for energy efficiency implementation in Alaska. The VEIC-CCHRC Team undertook this task in the context of energy efficiency's role in lowering individual and community energy costs.

This report contains findings and recommendations from several hundred hours of primary and secondary research and analysis by our team. Our research involved:

- **A thorough literature review** of existing efficiency programs in Alaska and in other jurisdictions; program documentation, program databases, authorizing legislation, supporting regulations, program reports, and related literature.
- **Meetings and interviews.** We conducted dozens of in person and telephone interviews and meetings, some with multiple participants.
- **Analysis of energy and demographic forecasts provided by AEA.** An efficacy assessment of current and past initiatives in Alaska, and consideration of how well strategies and best practices adopted elsewhere match the particular priorities and needs of rural Alaska.

The majority of the interviews and discussions were informal, and occurred during two visits to Alaska. The first occurred in late November-early December 2015, to coincide with the Bureau of Indian Affairs (BIA) Conference in Anchorage; the second occurred in April 2016, to coincide with the Alaska Rural Energy Conference in Fairbanks.

The team's *findings* are drawn primarily from the literature review, analysis, and feedback from stakeholders through one or more of the outreach channels. The term *recommendations* refers to the team's professional opinions, all of which are based on the research findings and our collective experience in the promotion and development of energy efficiency markets and financing.[1] We present findings first in this summary, because they provide the context and rationale for the recommendations that follow.

Findings

The findings and recommendations from this research are "cross-cutting." By design, the work and results do not reflect a deep-dive evaluation of any specific initiative,

organization, or program, but they do contain substantial analysis across the wide scope of energy efficiency practices to date in rural Alaska. Rather, the objectives and scope of work for this study are to identify the overarching needs and opportunities for energy efficiency in rural Alaska, with particular attention to how financing strategies can help to improve energy affordability. We have highlighted those areas with the broadest implications for future policy, program design, management, and implementation. Looking forward, as Alaska shifts to a practice of sustained investment in energy efficiency as an energy resource, we discuss the value of ongoing evaluation and monitoring as methods for informing program design and management, decision making, and safeguarding public and private expenditures.

Finding 1:	**There is significant need and opportunity for more energy efficiency.**

Energy efficiency is an important resource for rural Alaska. Efficiency has been consistently identified by regional plans, many studies, legislative action, and local communities as a priority. Research conducted in parallel with this study confirms this finding. In the study area, approximately 41,000 households and 10,000 non-residential buildings have not yet received comprehensive energy efficiency services during the 2008-2015 time frame. The **Forecast** section of this report provides details on the geographic distribution, fuel consumption, fuel costs, and potential fuel savings associated with providing efficiency services for these buildings. Our research clearly reaffirms the finding that energy efficiency has great potential for improving energy affordability in rural Alaska. Investment in energy efficiency is consistently identified by stakeholders as a priority need and opportunity.

Finding 2:	**Energy efficiency in Alaska is a cost effective strategy for the State and local economies.**

One of the reasons that energy efficiency is a priority for local communities and is widely considered by stakeholders to be a key strategy for improving affordability is that it is cost effective. In rural Alaska, the costs for delivering energy supplies and efficiency are usually much higher than in non-remote communities. The **Forecast** section of this report presents findings indicating the attainability of more than $697 million in present-value net benefits through cost-effective energy efficiency services to the cohort of residential and non-residential buildings not yet served. The present value costs for the efficiency improvements are estimated to be $866 million, with present-value benefits (based on local fuel consumption and prices) estimated to exceed $1.56 billion. Even when we incorporate the non-measure costs of the

recommended initiatives and strategies, the savings remain cost effective and provide an important economic opportunity for the State. The total present-value net benefits estimated in the **Forecast** section are the equivalent of more than $3,200 of net economic value for each of the 215,000 residents in the AkAES study area.

Finding 3:	**There are significant barriers and unique challenges to providing energy efficiency services for rural Alaska.**

Unique technical, logistical, and cultural factors influence the strategies that are appropriate for rural Alaska. The energy efficiency solutions that are appropriate elsewhere in the United States, or even in Railbelt Alaska, might need to be adapted, and in cases might not apply in rural Alaska. The **Efficacy Assessment** section of this report identifies gaps in the current and past initiatives serving the energy needs for rural Alaska. We supplement the **Efficacy Assessment's** broad view with a finer level of detail on how well a specific new or innovative strategy matches the unique needs and opportunities of rural Alaska. Sustained investment, training, research, coordination, monitoring, and evaluation, guided by comprehensive plans and strategies, are critical to long-term success.

Finding 4:	**Alaska has excellent resources and experience in delivering energy efficiency services to rural communities.**

Alaska has a strong community of dedicated professionals, organizations and leaders who understand the challenges and potential for energy efficiency. Alaska also has a diverse mix of actors in the energy sector with federal, state, local, tribal, non-profit, for-profit, and academic representatives all actively engaged. The literature review, program and services catalog, and efficacy assessment sections of this report provide greater detail and references on the nature, duration, and results across these initiatives. The collective experience and organizational capabilities are a valuable resource as Alaska seeks to further energy efficiency.

Finding 5:	**Certain strategies that have been successful elsewhere can be a good match for rural Alaska; others are less likely to be successful.**

Our research and this report offer several strategies, classified according to their relevance to efficiency programs, policy, regulation, and business approach—and summarized according to the Alaskan context. They are described throughout the report. These strategies illustrate how promoting energy efficiency deployed elsewhere might or might not be a good match for rural Alaska. In many cases,

modifications to or adaptations from the approach, and strategies used elsewhere, will be necessary to address specific conditions and challenges. The public-purpose energy services company (PPESCO) model is an example of a strategy that, with adaptations, holds promise for enhancing efficiency services and investment. Residential property-assessed clean energy financing (residential PACE) is an example of a strategy that is gaining some success in other markets. However, because of the administrative, tax, and property ownership characteristics of rural Alaska, that particular mechanism is not likely to be a good match.

Finding 6:	**Regional planning and data are critical for sustained success.**

The geographic span and environmental diversity of rural Alaska are immense. Important differences in the climate, available energy resources, transportation, economic drivers, demographics, culture, and political structures are all present. Regional energy planning plays an important role in identifying local priorities, engaging local communities and stakeholders, and in identifying specific metrics and milestones for success. As Alaska seeks to use efficiency as a key strategy to improve affordability in rural communities, coordination and tracking will help to facilitate best practices, reduce costs, and sustain progress.

Finding 7:	**Meeting the objectives of the Affordable Alaska Energy Strategy is likely to require new approaches to funding and financing.**

The total investments for enhancing energy efficiency in rural Alaska are significant ($866 million +), and Alaska faces real challenges and shifts in the fiscal and budget landscape as revenues from oil have declined and are not likely to provide the same level for appropriations as they have in the past. Therefore, it is apparent to our research team and to stakeholders that a shift from appropriations to sustainable funding and financing strategies is needed. Financing by itself, however is not a panacea that overcomes all barriers or reaches all potential for energy efficiency. Instead, financing strategies are one element in a portfolio of direct funding, support services and sustained consumer education.

Recommendations

Based on our research, analysis, stakeholder feedback, our discussions with AEA staff, and our team's professional judgment we recommend six areas for direct and indirect state

funding and four additional areas related to adoption of requirements and targets to further support efficiency. These are shown in **Table 1.**

Table 1. Overview of essential areas for direct and indirect state funding, and for establishing statewide requirements

Direct state funding	Indirect state funding	Establishing / enhancing requirements
Sustained **Weatherization** Program support	Continue **with technical services, training, and research**	Establish an energy efficiency resource standard (**EERS**)
Market-based programs and incentives	Join and/or create regional **coalition(s)**	Expand **building codes**, support and enforcement statewide; identify and implement "stretch" code
Upstream product initiatives and incentives		Participate in and adopt **minimum product standards**
Support **energy service contracts** via public and private channels		Create **targets or requirements for investment** of a portion of assistance, endowment or public benefit corporate portfolios to support energy efficiency

The annual funding needs to support these recommendations are estimated to be $61 million as illustrated in **Table 2.**

Table 2. Study area funding recommendations

Type of funding	Annual study area budget
Direct state funding	
Weatherization Services reaching 80% or more of all eligible rural Alaskan Households within the next ten years	$36 million
Market-based direct incentives, services, upstream incentives, and support for performance contracting	$17 million
Study area direct funding subtotal	**$53 million**
Indirect state funding	
Research, technical support, and training	$6 million
Regional collaboration (In State) and cooperation with out of state regional networks or alliances	$1 million
Study area indirect funding subtotal	**$7 million**

Type of funding	Annual study area budget
Requirements funding	
EERS, code enhancements, product and procurement standards	**$ 1 million**
Total study area recommended annual funding	**$61 million**

The net benefits of the proposed spending are estimated to be $40 million per year. Three-fourths (75 percent) of the expenditures by the State, presented in **Table 3,** are direct energy efficiency measure costs and incentives. The remaining 25 percent are non-measure costs, such as technical assistance and program delivery costs. The State's total expenditures of $61 million leverage additional participant investments of $24 million in measures, resulting in total expenditures of $69 million on measure costs and $16 million on non-measure costs annually, as presented in **Table 3.**

Table 3. Benefit / cost estimates for recommended portfolio

Annual costs	
Program: measure costs (direct incentives)	$45 million
Program: non-measure costs (non-incentive costs, market services, support, administration)	$16 million
Participant: leveraged customer investments in measures	$24 million
Total annual costs	**$85 million**
Annual benefits	
Residential buildings	$54 million
Non-residential buildings	$71 million
Total annual benefits	**$125 million**
Total annual study area energy expenditures	$397 million
Savings as share of annual energy expenditures	**31%**
Net benefits	
Estimated net benefits (total annual benefits – total annual costs)	**$40 million**

Capturing 30 percent (or more) in savings from energy efficiency is an aggressive, yet attainable, objective. It will require sustained funding, organizational development, training, commitment and education for consumers. However, as detailed throughout this report, Alaska has valuable experience and resources to draw upon, across all of these factors for a more sustainable energy future.

Alaska is facing significant challenges with declining oil revenues and pressure on State budgets. This study identifies an economic investment opportunity for the State to

improve energy efficiency in rural Alaska and to create significant net economic benefits. Together, they will help alleviate, rather than exacerbate, current economic challenges. The Legislature and other policy / decision makers will need to determine the most appropriate means for funding the recommended expenditures. **Table 4** presents an example of how investment of this magnitude might be structured and sustained.

Table 4. Illustrative funding profile that Alaska could adopt

Source	Annual Funding
Gross receipts tax / system benefits charges for electric and fossil fuel. Based on 4% of annual expenditures	~$16 million
Allocation of a portion of annual fuel assistance expenditures to support energy efficiency investments	~$20 million
Coordinate allocation of support from the U.S. Department of Housing and Urban Development (HUD), U.S. Department of Agriculture (USDA), BIA, other federal and foundation / private sources	~$15 million
Long-term (10-year) state appropriation / authorization, allocation from permanent fund, pipeline gas surcharge, etc.	~$10 million
Total	**$61 million**

Coordinated and consistent action across policy, regulatory and implementation segments of the energy economy will be required to make progress on the recommended portfolio. The **Policy and Strategy Recommendation** section of this report provides further detail on the following ten foundational recommended actions.

Recommendation 1.	**Establish a sustainable mechanism for Weatherization funding in rural Alaska.**

We recommend the Alaska Affordable Energy Strategy contain an explicit target for, and associated sustained funding to provide, comprehensive Weatherization services to all eligible households in rural Alaska over the next ten years. The estimated investment of $36 million per year to provide these services is consistent with past state investment levels in weatherization services, and will provide a substantial range of durable, non-energy benefits to the communities and families that are served.

Recommendation 2.	**Create statewide market-based energy efficiency programs, services and incentives.**

We recommend that market-based incentive programs and services for rural Alaska are part of a larger coordinated statewide effort, and that the savings and program expenditures in rural Alaska are counted towards contributions to broader statewide

savings targets and performance metrics. The creation of a statewide energy efficiency resource standard (Recommendation 7) is closely related to the creation of statewide programs and incentives. We note that a single statewide administrator should be considered, but is clearly not required to implement these recommendations. Coordinated and consistent program design and incentives, whether with single or multiple administrators, should be an objective unless there are specific compelling reasons for variations. Statewide delivery of efficiency services and effective market based incentive programs are identified in Recommendations 3 and 4, and are discussed further in the **National Best Practices** section of the report.

Recommendation 3.	**Develop upstream heating equipment and lighting initiatives and incentives.**

We recommend that to capture scale and administrative efficiencies, and to build market acceptance and awareness, Alaska should coordinate and implement strong, upstream (supply channel) initiatives in rural areas, as part of a broader, statewide (or regional) effort. The **Strategies in the Alaskan Context** section discusses upstream efficient lighting and heating / ventilation / cooling strategies for the market.

Recommendation 4.	**Support expanded use and models for energy service contracts.**

The State should create a formal initiative to foster and expand public- and private-sector actors who seek to provide energy services contract services for rural Alaska. The **Strategies in the Alaskan Context** section discusses the public-purpose energy services company model.

Recommendation 5.	**Continue support for technical services, research, and training**

Funding for the technical services, training, and research elements of the portfolio should be leveraged and coordinated with other state funds directed to services in other sectors, with funding for research and development through academic institutions, with federal funds, and with private support from foundations—and in some cases, with private investment.

Recommendation 6.	**Join and/or form collaborative partnership(s).**

We recommend that Alaska continue to encourage collaborations among market actors and the State, to advance statewide energy efficiency. The Alaska Energy Efficiency Partnership is a notable example of the benefits of collaboration and sharing of best practices in energy efficient building design, new technologies and promotion of new programs and financing supporting energy efficiency. We also recommend

participation in out-of-state regional or national alliances or collaborations supporting energy efficiency as an efficient means to access and maintain resources. Alliances developed with arctic climate regions in Canada through annual forums – most recently the Arctic Energy Summit – offer a broader scope of investments in energy efficiency technologies and building practices. Additional regional and national partnerships can support the development of resources for quantifying and reporting energy efficiency gains, such as a Technical Reference Manual (TRM) and standardized Evaluation, Verification and Monitoring (EM&V) protocols. If such an approach is less successful than planned, we strongly recommend Alaska consider forming a partnership or coalition that would more directly match the needs of northern climates and provision of services in remote communities.

Recommendation 7.	**Establish a statewide energy efficiency resource standard (EERS) and develop targets for assistance and portfolio investments to support energy efficiency investment.**

We recommend Alaska establish a formal EERS, and establish targets for total energy savings for at least the residential and non-residential building sectors over the 5- and 10-year horizons. See also Recommendation 2. Additionally, the State should establish legislative targets and guidelines for ensuring revenues, assistance, and other forms of investment are dedicated to energy efficiency, for the benefit of Alaska residents and businesses, statewide.

Recommendation 8.	**Adopt and expand support for statewide energy efficiency building codes for residential and non-residential buildings, including a stretch code element.**

We recommend that the State expand building code coverage to be statewide, and create an environment in which technical support is provided and enforcement is standardized. A stretch code will help support improvements in the code over time, and can be coordinated with the research and training elements in Recommendation 5.

Recommendation 9.	**Adopt minimum efficiency design and procurement standards.**

We recommend that the State establish standard purchasing / procurement requirements for energy-efficient equipment and other measures, ensuring that each energy-efficient product installed in Alaska meets or exceeds minimum performance standards established by nationally recognized rating organizations. In addition to

general market standards, procurement for state, municipal, and tribal organizations can also adopt minimum efficiency performance requirements and guidelines. Adoption of this recommendation can be related to research and training (Recommendation 5) and regional collaborations (Recommendation 6).

Recommendation 10.	**Establish targets and guidelines to channel a portion of assistance, endowment, and public-benefit corporation investments toward efficiency.**

The State should establish legislative targets and guidelines for ensuring revenues, assistance, and other forms of investment are dedicated to energy efficiency, for the benefit of Alaska residents and businesses, statewide. Such targets and guidance will help to fund the recommended initiatives and support all of the recommendations listed above.

Structure of the Report

The VEIC / CCHRC Team has structured this report to optimize and deepen readers' understanding of opportunities for Alaska's growth in energy efficiency service delivery—with special attention to rural communities. Alaska's accomplishments to date have prepared the state to evolve toward a comprehensive statewide energy efficiency strategy. The report supports decision makers in determining a path that considers future energy needs, costs, reliable funding methods, cost-effective customer project financing, and other factors that allow utility planners to incorporate the benefits of energy efficiency into their supply portfolios.

Section 2 offers an overview of Alaska's current and past initiatives. A catalog of these practices is contained in **Appendix A.**

Section 3 presents best-practice strategies that are being used in jurisdictions throughout the United States, and which have applicability for the Alaskan context.

Section 4, Alaska Looking Forward, assesses the efficacy of existing and past initiatives, assesses the savings potential for statewide code adoption, and offers a forecast of future energy in the context of demographic trends and likely resulting energy needs for rural Alaska. It also contains a discussion of building codes and standards.

Section 5 contains policy and strategy recommendations, describing in greater detail the findings and recommendations articulated in the **Executive Summary.** The findings directly reflect the information and feedback gathered from stakeholders in this study. The findings lead to specific recommendations from stakeholders, but they do not reflect recommendations from VEIC or CCHRC staff. The recommendations are the result of the VEIC / CCHRC Team's synthesizing the research, and reflect the professional experience of VEIC and CCHRC team members.

Appendices

A – Catalog of Alaska Programs
B – Bibliography
C – Efficacy Spreadsheet
D – Energy and Demographic Forecasts
E – List of Interviewees

Notes

[1] This report's **Introduction** presents information on the VEIC-CCHRC Team's professional experience with energy efficiency market development.

2. Alaska's Current and Historical Initiatives

Alaskans have long recognized the important role of energy resources and planning in supporting rural communities throughout the state. For decades Alaskans have worked through tribal, private, state, and federal planning and investment to operate energy infrastructure serving the needs of remote and rural communities. These communities face unique barriers and opportunities across climate, logistical, cultural, demographic, and technical dimensions.

In 2014, the Alaska State Legislature passed Senate Bill 138 (SB 138), a piece of natural gas pipeline enabling legislation that directed the Alaska Energy Authority to propose a plan for improving energy affordability for Alaska communities that would not have direct access to the proposed pipeline. The AEA's program to fulfill this mandate is the development of the Alaska Affordable Energy Strategy (AkAES).

SB 138 also established the Affordable Energy Fund that, if and when the natural gas pipeline is built, would receive income from pipeline revenues. Through the research and analysis conducted for the AkAES, the AEA would recommend plans for achieving near-term energy cost savings and prepare the state for revenue from the Affordable Energy Fund.

The full AkAES will have a broad scope and will consider options for efficiency and energy infrastructure and investments in supply, transmission, distribution, operations, and supporting energy infrastructure. This study, a contributing element to the broader AkAES scope of work, addresses efficiency at the consumer level, with a primary emphasis on the residential and non-residential building sectors.

The details of direct access to the natural gas pipeline remain to be determined. However, we have excluded from this study the "Railbelt" communities of the Anchorage Municipality, Fairbanks North Star Borough, Kenai Peninsula Borough, and the Matanuska-Susitna Borough. **Figure 1** shows the areas contained in the study, and the areas excluded.

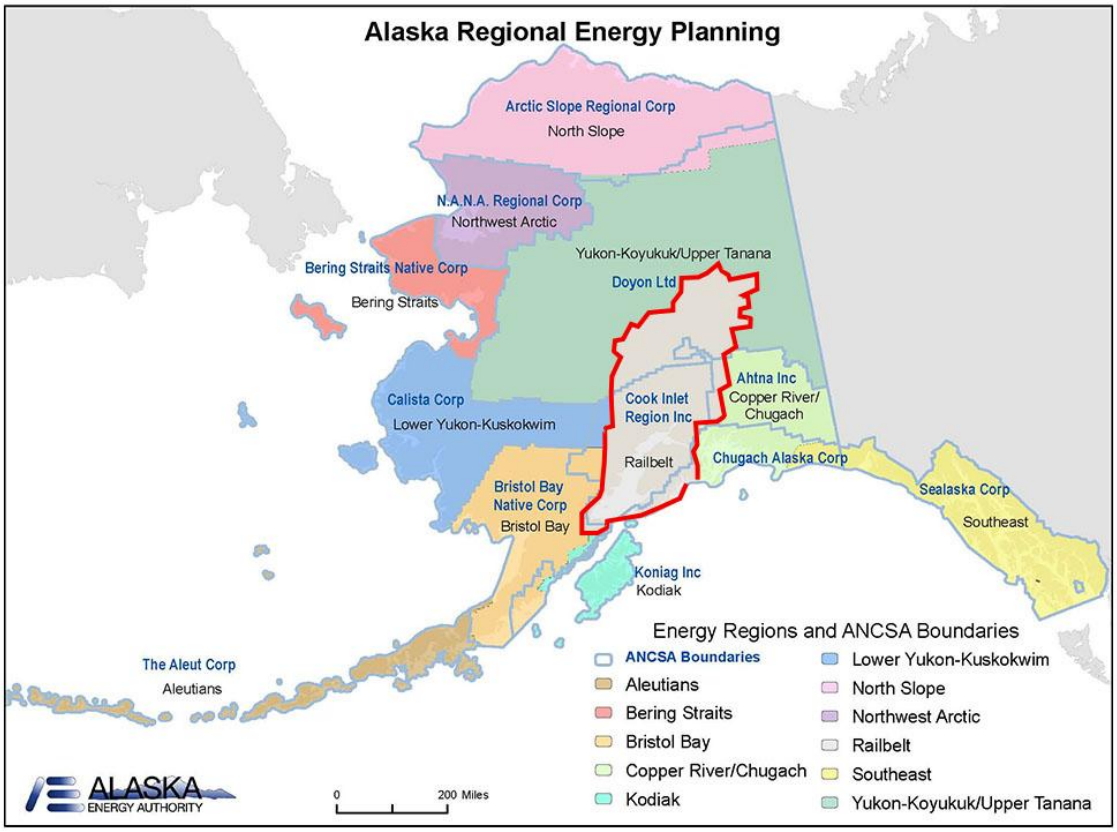

Figure 1. Alaska Affordable Energy Strategy study area: Regions outside the Railbelt.

Energy Efficiency as a Resource in Alaska

The Legislature has recognized energy efficiency in Alaska as a strategic policy objective with the passage in 2010 of House Bill 306 (HB 306). The resulting law established the target of achieving 15 percent reductions in per-capita energy consumption by 2020 through efficiency.

SB 138 and HB 306, and the AEA's initiation of the AkAES, build on a legacy of recognizing energy efficiency as an important resource, and provides an opportunity to develop an energy reduction strategy that helps address affordability, health, and safety needs in rural Alaska.

The AEA, along with other stakeholders and organizations, has emphasized the importance of efficiency as a long-term strategy for Alaska. Over the past decade, the following studies have prioritized energy efficiency as a resource:

- Rural Energy Action Council, *Findings and* Action *Recommendations,* 2005
- Information Insights (for AEA and Alaska Housing Finance Corporation [AHFC]), *Alaska Energy Efficiency Program and Policy Recommendations*, 2008
- AEA and the Alaska Center for Energy and Power, *Alaska Energy: A First Step toward Energy Independence,* 2009
- AEA, *Alaska Energy Pathway,* 2010
- CCHRC (for AEA), *Alaska Energy Efficiency Policy and Programs Recommendations: Review & Update,* 2011.
- AEA, Energy Efficiency Policy Recommendations for Alaska, 2012
- Commonwealth North, *Energy for a Sustainable Alaska: A Rural Conundrum,* 2012
- ISER, *Energy Policy Recommendations,* 2013
- Alaska Arctic Policy Commission, *Preliminary Report to the Alaska State Legislature,* 2014
- Regulatory Assistance Project and Ernest Orlando Lawrence Berkeley National Laboratory, *Sustainable Energy Solutions for Rural Alaska,* 2016

The Rural Energy Action Council, created by Governor Frank Murkowski and convened by the Alaska Energy Authority, recommended funding for weatherization and strategies such as a low-interest loan fund to support energy conservation and efficiency in rural Alaska. The 2008 *Energy Efficiency Program and Policy Recommendations* cited total investments in efficiency of more than $706 million, with present value energy savings estimated to exceed $843 million for a benefit-cost ratio of 1.59:1. The authors recommended state funding for weatherization of 45,000 households, and action by the Regulatory Commission of Alaska (RCA) to establish a system benefits charge to provide sustained funding for efficiency programs.[1]

The 2009 study prepared by the AEA and the Alaska Center for Energy and Power (ACEP) noted that end use energy efficiency was a key element to realizing a more affordable and independent energy economy. The 2010 *Alaska Energy Pathway* recommended ways for reaching targets of 20 percent in energy efficiency and conservation improvements by 2020.[2]

Commonwealth North's 2012 report was the result of a comprehensive study that emphasized the challenges of rural communities. They recommended prioritizing interconnection of rural communities where feasible, and coordinating planning and investment in infrastructure, and using efficiency to reduce or eliminate the need for the Power Cost Equalization program.[3]

The Institute of Social and Economic Research (ISER) drafted comprehensive Energy Policy Recommendations for the Alaska Legislative Affairs Agency and State Senate Energy Working Group in 2013. The priority recommendations primarily called for immediate and multi-year funding for energy efficiency initiatives that can effectively reduce energy burden costs for Alaskans, offer good returns on investment, and create jobs.

The ISER study affirms energy efficiency as an effective strategy with significant remaining potential:

> *Efficiency appears to be the most effective, dependable path to lowering energy costs for all segments of energy consumers. Significant potential savings to Alaska businesses and government - over $125 million and over $200 million per year respectively - remain to be realized.* [4]

In examining Alaska's role in the broader Arctic region, and strategies to support sustainability and economically viable communities, the Alaska Arctic Policy Commission made the development of stable long-term funding mechanisms for state weatherization and energy efficiency programs a priority.[5]

The U.S. Department of Energy (U.S. DOE) Office of Indian Energy Policy and Programs released a study "Sustainable Energy Solutions for Rural Alaska" (April 2016) examining "the reliability, capital and strategic planning, management, workforce development, governance, financial performance and system efficiency" for delivering energy in rural Alaskan communities. Several findings and recommendations from the report directly reflect opportunities for accelerating energy efficiency in the AkAES area: greater coordination of utilities for achieving greater economies of scale; improving long-term integrated resource plans (IRP); developing workforce capacity; increasing power system efficiency and commitment to energy efficiency; improving access to low-cost capital for rural utilities; and leveraging the existing market for energy efficiency services.

Regional Energy Planning

Since 2014, AEA has provided funding, and technical and planning support to the Alaska Regional Development Organizations (ARDORs) and other regional and statewide stakeholders. This effort has resulted in the development of nine separate regional energy plans in the AkAES area in addition to a separate plan for the Southeast. These plans are expected to result in strategic plans that prioritize and specify opportunities — including energy efficiency projects — for reducing the long-term cost of the energy supply and usage in rural Alaska regions and communities.

The regional energy plans involve individual community demographic data, identified renewable resources, and building energy data to support the analysis of the potential for energy savings.[6]

The regionally led and community-vetted planning process has consistently identified end use efficiency as a top priority, based on cost effectiveness, the potential for relatively quick implementation, and the level of their capital cost investments. In the residential sector, the regional planning studies suggest that between 50 and 85 percent of the housing stock has not yet received energy efficiency services in the 2008-2014 period.

Table 5. Regional energy planning estimates of remaining residential sector building stock energy efficiency potential[7]

Census area	Non-energy-efficient housing	Approximate number of remaining units	Estimated annual fuel savings potential (MMBtu)
Yukon-Kuskokwim	70%	4,187	236,000
Chugach Prince William Sound	81%	2,079	137,419
Interior	49%	1,354	117,000
Bristol Bay	64%	1,495	54,912
Aleutian	82%	1,329	41,114
North Slope	85%	1,671	91,237
Kodiak	63%	1,930	65,148
Bering Straits	90%	2,480	126,381
Southeast	84%	24,077	1,264,520
Northwest Arctic	78%	1,402	57,692
Total		**42,004**	**2,191,423**

The summary of estimated annual fuel savings in **Table 5** reflect avoided fuel oil consumption reported in the regional energy plans. However, they do not reflect savings from avoided fuelwood use and use of other heating fuels, nor the potential for electric energy efficiency savings through more efficient lighting, appliances, and other measures or their indirect fuel savings from reducing electric generation. Therefore, the actual, total energy savings potential is likely to be higher.

The regional energy plans consistently identify energy efficiency as a high priority for maintaining or improving energy affordability. This repeated recognition of the role of energy efficiency and shared opportunities for weatherization of residential buildings, and improvements in energy efficiency in public and commercial buildings, and water and sewer systems provides a strong argument for continuing to develop and coordinate services. Specific recommendations include expanding awareness, reducing barriers and increasing participation in existing statewide energy efficiency programs; benchmarking and conducting audits on existing non-residential buildings; upgrading street lighting to light-emitting diode products (LEDs); and investigating the public-purpose energy services company (PPESCO) model as a potential opportunity for retrofitting community buildings and schools. The consistency in the regional plans also indicates community understanding and "buy-in" on the value and the benefits of energy efficiency.

The regional plans tend to characterize energy efficiency potential in both the residential and non-residential sectors. However, they are not detailed implementation documents and therefore contain few specifics on budgeting, program services, delivery methods, and timeframes for capturing the cost-effective potential.

Data and Analysis

Alaska is rich in data and analysis on current energy consumption patterns and infrastructure. The work to date provides policy makers and planners with information to help decision making in investments, program designs and policies. Alaska has several publicly available data sources on community demographics, number and location of buildings, energy use, and energy efficiency building retrofits. These data are in public databases, and are an important source of information for the regional energy plans. The most extensive database is the Alaska Retrofit Information System (ARIS), which has energy audit data on an estimated 32 percent of occupied housing in the state, and information on energy audits of public buildings. The interactive Alaska Energy Efficiency Map contains summary statistics of these data, and data from AEA's energy efficiency

programs. Finally, the Alaska Energy Data Gateway offers researchers access to electricity use data, fuel prices, and other energy information published elsewhere.

ARIS is a SQL database developed jointly by AHFC, CCHRC, and Resource Data, Inc. (RDI). It stores, tracks, and manages data from residential and commercial energy efficiency programs. The primary data stored in the database are the inputs and outputs of energy models. It also contains data on actual fuel billing, program costs, and a regularly updated library of energy assumptions (fuel prices, R-values of materials, climate data, etc.) are included.

ARIS can be queried by AHFC-approved researchers, and it contains a web interface.[8] The web interface allows users with accounts to upload information, download AkWarm energy model files,[9] and view automated reports that AHFC personnel use in program tracking.

ARIS has energy audit data for residential buildings throughout the state. AkWarm home energy models are stored in the database for every home participating in the Home Energy Rebate, Weatherization, or Alaska Building Energy Efficiency Standard (BEES) programs.

In the autumn of 2015, there were more than 80,000 residential AkWarm energy audit models with unique locations in the database, representing approximately 32 percent of the occupied housing in the state.[10] The AkAES region represents approximately 20 percent of the entries in the database, of which over 50 percent were through the weatherization program, 25 percent in the Home Energy Rebate program, 18 percent new construction meeting BEES and remaining 2 percent participating in the New Home Rebate program. Pre- and post-audit data are available on homes that have been retrofitted through either the Home Energy Rebate or Weatherization Assistance programs. This large sample of building information was used in the 2014 Alaska Housing Assessment in combination with American Community Survey data and other sources to develop housing profiles for each ANCSA region, Census area, and community in the state. These profiles characterize the housing stock at each of these levels in four major categories: community, energy, overcrowding, and affordability.

ARIS also contains data for commercial buildings throughout the state. There are two primary sources of data on commercial buildings: benchmark data via AHFC's Retrofit Energy Assessment for Loan (REAL) benchmark form, and audit data from AkWarm-

Commercial energy modeling software. The benchmark data for 1,200 buildings are largely self-reported (by building owners), and come primarily from AHFC's effort to provide energy audits and loans for energy efficiency to public buildings throughout the state. There are 327 commercial building audits in the database that were performed under AHFC, which provided free ASHRAE Level 2 audits to qualifying buildings.[11] The Alaska Native Tribal Health Consortium (ANTHC) and AEA have also uploaded audits on village health clinics, water and wastewater treatment plants, and buildings participating in AEA's Village Energy Efficiency Program and Commercial Building Energy Audit (CBEA) program.

ARIS's appraisal tool calculates the value of energy efficiency for a home by comparing it to modeled homes in the database. AHFC, CCHRC and the Alaska Craftsman Home Program jointly created the tool for real estate professionals and appraisers to incorporate the value of energy efficiency into home price assessments. Users enter a home's annual energy costs and the general information (location, square footage, bedrooms, etc.) and the tool queries ARIS to find comparable homes. The energy costs of the home being evaluated are then compared to the energy costs of the comparable homes, and the net present value of the difference in energy costs is calculated over a 5-year period. Appraisers are advised to use this as the maximum value to be added to the home being evaluated.

Alaska Energy Efficiency Map

The interactive Alaska Energy Efficiency Map[12] shows where energy efficiency work by AEA and AHFC has been done in the state, as shown in **Figure 2**.

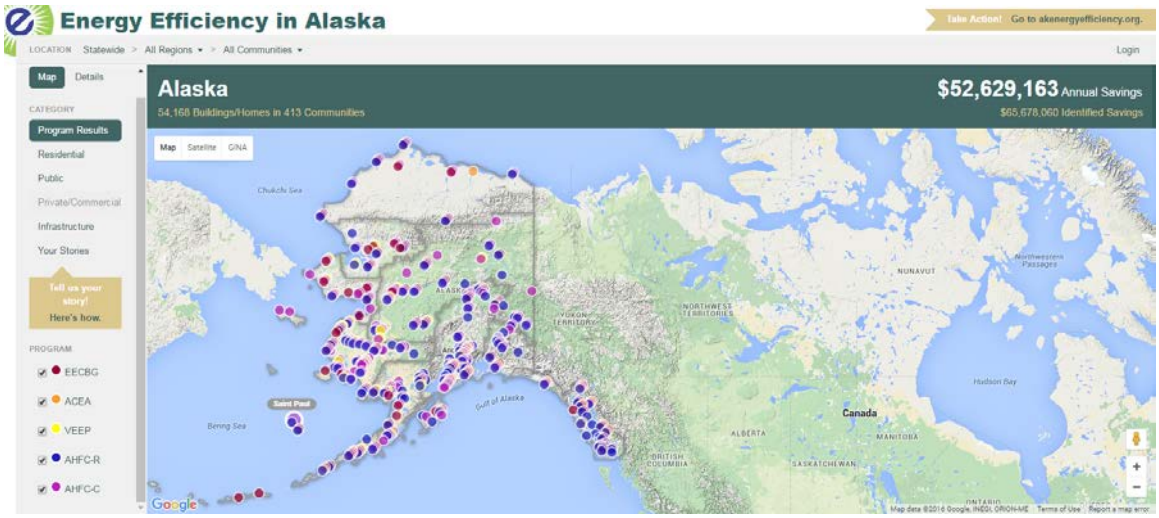

Figure 2. Screen shot of the Alaska Energy Efficiency Map.

This AEA map contains data for:

- AEA's Commercial Building Energy Audit program (specific buildings)
- AEA's Village Energy Efficiency Program (community totals & some specific buildings)
- AEA's Energy Efficiency and Conservation Block Grant program (specific buildings)
- AHFC's Home Energy Rebate and Weatherization Assistance Programs (community totals)
- AHFC's Public Building Audits (specific buildings)

The map also details the total amount of cost savings possible from energy efficiency measures that have been identified through audits, and the total savings that have been achieved by implementing energy efficiency retrofits in these buildings.

Alaska Energy Data Gateway (AEDG)

The University of Alaska's Institute for Social and Economic Research (ISER) created the Alaska Energy Data Gateway, in collaboration with AEA. The searchable database contains data from the Power Cost Equalization (PCE) program's mandatory reporting requirements, as well as bulk fuel inventory and 2012 powerhouse inventory, fuel prices from the AHFC and Department of Community and Regional Affairs (DCRA) biennial fuel price survey, economic and demographic information from the Alaska Department of Labor and Workforce Development research division and the U.S. Census Bureau, and

tables from the Alaska Energy Statistics publication. PCE offers a subsidy for electricity in rural Alaska and requires that utilities report their generation, diesel generator efficiency, sales, and other data for every community that participates. The Gateway provides access to many years of reports in API, CSV, Excel, or SPSS file formats. Several of the Gateway's datasets are not publicly available elsewhere including Renewable Energy Fund (REF) project performance and detailed time-series operational data for all operational REF – funded projects.

Market Assessments, Reports, and Audits

A significant number of reports, market assessments and project / facility specific audits help quantify and characterize the savings potential and needs related to Alaska's energy efficiency resources. These involve survey studies that expand on the data sets listed above, compilations of data from audits, and benchmarking for the energy performance of existing buildings, irrespective of whether their owners have undertaken energy efficiency improvements. Recent reports and assessments that are valuable to future planning and delivery of efficiency services are:

- Alaska Energy Authority, *End Use Study,* 2012.
- Alaska Housing Finance Authority, *A White Paper on Energy Use in Alaska's Public Facilities,* 2012
- Alaska Housing Finance Authority and Cold Climate Housing Research Center, *Energy Efficiency of Public Buildings in Alaska: Metrics and Analysis,* 2014
- Alaska Housing Finance Authority, *2014 Housing Assessment*

The findings from the *White Paper on Public Facilities* and supplementary analysis of schools and other public buildings illustrate the rapid paybacks on average of four to five years for investments in energy efficiency. The series of white papers evaluates the cumulative opportunity identified through 327 investment-grade audits conducted on public facilities by AHFC and an additional 65 audits completed by ANTHC on health clinics, washaterias, and water treatment facilities. Financing for public facilities through AHFC's Energy Efficiency Revolving Loan Fund (EERLP) is highlighted as a cost-effective way for communities to accelerate the rate of efficiency improvements, as shown in **Figure 3.** It also provides an attractive annual return on investment: 26 percent for schools included in the study.

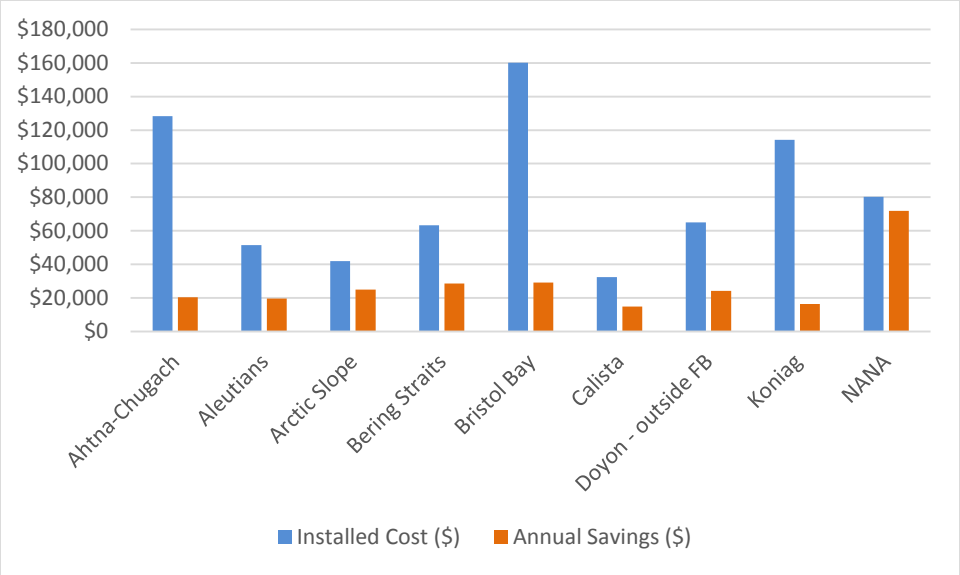

Figure 3. The regional average costs, savings, and payback from efficiency retrofits of public buildings. [13]

Although the AHFC loan program has not yet been used, the benchmarking and audits have created a trained workforce of Certified Energy Auditors, prompted the majority of the buildings to implement some amount of energy efficiency retrofit work, and increased the amount of information available on commercial-scale building efficiency in the state. The audit and benchmark data have informed two types of reporting in the ARIS database: the *White Paper on Energy Use in Alaska's Public Facilities* and follow-up, topic-specific reports, *Energy Efficiency of Public Buildings in Alaska*.[14] In addition to providing energy metrics for different building types specific to Alaska,[15] these reports produced the following key findings:

- Ventilation rates appear to be the largest driver of thermal energy efficiency[16] in Alaska.
- There is no correlation between building age and energy efficiency, even when compared to similar building use types in similar climates. A lack of commercial building energy codes is likely a large factor.
- Operations and maintenance can play a significant factor in energy use in buildings.
- In rural communities, operations and maintenance changes or retrofits that can be done with local labor are the most cost-effective energy efficiency measures.
- Energy audits indicate that the average annual cost savings per building, if the building owner were to undertake the recommended measures, was $21,000. The costs to implement the corresponding efficiency measures was $82,000

per building, leading to average return on investment of approximately 4 years.

Applied Research and Demonstration

CCHRC is the most prominent Alaskan organization with research scientists, engineers, and practitioners delivering a hands-on approach to designing, testing, demonstrating, and deploying energy and building system technologies. They have designed their approach to be particularly appropriate for rural Alaska. Each is an essential resource for training new tradespeople and professionals. Each also makes significant contributions in designing sustainable and innovative energy efficiency solutions for buildings.

This approach targets efforts to support high-performance buildings for rural Alaska, to reduce residents' upfront capital costs, improve health and performance of homes, and support significant reductions in energy use. CCHRC's Sustainable Northern Communities (SNC) program supported two prototype projects in Quinhagak and Anaktuvuk to address location-specific challenges to the construction of high-performance buildings.[17] Performance monitoring of the Anaktuvuk Pass prototype buildings suggest heating fuel reduction of 78 percent over comparable buildings in the 2009 Alaska Housing Assessment and 41 percent reduction over BEES rated homes in Anaktuvuk. The prototype home completed in Quinhagak resulted in similar reductions in fuel usage to comparably sized homes in the community with a usage of 171 gallons of fuel oil. The Quinhagak building was built with local labor for $220,000 – lower cost than a recently constructed affordable housing building.

In February 2015 the Association of Alaska Housing Authorities (AAHA) hosted a collaborative training event, Developing Alaska Sustainable Housing (DASH). The event was an opportunity for experts and key stakeholders to discuss topics such as housing design, building materials, construction methods, and project financing within the context of building cold-climate, high-performance buildings, in the context of energy affordability in Alaskan communities.

Efficiency Experience: Opportunities and Barriers

Alaska also has decades of experience with the delivery of energy efficiency services through efficiency program initiatives. However, rural Alaska offers many logistic, environmental, and institutional challenges to program design and delivery. This

subsection offers an overview of the literature and experience from existing programs. **Section 3** offers a gap analysis of existing program initiatives; the analysis supports the recommendations on priority strategies. The listing in this section concentrates on the major program initiatives. **Appendix A** presents a fuller catalog listing of programs.

Weatherization Assistance Program

The Weatherization Assistance Program (WAP) began in Alaska as a purely federal program and has been in existence since 1981. In response to the spike in oil prices in 2008, the Alaska State Legislature enacted Senate Bill 289, which dramatically increased funding for the program and expanded the income eligibility requirements from households earning up to 60 percent up to 100 percent of Area Median Income (AMI). AMI is determined by the U.S. Department of Housing and Urban Development (HUD) and adjusted by family size. Between enactment of the legislation in 2008 and September 30, 2015, $323.4 million have been spent, resulting in 16,914 unit retrofits. The program has historically been funded through the State of Alaska's capital budget. The most recent authorizations for Weatherization are significantly lower. The FY 2016 allocation was $7.1 million, of which $1.5 million was from federal funds.[18] Federal spending for weatherization in Alaska has historically been a lower share compared to the state funding ranging from a low of $360,000 to a high of $2.5 million in 2008.

Five separate agencies and 14 regional housing authorities carry out the Weatherization retrofits. As in the Home Energy Rebate Program, pre-project audits and post-project audits are performed for every participating home using AkWarm, and the most cost-effective energy efficiency measures are recommended. The energy assessors then prioritize the energy efficiency measure recommendations, taking into consideration project budget constraints, and which agency or housing authority can undertake the work. Each region has a funding allocation. Homes on the Railbelt or Marine Highway may receive up to an average of $11,000 in energy and health and safety measures per home, and homes in remote rural areas may receive up to an average of $30,000 per building. Applicants must meet one of the qualifying criteria (for example, relating to income or disability) to be accepted; once accepted, they are ranked according to need.[19]

CCHRC published an evaluation in 2012 of the Weatherization Assistance Program, with an unpublished data update performed at the end of that year. The data update showed that homes participating in the Weatherization program reduced their energy consumption by approximately 28 percent for single-family homes and 18.5 percent for multi-family units, for an average annual fuel cost savings of $1,295 per

year and $396 per year, respectively. Based on the cumulative number of homes weatherized, the program is estimated to save 371 million MMBTUs annually, equivalent to 2.7 million gallons of #1 heating fuel, or 3.7 million therms of natural gas. Because of issues with data quality (both cost reporting and a significant number of energy audits that were not uploaded into the ARIS database), the study team could not perform a cost-effectiveness analysis of the Weatherization program.

Regionally, the Weatherization program performs a larger percentage of retrofits in rural Alaska than does the Home Energy Rebate Program. Based on available data, approximately 42.5 percent of the retrofits completed by the Weatherization program were in the AkAES region; the rest were performed in the Cook Inlet region (36.6 percent) and the Fairbanks North Star Borough (20.9 percent). However, approximately 60 percent of State program funding for Weatherization is directed to the AkAES region, because of higher per-unit costs for efficiency improvements in rural areas of the state.

Home Energy Rebate Program

The Home Energy Rebate Program provides an energy retrofit rebate based on the amount of estimated energy savings for participating Alaskan homeowners' primary residences. The program was started in 2008 in response to high oil prices that burdened Alaskan citizens with high energy costs. The Alaska State Legislature supported the program with a significant increase in funding. As of November 1, 2015, approximately $204.6 million has been spent since the inception of the program, resulting in 23,980 energy efficiency retrofits and leveraging over $120 million in homeowner investments.[20] The program is funded by the Legislature through the Alaska State Capital Budget, but in March 2016, AFHC suspended the Home Energy Rebate Program for new applications to the program due to state funding constraints.

From a customer perspective, the Home Energy Rebate Program involves an energy audit performed by an AHFC-qualified energy rater certified as a Building Performance Institute (BPI) Building Analyst. This audit uses the AkWarm home energy modeling software to provide an energy rating score and a list of potential energy efficiency improvements prioritized according to cost-effectiveness. The homeowner then implements their chosen energy efficiency improvements and a post-project audit is conducted. Depending on the modeled increase in the energy efficiency of the home,[21] the homeowner receives a rebate from between $4,000 and $10,000, not to exceed the actual cost of the improvements, as verified by receipts.[22]

CCHRC evaluated the Home Energy Rebate Program in 2012,[23] and supplemented the evaluation with an internal update for program data through December 2012. The evaluation determined that the average energy savings for a building was 34 percent, resulting in an average reduction in energy consumption of approximately 102.7 million BTUs (equivalent to 742 gallons of fuel heating oil) of energy per home and annual energy savings of $1,297. The study also evaluated the cost-effectiveness of the program, in terms of simple payback and return on investment, described in **Table 6.** The cost-effectiveness analysis compared AHFC spending, homeowner spending (based on submitted receipts), and total spending. Anecdotally, the report notes that some participants did not submit receipts beyond the amount for which they expected to be reimbursed. Underreporting of homeowner expenses would result in decreasing the evaluated cost-effectiveness of the program and increasing the average payback period for energy efficiency improvements.

Table 6. Home Energy Rebate Program cost effectiveness

	Average costs (2012 $)	Simple payback (years)	Return on investment
AHFC	$6,516	5.0	20%
Homeowner	$4,447	3.4	29%
Total	$10,963	8.5	12%

The Home Energy Rebate Program evaluation has shown that it is effective in reducing energy use and costs for participants. However applicable these results might be for all Alaskans, it is primarily the state's urban residents who have taken advantage of the program, to date. At the time of the December 2012 update, the vast majority of the participants were in the Cook Inlet Region, accounting for 72 percent of all building retrofits.[24] An additional 14 percent of retrofits were located in the Fairbanks North Star Borough,[25] leaving the remaining 14 percent in the AkAES regions. The 2012 CCHRC report noted that the lowest participation rates were in regions with the highest construction costs, but that participation rates are potentially impacted by a lack of trained energy raters in rural areas, program awareness, lower homeownership rates, and the demographics of typical program participants among other variables. A 2013 web survey of 574 program participants found that the demographics were not representative of Alaska as a whole; participants had higher average incomes and significantly higher education levels than Alaskan averages.[26]

One significant result of the Home Energy Rebate Program has been the development of an energy efficiency industry in the state. Prior to the program's inception in 2008, there were very few trained energy auditors. Currently there are 59 active BPI- and AHFC-certified energy auditors.

New Home Rebate Program

The New Home Rebate Program is a branch of the Home Energy Rebate Program. It provides a cash incentive to buyers of new homes that meet a "stretch" code for building energy. The program was started in 2008 and initially paid out rebates of $7,500 for homes that received an energy rating of 5 Star Plus using the AkWarm modeling software. When the BEES was updated in 2013, the incentive level was changed so that buyers of a 5 Star Plus home could qualify for a rebate of $7,000, and buyers of the newly added stretch goal of 6 Star could qualify for a rebate of $10,000. This new rebate level for 6 Star homes was informed by an economic analysis of the additional costs required to increase the energy efficiency of a home from the minimum BEES standard to a 6 Star Rating.[27] It should be noted that the rebate is paid directly to the buyer; builders have suggested that more homes would be built to these standards if the rebate went directly to them.[28]

Since the inception of the program to November 2015, AHFC has paid out 2,954 5 Star Plus rebates and 139 6 Star rebates.

Technical Assistance and Training Grants

The Association of Alaska Housing Authorities offers a grant program for training and technical assistance. The program began in 2013, and is offered in collaboration with the U.S. Housing and Urban Development (HUD) Alaska office of Native American programs, regional housing authorities, and housing experts. The grant program's purpose is to promote community sustainability and build capacity in Alaska's remote villages that are not otherwise connected to training resources.

Training and energy technical assistance are key to providing high-value energy efficiency measures for residential (and commercial) customers. Enabling this expertise to be available in remote areas helps strengthen communities in the context of workforce development and economic opportunity for contractors.

The program is an on-demand program, and plans training and technical assistance for tribes and regional housing authorities that ask for assistance with specific topics. Since 2013, the program has delivered more than 180 hours of Alaska-based workshops, provided training for more than 370 attendees, and offered more than 1,000 hours of on-

site assistance to housing programs in rural areas.[29] Workshop topics have included Indian Housing Plans, Annual Performance Reports, and environmental reviews. The technical assistance has involved policy development, filing system development, self-monitoring procedures, staffing plans, and program compliance. The program has also provided needs assessments, materials and tools relevant to housing development, and direct on-site technical assistance.

In 2015 the AAHA hosted a training event Developing Alaskan Sustainable Housing (DASH) to bring together key stakeholders and industry professionals to support the design and development of sustainable housing. The training included elements of housing design, building materials, construction methods and project financing.

Supplemental Housing Development

The Supplemental Housing Development Grant Program, which has been in existence since 1981, is legislatively funded and promotes energy efficiency in rural housing. The program received $3 million in state funding in 2014. The funds are used for grants to the regional housing authorities for use on HUD new construction or rehabilitation of homes. They can fund up to 20 percent of HUD's total development cost per project, and the homes in the project must meet the AHFC BEES to qualify. Housing authorities can apply for the grants in one of four categories: on-site sewer and water facilities, road construction to project sites, electrical distribution facilities, and energy efficiency design features.[30] In fiscal year 2015, there was a total of approximately $8.4 million from state funding and leftover funds made available for grants. This money was applied via 14 grants to 12 of the housing authorities and was used on the construction of 176 units and the rehabilitation of 170 units. Over $5 million of the funding was used in the energy efficiency design category; 47 of the newly constructed homes achieved 6 Star rating, the highest attainable rating under the 2012 BEES.[31]

Publicly Owned Commercial Buildings

Village Energy Efficiency Program

The Village Energy Efficiency Program (VEEP) is a rural energy efficiency program run by the Alaska Energy Authority. With funding from the Denali Commission the program started as the Village End Use Efficiency Measures Program (VEUEM) in 2005 and primarily provided lighting upgrades and some weatherization measures. The program received American Recovery and Reinvestment Act (ARRA) funding between 2010 and 2012, at which point the program was expanded to include more significant building energy upgrades.

The Village Energy Efficiency Program assists with community-driven priorities in energy efficiency. Local organizations can apply, provided that they are located in communities of 8,000 people or fewer. In the most recent iteration of the VEEP, communities underserved by energy efficiency programs became a priority for service. These communities also had the highest fuel costs, and were in areas with the highest level of heating demand. The communities that have participated in one of the rounds of the VEEP are in the Affordable Energy Strategy study area, lack road access, and are generally not large enough to be a hub community for surrounding villages.

The program has reported outcomes at the village level between 2005 and 2010. The program has also aggregated data from the work done by the Alaska Science Building Network (ABSN) for the ARRA-funded retrofits performed between 2010 and 2012. The aggregate numbers showed that the ABSN retrofits on average achieved a simple payback period of 5.4 years, taking into consideration village in-kind contributions of labor and materials.[32]

The study team analyzed the 40 VEEP energy audits that used AkWarm modeling software and which had been uploaded to the ARIS database. These models appear to be from several different phases of the VEEP work. This analysis of pre- and post-retrofit energy models showed that on average, building energy use was reduced by 28 percent, for average annual energy cost savings of approximately $6,000 per building. This analysis was for space heating data only; the ABSN report showed that electricity savings were approximately 44 percent of total savings from the buildings retrofitted in the village. Extrapolating this proportion to the buildings modeled in AkWarm would result in combined space heat and electricity energy cost savings of approximately $10,700 annually per modeled building.

Alaska Housing Finance Corporation Energy Efficiency Revolving Loan Fund

Senate Bill 220 established the Energy Efficiency Revolving Loan Fund (EERLF), which AHFC makes available for building efficiency upgrades by the State of Alaska, municipalities in the state, the University of Alaska system, and regional education attendance areas. AHFC led an ARRA-funded project to provide energy audits to public facilities throughout the state, which would then be able to take out loans to perform the auditor-recommended energy efficiency measures.

The AHFC-led public building audit program was a multi-phase process. AHFC made an effort to obtain energy use benchmark data for public buildings. Statewide, 1,200 buildings self-reported their electricity and fuel use and costs via the Retrofit Energy Assessment for Loan (REAL) benchmark form. AHFC then identified the candidates most likely to benefit from energy efficiency retrofits and provided free energy audits, ensuring that every region was covered. AHFC offered training to increase the number of Certified Energy Auditors in the state, after which the auditors conducted 327 energy audits throughout the state, with approximately 58 percent of them occurring in the Affordable Energy Strategy study area. Although building owners and operators welcomed the audits, no loans have resulted through the program through June 2016.

AHFC subsequently contacted representatives for 76 percent of the buildings that received an audit.[33] Of these, 84 percent reported implementing some of the energy efficiency recommendations from the energy audits, funding them with bonds (29 percent), grant money (22 percent), and cash on hand (33 percent). The remainder were not specific about how they funded their projects.

Fairbanks Non-Profit Retrofit Pilot

The Fairbanks Nonprofit Retrofit Program launched in 2014 to help nonprofits and tribal organizations in the Fairbanks area realize energy savings through energy efficiency upgrades. The pilot project, funded by the Denali Commission and the Rasmuson Foundation, provided energy audits, technical assistance, and the opportunity to finance retrofits through low-interest loans. The program chose 14 buildings, owned by 12 applicant organizations, for the pilot cohort. Each building has received an energy audit, and the organizations are now in varying stages of the retrofit process: 2 buildings have completed retrofits, 7 have begun the retrofit process, and 5 have plans to retrofit in the future. One project was loan-funded, 1 was grant-funded, 7 are being self-financed, and 5 have combined different funding mechanisms.

Although outside of the AKAES region, the retrofit pilot addresses some of the consistent barriers to participation found with non-residential customers, especially non-profits. The Program published an interim report on the pilot at the end of 2015.[34] It contains information about how the project was designed and carried out, identifies barriers to energy efficiency loan financing, and offers lessons learned about energy retrofit programs. One of the primary recommendations from the pilot was for providing a "packaged" retrofit program that includes both comprehensive technical and advisory guidance, as well as offering flexibility in responding to the variability in the type and

needs of different customers and buildings. The primary barriers to loan participation were the organizations' ability to self-finance, reluctance of nonprofits to take on debt, unfavorable loan terms, long approval process to acquire loans, and grant restrictions for paying off debt. The report also identified possible improvements to future retrofit programs, and suggested ways to address the barriers to energy efficiency loan financing. The project is scheduled to continue through 2016 so that researchers can document and evaluate the retrofits, the retrofit project financing, and the energy audits' ability to predict energy savings.

Public Facilities Energy Efficiency Improvement Program

Alaska Department of Transportation and Public Facilities (DOTPF) manages the Public Facilities Energy Efficiency Improvements Program. The program began via 2010 legislation directing the public facilities division of DOTPF to perform energy retrofits on the worst-performing 25 percent of state-owned buildings over 10,000 square feet. This mandate was met in 2014, but the program has continued. The state funds two salaried positions to manage energy retrofit projects, and building managers work with these employees to implement energy retrofits in their buildings.

Project funding varies, and can involve state funding, grant funding, and loan financing. Each project begins with a feasibility analysis, and if that has a positive outcome, proceeds with an investment grade audit to benchmark energy and water consumption, identify detailed cost and savings for efficiency improvements and develop bundled proposal with financing, implementation and verification plans. All projects involve post-project energy measurement and verification. For some projects, this verification occurs immediately following construction, and with others, it can occur annually for up to three years. Each year, the energy savings are compiled with project summaries into an annual report for the Legislature.[35] Thus far, the program has completed approximately 60 energy retrofits; the estimated cumulative energy savings are greater than $2.7 million. The legislative reports and energy tracking spreadsheets are available on request.

Community Facilities Direct Loan and Grant Program

USDA's Community Facilities Direct Loan and Grant Program has existed for over 40 years. The program provides loans and grants to public bodies, community-based nonprofits, and tribes in rural areas. The funds can be used for purchasing, constructing, and improving community facilities. The funds can be used for building energy-efficient facilities, or to make existing buildings more energy efficient. These facilities provide essential services to communities, such as health care; travel; and education; and food

production, distribution, or storage. Financed projects must serve the area in which they are located, demonstrate community support, and undergo an environmental review.[36] The funding can be a grant, loan, or combination of the two. Grant funds are prioritized for small communities and communities with low median income. From 2009 to 2013, the program funded 23 loans and 55 grants for over $100 million in Alaska. Since then, the program has issued 21 loans and awarded 10 grants in 2014 and 2015.[37]

Rural Utilities Service

The U.S. Department of Agriculture (USDA) offers Rural Utilities Service grants and loans to organizations that run water, environmental, and electric programs. Examples of eligible organizations are public bodies, nonprofits, Indian tribes, cooperatives, and states. The funds can be used for infrastructure projects in rural communities to improve the quality of life for rural residents. Programs that fund sustainable renewable energy development and energy conservation qualify, along with programs that increase access to broadband and telecommunications, improving the reliability of electric systems, integrating smart grid technologies, and developing reliable water and wastewater systems.[38]

Private Commercial Buildings

Commercial Building Energy Audit (CBEA)

The Alaska Energy Authority has offered three rounds of funding for privately owned commercial buildings to obtain reimbursements for energy audits. The program ran in 2011, 2012, and 2013. The Alaska State Legislature allocated funds for rebates, which have been distributed for approximately 300 audits. Overall, AEA estimates that the average energy savings predicted by the audits is 33 percent of energy costs, with the retrofit investments having simple paybacks of just over 6 years.[39] AEA has made copies of the audits available for parties wanting to analyze them.

Alternative Energy and Conservation Loan

The Alaska Department of Commerce, Community, and Economic Development offers this loan fund for small businesses to construct and install alternative energy systems, or make energy conservation improvements in commercial buildings. The Legislature amended the Alternative Energy Loan program in 2010 and made effective in 2012 with a capital outlay of $2.5 million.[40] The maximum loan amount from the fund is $50,000, and the maximum loan term is 20 years. The loan interest rate is fixed at the time of

approval. Applicants must be Alaska residents for 12 months before they may apply for a loan.[41] As of the end of 2015, no loans had closed.

Loan Participation Program (LPP)

In 2012, the Legislature expanded AIDEA's Loan Participation Program for commercial and nonprofit buildings to include "qualified energy development" projects. This classification allowed energy conservation projects and projects involving the transmission, distribution, generation, and storage of energy. The program was originally funded by a one-time appropriation from the State of Alaska, and is now self-sustaining through interest from loans and loan repayments. Businesses and nonprofits can receive loans from the program by first obtaining a loan from a qualified financial institution, and then using AIDEA as the secondary lender. The loans have a long-term fixed or variable rates, offering the potential to lower loan payments if the term of the loan is lengthened. Thus far, the program has been used for one energy efficiency project, with a loan of over $2 million issued to the Alaska Pacific University for deep retrofits in some of the campus's older buildings.[42]

Sustainable Energy Transmission and Supply Development Fund

This program originated with legislation in 2012, which allocated $125 million into a fund for the Alaska Industrial Development and Export Authority (AIDEA), to directly issue loans and bonds for energy development projects in Alaska. The program can finance up to one-third of project costs, from a minimum of $5 million up to a maximum of $20 million (loans exceeding that require legislative approval).[43] The program is self-sustaining because interest and loan repayments return to the fund. The rates for financing in this program are fixed or variable, and are set equal to the interest rates in the Loan Participation Program, so that the two programs do not compete with each other. Thus far, this program has not been used to fund an energy conservation project.[44]

Rural Energy for America

The USDA Rural Energy for America Program provides loans and grants for renewable energy systems and energy efficiency. The federal budget governs the funding for this program, which is open to agricultural producers and rural small businesses for purchasing, constructing, and installing renewable energy systems or for energy efficiency improvements. There is also funding available for feasibility studies or to develop renewable energy projects. Businesses can apply for a loan, grant, or combination of the two.[45] The grants can be used to fund up to 25 percent of the project cost, and loans for up to 75 percent of the project cost. The 2012 USDA reports that from 2009 to 2011, Rural Energy for America awarded 44 grants totaling over $1 million in Alaska. Fifteen of these

grants were for energy efficiency projects; the total amount awarded, $174,380, saved an estimated 629,000 kWh.[46] Sample projects were a lighting upgrade on commercial properties in Wasilla, and energy efficiency improvements for a business in Chicken.

All Building Types

Some statewide programs address more than one type of building. A program offered by the USDA to utility businesses for implementing customer programs is one example; another is a regional partnership that leverages resources. A third is the U.S. Department of Energy (DOE) Office of Indian Energy's Strategic Technical Assistance Response Team (START) program, which offers assistance with village energy plans. In each case, the programs take a comprehensive view of a village. They address high-need areas and identify opportunities for programs to address more than one type of building.

Sustainable Southeast Partnership

The partnership is made up of seven Southeast communities[47] and several organizations that work in Southeast Alaska. They have partnered under a common framework and guiding principles to fund and implement resiliency and sustainability projects as a group. One of its objectives is energy independence for the region. The goal of this component is to help Southeast Alaska become less dependent on outside energy and encourage the more efficient use of existing energy resources. Their most recent energy efficiency project was providing 20 walk-through (ASHRAE Level 1) energy audits to businesses in Hoonah and Haines. The audits were supported and funded by the Partnership, AHFC, USDA, the Southeast Conference, the USDA's Rural Energy for America Program (REAP), and AEA.[48] Other energy efficiency projects are currently in planning stages.

Strategic Technical Assistance Response Team

The START program is delivered by DOE's Office of Indian Energy and the Denali Commission to rural Alaska native communities and village corporations. The program aims to reduce the cost and use of energy in rural areas, and to increase local capacity, energy efficiency, and conservation through training and public education. It also increases renewable energy deployment. The program is currently in its third round. Each round has been slightly different from the last, and in the current round villages can receive technical assistance for advancing tribal energy and infrastructure projects for financing and construction, but does not include funding for community grants as per previous years. DOE and the Denali Commission will decide whether to fund a fourth round after they review results from the third round. In total, there have been 15 projects

in Alaska. Some of these are listed on the program website.[49] Thirteen projects supported community energy planning and clean energy projects in villages, and a community-scale biomass system. There are some data on individual projects available through different agencies (such as the AEA, Tanana Chiefs Conference, the AHFC, and Regional Housing Authorities) that worked with the program in different villages. Documentation of 30 previous round projects are tracked on DOE's START web portal.[51]

Energy Efficiency and Conservation Loan Program

USDA recently began offering the Energy Efficiency and Conservation Loan Fund for businesses or services that provide electric service to rural areas. The electric utilities can apply to become borrowers for loan funds that are to be used to implement energy service projects for their customers. The utilities design the programs, which must improve energy efficiency or reduce peak demand on the customer side of the meter, reduce overall electric load in the system, use existing electric facilities more efficiently, attract new businesses or create jobs, or encourage the use of renewable fuels or reduce the use of fossil fuels.[52] For example, programs could implement on-bill financing, energy audits, demand-side management, energy efficiency measures, or renewable energy systems, re-lamping, and outreach programs. To date, two programs have been funded through this nationwide program, one in North Carolina, and one in Arkansas.[53] See also **Section 2, Rural Utilities Service Loan Program.**

Water / Wastewater Facilities

Water and wastewater treatment plants in rural Alaska can be responsible for a significant amount of a community's energy use—and thus can burden residents with very high utility costs. These systems often require heating of the water to prevent freezing, either centrally or by using electrical heat tape on lines connected to homes. The Alaska Native Tribal Health Consortium (ANTHC) estimates that 10 to 35 percent of a community's energy use can be attributed to the community sanitation system for small communities with inefficient systems.[54] However, more broadly across the AkAES regions, wastewater represents approximately 2% of total energy usage. ANTHC documents that in some areas of rural Alaska, "…it is common for households to spend over 10 percent of their incomes on utility service fees," but ANTHC estimates that approximately 50 percent of the cost savings from water and wastewater efficiency improvements appear as a reduction in PCE payments—offering savings to the state program. ANTHC provides guidance for communities to target the best candidates for energy efficiency improvements—for example, small northern villages with vacuum sewer systems. The

majority of the energy efficiency work on water and wastewater treatment plants has been performed by ANTHC, with 46 energy audits and completed retrofits of community sanitation systems leading to total annual energy cost savings of approximately $3.8 million.[55]

Utility Programs

The size and sophistication of utilities in Alaska range from large, grid-connected systems in urban areas to isolated micro-grids. The few energy efficiency programs offered by Alaskan utilities have thus far been in urban areas. The programs described here represent the types of utility programs that exist in Alaska. Absent cost recovery mechanisms and/or sustainable funding sources, Alaska utilities have offered efficiency programs in limited scope and duration, typically responding to customer demand or need due to high costs of energy or grants supporting pilot programs.

Chugach MyPower

Chugach Electric has offered the online program MyPower to its residential customers since 2013. The program is ending this year, but it has allowed customers to track their electricity use and compare it to that of their "neighbors," through their online bills. Members could also use MyPower to create an energy plan online and identify recommended personalized tips on saving energy. In 2014, Chugach Electric used MyPower to create (from the online website) and send out to residents e-mailed reports on their energy use, with comparisons to neighbors' energy use. A test group of 10,000 residents has demonstrated an approximate 1.5 percent reduction in electricity use, compared to a control group that did not receive the e-mails.[56]

GVEA Energy$ense Programs

GVEA's Energy$ense Program currently consists of Home$ense, an energy efficiency program that provides one-on-one homeowner education. However, Energy$ense has historically offered two other programs, Business$ense (for commercial buildings) and Builder$ense (for new homeowners).

Home$ense. GVEA has offered the Home$ense program for its residential customers since 1992. Today, the program offers one-on-one electrical energy audits to homeowners. These audits involve personalized information-sharing, information handouts, more efficient light bulbs, and a vehicle timer. It costs $19.95, or is free to income-qualified homeowners. The basic premise of the program has remained the same

since it began, although details such as the program costs, handouts, and equipment have varied over the years. The program helps the utility build personal relationships. It is marketed to homeowners with high energy bills and / or low incomes, and empowers people to take control over their own energy use. During the program's first 20 years, the program provided audits for 7,958 homes or 21% of its residential accounts for a total expense of $2,219,556. The estimated cumulative kWh savings during that time was just over 44 million, resulting in an average program cost of $0.05 / kWh during that time or a reduction of approximately 275 kWh annually per household. Results of a 2013 survey of participants indicated that there was a high satisfaction with the program, with 106 out of 108 homeowners saying that they found the auditor recommendations helpful, plan to follow up on the recommendations, and now understand more about their bill, electricity use, and potential energy savings of behavior changes and energy efficiency improvements.[57]

Business$ense. GVEA offered Business$ense, a lighting rebate program for commercial buildings, from 1994 to 2012. During that time, more than 200 businesses received rebates from GVEA for lighting upgrades that decreased peak load and overall demand while maintaining lighting output. To receive a rebate, businesses submitted proposals containing an estimate of savings, and then submitted to pre- and post-project inspections. The rebate covered up to 50 percent of the equipment and installation cost, with the exact amount based on the anticipated load reduction. The program was funded annually, and funds would often run out before it could be renewed. Also, a few large rebates in an annual funding period could deplete the program funding with only a few retrofits. The program cost $0.05 per kWh saved over its lifetime.[42] GVEA's current commercial rate is $0.115 per kWh for general service, and $0.06 / kWh for large general service.[58]

Builder$ense. GVEA offered Builder$ense, a program targeted at promoting electrical efficiency in new homes, retrofits, and additions, from 1993 to 2012. Builders could contact GVEA for an inspection of newly completed construction, and receive a rebate for energy-efficient equipment such as efficient light bulbs for hard-wired fixtures, exterior motion detectors, vehicle timers, vehicle switch outlets, insulating blankets on water heaters, and water heater timers. Builder$ense offered GVEA an opportunity to connect with new utility customers and local builders. However, few builders were aware of the program and it did not fund more expensive appliances. Further, GVEA allocated the annual funding in the order in which requests came in; it frequently ran out of funds prior to the next funding cycle. From 1993 to 2012, GVEA tracked the expenses and estimated

savings from the program, which had an average cost of $0.04 per kWh during that time period. Total participation involved more than 1,000 buildings.

HEA Loan Program

The Homer Electric Association promotes "buy local" and energy efficiency initiatives through a loan program for its residential members. Members can obtain a loan up to $5,000 for equipment and labor from a local vendor.[59] Members typically take advantage of the loan to replace a failing appliance or for purchasing appliances when buying a new home. Loans are re-paid through an automatic draw-down from a line of credit or bank account over the course of 6 to 36 months. The program itself is self-sustaining, since the interest earned supports the program's administration.

Sitka ENERGY STAR Rebate Program

The City and Borough of Sitka's Electric Department ran a rebate program for residents to exchange old, inefficient appliances with ENERGY STAR equivalents. The program reduced the peak electrical demand and dependence on diesel back-up generators. Prior to its funding the program, the Electric Department conducted a survey to gauge interest and choose the appliances that would qualify. The program began in February 2012 and was scheduled to end in June 2013, or when funds ran out. Because of the popularity of the program, funds expired in January 2013. Through the program, residents installed 18 freezers, 3 heat pump water heaters, 75 refrigerators, 58 washing machines, and 40 heat pumps. The appliances they replaced were recycled or given to other residents. A synopsis of the program, published by the City and Borough of Sitka estimated that the electrical savings from the program were approximately 34,000 kWh.[60]

Red-Yellow-Green Programs

There are two areas in Alaska that employ a Red-Yellow-Green program to indicate to electric customers when rates might rise because the electricity is being produced using more expensive fuels. In Sitka, the City and Borough of Sitka Electric Department advertises green for times when there is no shortage of hydropower resources, yellow when diesel back-up might be used, and red when diesel back-up generation is being used. In the Mat-Su area, several utilities and the borough collaborate on an Energy Watch program that similarly lets consumers know when there is a potential shortage of natural gas for producing electricity, and when more expensive fuels may be employed. The Mat-Su program has not been used recently, but is still in existence in case it is needed again. Both programs then rely on consumers to change their behavior and use less electricity during times advertised as "yellow" or "red."

AVEC Commercial Energy Audit Program

The Alaska Village Electric Cooperative received $200,000 in funding from the USDA Rural Business Enterprise Grant (RBEG) program to support technical assistance and up to 42 commercial energy audits for small businesses in their service territory. As of May 2015, the allotted 42 audits were completed on for-profit and non-profit small businesses in 11 of the 56 communities that AVEC serves. Applications for grants for supplemental funding through the USDA Rural Energy for America Program (REAP) were identified to support energy audit recommended improvements.

Building Energy Codes

Alaska has no mandatory statewide building energy codes for either residential or commercial buildings. Responsibility for the adoption and enforcement of energy efficiency building standards has been assigned to AHFC, the Department of Education and Early Development, and the Department of Transportation and Public Facilities.[61] The state allows individual municipalities to adopt and enforce codes that meet or exceed the requirements of the state agencies. However, residential housing constructed since 1992 must undergo an approved inspection process to be eligible for financing by Alaska Housing Finance Corporation.[62]

Several key reports on building energy codes in Alaska have been released since 2008:

- *2012 Statewide Codes White Paper* (CCHRC).
- *2012 Gap Analysis and a Strategic Compliance Plan* (Building Codes Assistance Project; BCAP).
- *2011 Comparative Analysis of Prescriptive, Performance-Based and Outcome-Based Energy Code Systems* (Cascadia Green Building Council).

BCAP's *Alaska Gap Analysis*[63] evaluated the state's building code environment and described the missing policies that would be needed to meet the DOE goal of 90 percent compliance with model codes by 2017. AHFC's concurrent *Strategic Compliance Plan*[64] recommended steps to meet this goal.

The *Gap Analysis* identified several findings:

- Absence of mandatory statewide energy efficiency code.
- Multiple building code agencies' adopting and enforcing building codes.

- Alaska's legislated goal of a 15 percent reduction in energy assigns no responsibility to a single agency, allocates no funding, and directs no coordinated formal action to meet the goal.
- Absence of a method for fully tracking new construction starts in the state.
- No lenders other than AHFC are required to ensure that homes are being built to BEES.
- No study has been conducted to evaluate efficiency of homes that have not been BEES-certified in various areas of the state.

The *Strategic Compliance Plan* described a framework for Alaska to achieve 90 percent compliance with codes by 2017. The first three steps in this plan are:

- Establish a stakeholder group to promote code adoption.
- Grant authority to a single state agency for codes.
- Implement a statewide building energy code with secured funding, establishing a framework for enforcement and future evaluation of compliance with the code. Funding for evaluating code compliance was estimated to be approximately $100,000 to $200,000 with a smaller funding allocated for training and "code ambassadors."

The recent *2016 Governor's Housing Summit and Workgroup Report*[65] identified several recommended actions and focus areas to improve housing affordability in rural Alaska directly and indirectly related to energy efficiency:

- Reduce costs of construction for homeowners through collaboration with regional housing authorities, AHFC, USDA, Rural Community Assistance Corporation (RCAC), Housing & Urban Development (HUD) with current Alaskan self-help programs and other stakeholders.
- Improve access and address funding gaps for homeowners.
- Implement a Statewide Residential Building and Energy Code authorized and maintained under AHFC.

The 2011 *Comparative Analysis of Prescriptive, Performance-Based, and Outcome-Based Energy Code Systems* by the Cascadia Green Building Council summarized the pros and cons of the three different types of building energy code for commercial buildings. The study recommended the adoption of outcome-based codes because they account for whole-building energy use (including plug loads).[66] The report also recommended energy use disclosure, which is necessary for an outcome-based requirement, and using variable

loan interest rates to motivate owners of commercial buildings to continue to maintain their commitment to lowering energy use.

Section 4 contains an update on the potential for codes to enhance energy affordability for rural Alaska.

Notes

[1] Information Insights for AEA and AHFC, 2008 Alaska Energy Efficiency Program and Policy Recommendations, 8 and 15.
[2] Alaska Energy Pathways, 2010, Executive Summary, 7.
[3] Commonwealth North, 2012, Executive Summary, 2.
[4] ISER, Energy Policy Recommendations, 2012, 3.
[5] Alaska Arctic Policy Commission, 2014, 11.
[6] Alaska Energy Authority *Regional Energy Planning Fact Sheet*, November 2015.
[7] Draft Regional Energy Plans and AHFC 2014 Housing Assessment, for North Slope and Southeast; VEIC has based its calculations on average annual consumption and application of an assumed 26 percent comprehensive savings.
[8] https://akrebate.ahfc.us/ARISWeb/Default.aspx
[9] AkWarm, AHFC home energy rating software. http://www.analysisnorth.com/AkWarm/AkWarm2download.html.
[10] Energy audit model count as of October 16, 2015. Percentage calculated from ~251,899 occupied housing units in Alaska; 2013 American Community Survey 5-Year Estimates: Table DP04: Selected Housing Characteristics.
[11] The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) sets national standards for commercial building energy audits. https://www.ashrae.org/resources--publications/bookstore/procedures-for-commercial-building-energy-audits.
[12] http://akenergyefficiencymap.org
[13] AHFC Potential Paybacks from Retrofitting Alaska's Public Buildings Appendix A
[14] See: https://www.ahfc.us/efficiency/research-information-center/energy-efficiency-public-facilities/
[15] Energy use intensity and energy cost index are reported nationally in publications like CBECS; they survey few buildings in very cold climates; Alaskan energy professionals generally do not consider them to be representative.
[16] Defined here as BTUs of energy used annually per square foot, per heating degree-day.
[17] Garber-Slaght, Robbin. Cold Climate Housing Research Center. "*Monitoring and Verification of Sustainable Northern Shelter Building Performance Quinhagak Prototype House Final Report,*" December 2011.
[18] https://www.omb.alaska.gov/ombfiles/16_budget/Rev/Enacted/2016proj50683.pdf.
[19] See AHFC's Weatherization Operations Manual: https://www.ahfc.us/files/5414/2842/3326/wom2015.pdf.
[20] AHFC Program Update 6.1.15.
[21] The ENERGY STAR® rating is used to characterize building energy efficiency; the rebate amount is set by the number of star-step increases achieved.
[22] See AHFC's Home Energy Rebate Consumer Guide for more details.

[23] *Home Energy Rebate Program Outcomes.* http://www.cchrc.org/sites/default/files/docs/HERP_final.pdf

[24] The Cook Inlet watershed region has 400,000 inhabitants, nearly two-thirds of the state's total population.

[25] Fairbanks North Star Borough population is ~100,000, accounting for one-sixth of the state's total population.

[26] Dodge, K., Y. Hossain, N. Wiltse, CCHRC. *A Report on the Effectiveness of Alaska Craftsman Home Program Consumer Education Classes and Recommendations for Improvements.* 2013

[27] AHFC, *Alaska-Specific Amendments to IECC 2012,* 2014. https://www.ahfc.us/files/5014/0328/1907/final_AK_Spec_Amendments_to_IECC_2012_061814.pdf

[28] Personal communication with builders during BEES update presentations.

[29] http://www.aahaak.org/training.php.

[30] https://www.ahfc.us/pros/grants/development-grants/supplemental-housing-development-grant-program/

[31] *Supplemental Housing Program Activity Highlights for State Fiscal Year 2015*.

[32] *ABSN VEEP 2010-2012 Executive Summary.*

[33] Ramsey, Carolyn. *ARRA Level II Audit Summary*. Alaska Housing Finance Corporation.

[34] Danny Powers, Vanessa Stevens, Dustin Madden. *Fairbanks Nonprofit Retrofit Pilot Project Interim Report: Documentation and Recommendations*. Cold Climate Housing Research Center. May 2016.

[35] *Alaska Sustainable Energy Act Annual Report: 2014 Progress Report*. Alaska Department of Transportation and Public Facilities. January 2015.

[36] http://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program

[37] USDA 2015 Progress Report. http://www.rd.usda.gov/files/USDARDProgressReport2015.pdf

[38] http://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

[39] Personal communication, Cady Lister, Alaska Energy Authority, November 5, 2015.

[40] Personal communication, Jim Andersen, Loan / Collection Manager, DCCED, November 5, 2015

[41] https://www.commerce.alaska.gov/web/ded/FIN/LoanPrograms/AlternativeEnergyLoanProgram.aspx

[42] Personal communication, Mark Davis, Chief Infrastructure Development Officer, AIDEA, November 4, 2015.

[43] http://www.aidea.org/Programs/EnergyDevelopment.aspx.

[44] Personal communication, Mark Davis, Chief Infrastructure Development Officer, AIDEA, November 4, 2015.

[45] Personal communication, Renee Johnson, November 6, 2015.

[46] USDA REAP Report, 2012. http://www.rd.usda.gov/files/reports/rdREAPReportMarch2012.pdf

[47] Sustainable Southeast Partnership communities: Hoonah, Hydaburg, Kake, Kasaan, Sitka, Klawock and Yakutat.

[48] http://sustainablesoutheast.net/energy/.

[49] http://www.energy.gov/indianenergy/resources/start-program.

[50] http://www.energy.gov/indianenergy/resources/start-program

[51] http://www.rd.usda.gov/programs-services/energy-efficiency-and-conservation-loan-program

[52] *USDA 2014 Progress Report.*

[53] Dixon, G., D. Reitz, C. Remley, M. Black. *Energy Use and Solutions in Rural Alaskan Sanitation Systems.* ANTHC. http://www.anthc.org/dehe/documents/Energy_Efficiency_Paper.pdf.

[54] ANTHC Rural Energy Initiative 2014 Report on Activities. http://anthc.org/wp-content/uploads/2015/12/REI_2014ReportonActivities.pdf

[55] Personal communication, Kate Ayers, November 5, 2015.

[56] CCHRC. 2014. *GVEA Energy$ense: Program Review and Recommendations*. Fairbanks: CCHRC.

[57] GVEA rate tariff, 2016. http://www.gvea.com/rates/rates.

[58] http://www.homerelectric.com/line-of-credit-program/.

[59] Personal communication, Member Services Supervisor, November 4, 2015.

[60] Agne, J. (2013). *ENERGY STAR Rebate Program.* Sitka: City and Borough of Sitka Electric Department.

[61] Davies, John, and Kathryn Dodge. *Statewide Codes White Paper.* Fairbanks: CCHRC, 2012.

[62] Alaska Statute (AS) 18.56.300

[63] *Alaska Gap Analysis.* Building Codes Assistance Project. 2012. http://energycodesocean.org/sites/default/files/resources/Alaska_Gap_Analysis_FINAL_November_2012.pdf

[64] *Alaska Strategic Compliance Plan*: Improving Energy Code Compliance in Alaska's Buildings. November 2012. AHFC, CCHRC, and Building Codes Assistance Project. http://bcap-energy.org/wp-content/uploads/2016/01/Alaska-Strategic-Compliance-Plan.pdf

[65] Governor's Housing Summit. *Workgroup Reports.* January 6, 2016. http://gov.alaska.gov/wp-content/uploads/sites/5/20160411_housing-summit-report-final.pdf

[66] Spataro, Katie, Marin Bjork, and Mark Masteller. *Comparative Analysis of Prescriptive, Performance-Based, and Outcome-Based Energy Code Systems.* Cascadia Green Building Council. 2011, 15. https://www.ahfc.us/files/9013/5754/5384/cascadia_code_analysis_071911.pdf

3. Energy Efficiency National Strategies and Best Practices

National, regional, state, utility, and community investments in the energy efficiency of residential homes, businesses, and industries have dramatically increased in North America over the last several decades. States and utilities supporting energy efficiency and demand response reported that U.S. and Canadian combined gas and electric demand side management (DSM) program budgets reached nearly $9.9 billion in 2014 and saved an estimated 25,177 GWh of electricity, and 473 million therms of natural gas in 2013.[1] These expenditures support individual programs and sectors—commercial, industrial, residential, and demand response—as well as the program administration costs associated with marketing, evaluation, and customer rebates and incentives.

Evaluating the effectiveness of individual strategies for energy efficiency program delivery is critically important for achieving aggressive federal, state, and municipal annual goals, as well as in leveraging external private and public financial investments. Although many different evaluations have been conducted on individual state and utility programs, the American Council for an Energy-Efficient Economy (ACEEE) has developed a State Energy Efficiency Scorecard[2] to track and compare individual state efforts around energy efficiency. The annual scorecard incorporates state efforts in six areas:

- Utility and public benefits programs and policies
- Transportation policies
- Building energy codes and compliance
- Combined heat and power (CHP) policies
- State government–led initiatives around energy efficiency
- Appliance and equipment standards

Alaska currently ranks 42nd nationally in its overall efforts in the 2015 State Scorecard, ranking relatively high for state government initiatives, but very low for utility and public benefits programs and policies. In the annual report, ACEEE highlights the fact that 25 states currently have established and adequately fund energy efficiency resource standards (EERS) to identify specific energy savings targets for customer energy efficiency programs administered by utilities or independent statewide program administrators. An EERS provides a framework for supporting long term, cost-effective investments in increasing energy efficiency and for tracking the associated economic and environmental

benefits. To this end, ACEEE emphasizes the importance of individual state "utility and public benefits programs and policies" that incorporate an adequately funded EERS.[3]

In addition to the mandated efficiency targets established by an EERS for utility and statewide efficiency programs, regulatory mechanisms involving cost recovery and performance incentives provide an equitable revenue balance similar to those provided for supply side investments. The Edison Electric Institute for Electric Innovation report on "State Electric Efficiency Regulatory Frameworks"[4] provides a description of these key mechanisms:

- **Direct-cost recovery**. "…recovery of costs related to the administration of the efficiency program by the administrator, implementation costs such as marketing, and the actual cost of product rebates and mid-stream product buy-downs. Such costs are recovered through rate cases, system benefits charges, and tariff rider/surcharges."
- **Fixed-cost recovery.** "…decoupling and lost revenue adjustment mechanisms that assist the utility in recovering the marginal revenue associated with fixed operating costs. Rate making practices tie the recovery affixed costs to volumetric consumption charges with rates set based on an assumed level of energy sales. The purpose of electric efficiency programs is to reduce the consumption of electricity; decoupling and lost revenue adjustment mechanisms allow for timely recovery affixed costs."
- **Performance incentives.** "…mechanisms that reward utilities for reaching certain electric efficiency program goals, and impose a penalty for performance below the agreed-upon goals. Performance incentives allow utilities to earn a return and impose a penalty for performance below the agreed-upon goals. Performance incentives allow utilities a return on their investment in electric efficiency, typically similar to the return on supply-side investments."

This section of the report examines national practices and in particular cases presents discussions of how well specific strategies for improving energy efficiency financing are matched to the needs of rural Alaska. These provide thumb-nail overviews of a strategy, where and how it has been used elsewhere, along with a specific discussion considering how well the strategy does – or as importantly, does not – meet the priority needs, issues and challenges facing rural Alaska. The materials are based on professional experience of subject matter experts at VEIC, and we have reviewed and discussed each with informed Alaska stakeholders in order to provide insights on the goodness of fit.

Developing Comprehensive Energy Efficiency Programs

Utility or state efficiency program portfolios typically reflect the primary sector expenditures for electricity and natural gas: commercial, industrial, agricultural and residential**.** Demand response programs also target opportunities to reduce the impacts associated with the transmission, distribution, and generation during peak periods during the day and year for a particular service territory or region. As reflected within the ACEEE State Scorecard, a growing emphasis on state level efforts to address transportation efficiency, building codes, and equipment standards are increasing the scope and roles of efficiency programs nationally.

Expenditures for efficiency programs recognize the balanced investments in the direct or in-direct rebates and incentives.

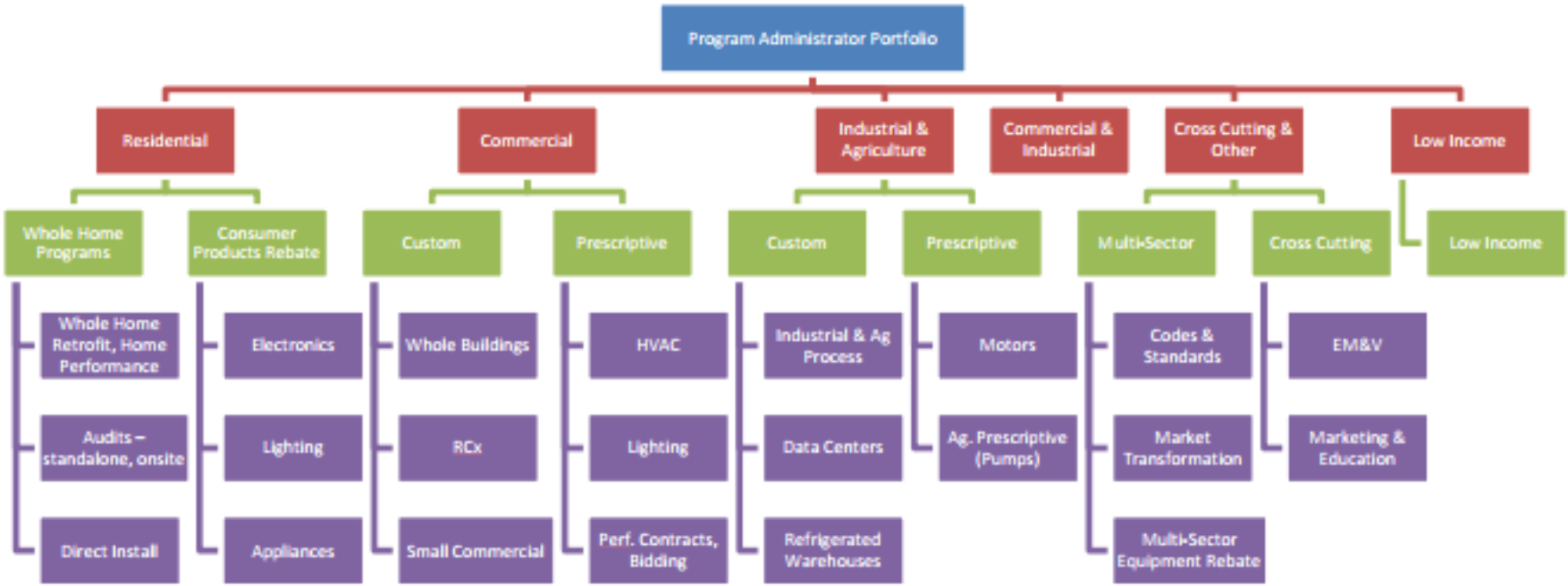

Figure 4. The structure of a third-party energy efficiency program.
Source: Lawrence Berkeley National Laboratory

During 2013 commercial and industrial programs represented the largest share (41 percent) of $6 billion in electric DSM expenditures in the United States with slightly lower residential (36 percent), demand response (16 percent), and cross-cutting (9 percent) program expenditures. The customer class breakdown is presented in **Figure 5** (for electricity) and **Figure 6** (for natural gas).

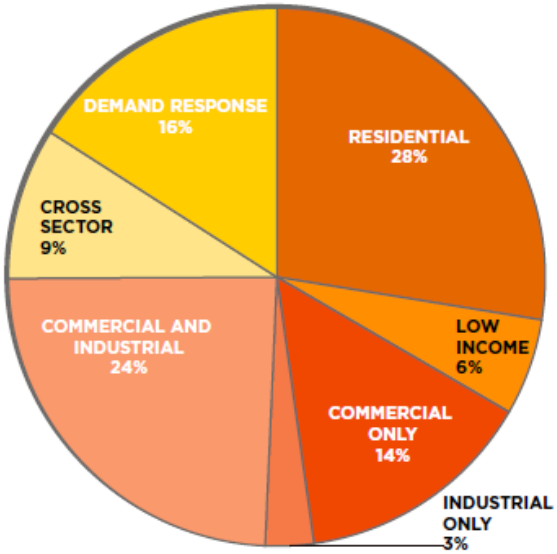

Figure 5. U.S. electric DSM expenditures by customer class (2013).[5]

Alternatively, 70 percent of the U.S. natural gas expenditures are targeted toward residential customers, including low-income and multifamily customers. The recent declines of the cost of natural gas have reduced the overall energy burden on customers, but they have affected the cost-effectiveness, approaches, and scale of natural gas DSM programs.

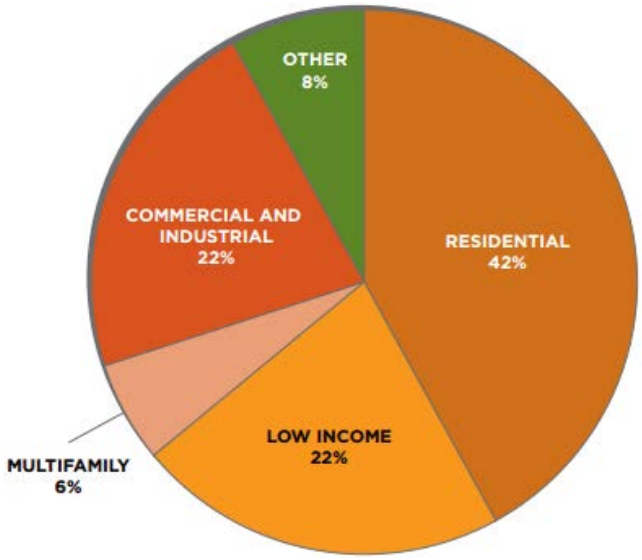

Figure 6. U.S. natural gas DSM expenditures by customer class (2013). [6]

Efficiency program strategies are evolving at a dramatic rate, but specific examples of exemplary programs serving residential, commercial, and industrial customers provide benchmarks for comparing programs.[7] In a 2013 study, ACEEE identified leading programs nationally and core elements of best practices in program strategy:

- Ability to adapt, to continue to achieve cost effectiveness.
- Simplifying processes for customers and "one-stop shops."
- Diverse financing strategies in all customer sectors.
- Consistent statewide programs and initiatives.
- Incorporation of advanced and emerging technologies (for example, LEDs).
- Targeting underserved markets and customers with new programs.

Comprehensive Energy Efficiency Administration and Service Delivery

Utility-Administered Demand Side Management Programs

Nationally, utilities have historically dominated the delivery of energy efficiency programs[8] and are often guided by legislative or regulatory requirements for achieving cost-effective annual savings targets for customer or DSM energy efficiency programs. The majority of programs are supported by regulated, investor-owned utilities (IOUs), but an increasing number of municipal utilities and electric cooperatives are introducing more comprehensive efficiency programs to reduce the collective and individual costs of energy for their customers.

Comprehensive DSM programs are typically funded through a system benefits charge (SBC) applied to residential and commercial customer monthly utility bills. The SBC funding is then either administered by the utility or a statewide program administrator to support energy efficiency programs within the utility's service territory or, alternatively, statewide.

The potential advantages of utility-administered programs are pre-established customer engagement and identification as a trusted energy advisor; direct access to customer energy data; established business (utility) model; and existing customer service departments such as marketing, customer service, and engineering. In turn, the potential disadvantages are lost opportunities associated with greater economies of scale for marketing or partnership with market actors; financial conflicts associated with lost revenue from efficiency; market confusion around customer eligibility with neighboring utilities; and regulatory burdens associated with approvals of annual program plans.

Independent Program Administrators for Demand Side Management Programs

Nationally, several states—Vermont, Oregon, New York, Wisconsin, Maine, New Jersey, Delaware, and the District of Columbia—have statewide energy efficiency programs administered by a third party, or they operate as a hybrid program coordinated with individual utility programs.[9]

The advantages of independent statewide-administered programs are frequently cited for providing better coordination across multiple utilities serving a state and for providing economies of scale and consistency in marketing programs to customers and key market actor partners. However, long-term continuity of programs can often depend on the strength of the legislated structure for the statewide entity. Utilities remain as important key partners in this model in providing access to customer data, increasing awareness of programs, and establishing financing mechanisms (for example, on-bill financing) to support efficiency investments.

Alternative models to the statewide-administered efficiency programs are regional organizations that provide services supporting multiple utilities. Examples of this approach are:

- **Northwest Energy Efficiency Alliance (NEEA**). This is a non-profit organization supporting 140 regional investor-owned and public-owned utilities and energy efficiency organizations in the Northwest. It represents more than 13 million natural gas and electricity customers. NEEA's initiatives are targeted toward

transforming markets through economies of scale and risk pooling, for broader market strategies and initiatives. NEEA's program activities leverage the direct program implementation activities of its regional partners to advance the customer adoption of energy-efficient products, services and practices.[10]

- **Bonneville Power Administration (BPA)**. BPA offers wholesale electrical power from 31 federal hydroelectric projects, one nonfederal nuclear plant, and several small nonfederal power plants to more than 142 individual electric cooperatives, municipalities, and investor-owned and tribal utilities in the Pacific Northwest.[11] To meet aggressive energy efficiency savings targets set regionally by the Northwest Power and Conservation Council, BPA has established agreements with 133 publicly owned utilities to provide efficiency services and acquire energy savings from its customers. BPA's primary role in acquiring savings is to "guide the delivery of opportunities and programs, and provide the necessary tools, technical support and financial resources to its Utility Customers" for commercial, industrial, agricultural, and residential programs.[12] To support the "Case for Conservation" with its partnering utilities, BPA developed multiple financial models from the regional, retail utility and consumer perspectives demonstrating the direct and indirect savings from energy efficiency—and its value as a least-cost resource acquisition.[13]
- **Efficiency Smart**. Established in 2011 by American Municipal Power (AMP), Efficiency Smart® provides energy efficiency services to member public-power communities that subscribe to its services. Efficiency Smart provides services such as technical assistance and financial incentives to residential, commercial, and industrial customers of participating public-power communities. Efficiency Smart is administered under contract by a third party that provides a comprehensive program of technical services and independent evaluation under a subscription-based agreement with individual member utilities. Each participating community gets a performance guarantee for delivered energy savings and program services are tailored to individual community needs.

Subscription-Based Energy Efficiency Program Model

Strategy Summary: Develop a subscription-based energy efficiency program model for rural Alaskan communities served by regional electric utilities or other organizations. This model pools technical services and targeted financial rebates to provide guaranteed annual energy savings to participating communities and increases the overall cost-effectiveness of the program through economies of scale. This strategy can be complemented with a centralized pool of statewide technical support services and / or

financial incentives, to coordinate and streamline industry engagement and leverage the market and scale of the Railbelt communities.

When faced with challenges such as increased energy demand, limited budgets, or environmental concerns, a growing number of municipal electric utilities are choosing to invest in energy efficiency services to offset these pressures. For these utilities, energy efficiency provides many short- and long-term benefits, including lower levelized costs (**Figure 7**):

- The lowest-cost resource compared to other long-term power supply options.
- The least risk of any resource, alleviating uncertainty associated with market variability, financial exposure to potential carbon regulations, and mitigating exposure to transmission and capacity costs.
- Local job creation assistance, supporting approximately 21 jobs for every $1 million[14] in related investments.
- Significant cost reduction in transmission and distribution charges, which are likely to increase in value each year.
- A reduction in power bills for end users—possibly even when energy prices go up, which frees up funds for consumers to reinvest in the economy and may ultimately induce a second round of spending and job creation.
- A primary business retention and attraction tool that can aid in economic development by helping businesses to reduce their operating costs.

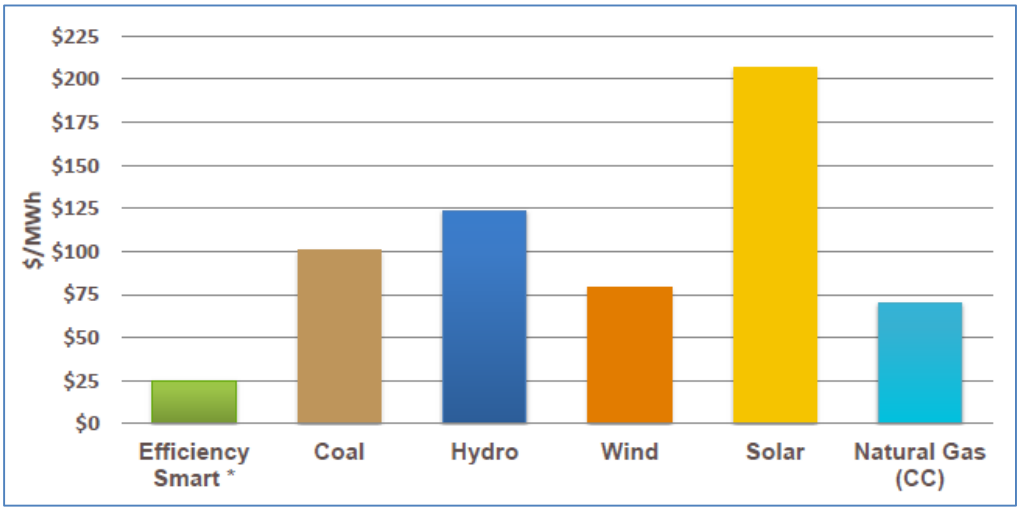

Figure 7. Comparison of levelized cost of energy options for Efficiency Smart customers.[15]

Pooling program services helps participating municipal electric systems compete with surrounding utilities, providing comprehensive energy efficiency services that rival those of investor-owned utilities. It also assists municipalities' customers to overcome common

barriers to energy efficiency, such as a lack of knowledge or resources. Additional benefits from a subscription-based model like Efficiency Smart are:

- Tailored services to fit the needs and resources of the municipal electric system and its customers.
- Savings guaranteed at the municipal level.
- Independent, third-party measurement, verification, and evaluation of savings claims → turnkey services supported by an experienced staff with extensive technical expertise → a consultative approach that goes beyond simply offering rebates.
- Customized incentives and services for large commercial and industrial utility customers → partnerships with local organizations, such as area economic development agencies → community-based and customer-focused tactics.
- Cost-effective solutions, with an emphasis on making energy efficiency affordable to all customer classes.

A comprehensive program portfolio includes residential, commercial and industrial services.

Targeted residential services offer renters and homeowners in participating communities many options to reduce their electricity use, save on energy bills, and make their homes more comfortable. Prescriptive financial rebates for purchasing qualified energy efficient products are often cooperatively promoted through local retailers, distributors or direct to consumer through mail-in coupons. Typically common household appliances including refrigerators, clothes washers and dryers, high efficiency water heaters, dehumidifiers, air source heat pump technology and LED and CFL lighting products are supported with financial rebates.

Commercial and Industrial (C&I) services often include a consultative approach that combines technical assistance with financial incentives to help business customers of its subscribing municipal electric systems implement energy-saving improvements at their facilities. Account managers help large commercial and industrial customers identify and assess energy efficiency opportunities while energy consultants work closely with these customers to understand the proposed technology, the amount of energy savings they can expect to realize, and the economic implications of their decisions. Program managers and customer support specialists provide technical advice about qualifying products and projects for small to midsize businesses. Targeted business outreach provides additional assistance for businesses with economic or other resource barriers to implementing energy efficiency projects on their own. Typically the technical services include: Proposal and design review; Energy and cost savings analysis; Product and control strategy

optimization; and Project verification and inspection. The C&I custom or consultative approach is complimented by prescriptive rebates to better serve small and midsize businesses to assist with completing energy saving upgrades and improvements at their facilities. These rebates support common energy efficiency measures including: Compressed air; food service equipment; heating, ventilation, and air conditioning (HVAC); lighting and lighting controls; motors and variable frequency drives; and refrigeration.

Additionally, programs and initiatives can be designed to concentrate on specific areas such as targeted populations, educational outreach, supply chain relationships, workforce development, and job creation in the region.

Comprehensive Energy Efficiency Administration and Service Delivery - Alaska Context: The above examples illustrate the potential benefits of a single organization providing energy efficiency services for multiple local utilities, whether through a statewide agency, regional non-profit or a private subscription based service. One of the largest barriers to this strategy for individual communities and utilities is developing a compelling case to initially participate in a statewide or subscription based efficiency program model. Addressing revenue losses from increased efficiency in participating utilities and communities is important, as the fixed charges for operations typically do not decrease correspondingly. Communities that are already members in a regional electric utility or other fee based organizational structure can provide a strong basis for an extension of services and alleviate the concerns around cross-subsidization of other participating communities. The increased efficiency services offered in the communities can serve as an effective tool for attracting businesses to come or stay in participating communities by addressing the high cost of energy and can offset revenue losses.

Application in Today and Tomorrow's Rural Alaska. Regional organizations and utilities currently providing services to rural communities in Alaska can provide a supporting structure for effective residential and commercial efficiency services. However, this efficiency service model would likely benefit from drawing on a more centralized and statewide pool of efficiency technical services also serving larger hub or Railbelt communities to leverage economies of scale. Similar to the existing role that state agencies, regional utilities and organizations serve, coordinated efficiency services can access funding sources at the state and federal level to offer streamlined administrative services and cost-effective financing for implementing efficiency projects in individual utility service territories.

Serving Low-Income Energy Efficiency Customers

Low-income residents of single-family and multifamily housing face more barriers to energy efficiency than the populations of nearly any other part of the built environment, with the result that the sector often lags other building sectors in energy improvements, and its residents bear the brunt of high energy costs. A recent study found that low-income households typically spend a disproportionate share of annual income: 17 percent, compared to 4 percent for households not in this category.[16]

There are four broad categories of low-income housing:

- Single family
- Public housing owned and operated by public housing authorities (PHAs)
- Assisted housing, with reduced mortgage or subsidized operating costs
- Naturally affordable housing—units that, by virtue of their rent levels, are considered affordable with no subsidy

The most effective and least-cost methods for achieving significant improvements in energy efficiency in low-income housing are:

- Requiring the highest levels of energy efficiency at the time of new construction or major rehabilitation. This is the time at which energy efficiency has the lowest cost, and affordable housing developers should be encouraged to maximize every opportunity.
- Increase availability of capital for energy upgrades at time of new construction or major rehabilitation. Any and all energy systems being addressed should be optimized at this time. Capital should be made available specifically for energy upgrades so that they are not value-engineered out when project budgets do not align with available resources.

Low-income weatherization programs provide energy efficiency services, as well as health and safety and some housing durability measures, to income qualified households at no charge to the customer. In addition to energy savings, low income weatherization programs also provide a range of non-energy benefits, or benefits other than direct energy bill reductions.

Current and past national evaluations of the federal WAP, conducted by Oak Ridge National Laboratory, quantify the effects of non-energy benefits. The last national evaluation report (2002) and a new evaluation now under way will take a fresh look at the program's impacts. Generally, non-energy benefits are viewed from three

perspectives: household benefits, utility benefits, and societal benefits.[17] Household benefits are increased affordability of housing, as well as health and safety improvements. Utility benefits include reduced bill arrearages (lower bad debt write-off, reduced carrying costs on arrearages, and fewer notices and customer calls), as well as fewer utility shutoffs and reconnections (and their associated costs). Societal benefits are typically considered as the environmental benefits of reduced energy use, and the local economic benefits of increased spending on energy efficiency upgrades (which are installed by a local workforce, using materials purchased through local retailers).

Some non-energy benefits can be hard to quantify effectively. However, many of the Weatherization Assistance Program's impacts are documented and are significant. Consequently, several states have chosen to include a low-income "adder" to the cost-effectiveness screening requirements for utility-funded low-income programs. A report by the National Consumer Law Center found that non-energy benefits could justify adjustments anywhere from 17 to 300 percent.[18] An example of how this has been implemented at the statewide level can be seen in the Colorado Public Utilities Commission's direction of electric DSM programs to increase benefits included in the Total Resource Cost (TRC) calculation by 20 percent "to reflect the higher level of non-energy benefits that are likely to accrue from DSM services to low-income customers."[19]

Zero Net Energy Manufactured Home Replacement

Strategy Summary: Develop an alternative to mobile and manufactured homes that fits the same footprint as a traditional manufactured home but with energy characteristics that make it affordable and durable for the long-term.

The strategy is to partner with affordable housing providers and other key stakeholders to design, build, and properly site a new kind of high-performance modular home in the footprint of a traditional manufactured home. Built to the highest construction standards, and sited on a foundation (or piers if desired) these homes balance a higher initial purchase price against significantly lower operating and lifetime costs when financed and titled as real property.

For mobile / manufactured homes, the benefits of low upfront purchase prices are degraded by high energy and operating costs for decades. Mobile and manufactured homes have higher energy costs, and these costs often end up being a public cost as part of the Low-Income Home Energy Assistance Program (LIHEAP), state or federal

weatherization programs and other public or utility subsidies. There is now an alternative to mobile and manufactured homes: a Zero Net Energy Modular Home (ZNE MH).

In order to achieve the objectives for ZNE MH, it is imperative to develop a coalition with the breadth and depth of knowledge to deal with full range of tasks and issues associated with the design (architectural, structural, mechanical, site-work, etc.), permitting and zoning, financing options and appraisals, partner relations and legal agreements. In other states including Vermont, Delaware and the Northwest, the working groups have included affordable housing entities, state and private financing organizations, high-performance home builders, universities and other key stakeholders.

As of April 2016, thirty-three ZNE MHs are located in 18 different communities across Vermont. Twelve are on owned land and 21 of the homes are in parks on leased land, with 17 located in nonprofit / resident-owned parks.

Key elements for successful development and implementation for an initiative:

- Refinement and final identification of the pilot program market, with determination of pilot market size characteristics with a focus on supporting low- and moderate-income participants
- Develop ZNE MH technical specifications optimized for the Alaska climate, housing affordability and manufacturability
- Identification of the supply and delivery chain with an emphasis on a reasonable geographic area
- Creation of the customer economic model
- Determination of program eligibility, partners, incentives, and other resources
- Development of an evaluation plan to verify pilot effectiveness

What are the major barriers to this strategy's being successful? A low-load home is by definition a building with an extremely tight thermal shell, and this requirement complicates the utilization of conventional heating and ventilation strategies to ensure both the comfort and health of the occupants in parallel to optimization of efficiency of the building. Eliminating forced ventilation with new technologies—for example, conditioning energy recovery ventilator, cold climate ductless mini-split, heat pump water heaters and vent-less heat pump clothes dryers—has the potential to put partnering builders and ultimately the homeowners at the "bleeding edge" of innovation. A successful ZNE MH pilot must ensure an adequate level of training and technical assistance to minimize the risk of the technologies being unreliable and incurring greater expense for the early adopters.

It is important to incorporate design optimization to balance the higher incremental capital costs against the longer term operating costs to not only to support the affordability of the new modular design for low-load homes, but also to the financial viability of the partnering home builder's business. In Vermont, a combination of existing commercialized technologies was often selected over the introduction of a non-commercialized product to avoid creating technical and market barriers to the broader objective of a viable high-performance modular home.

It is important to develop a cost-benefit analysis, with a summary of non-energy benefits and a cash flow analysis of estimated housing and energy costs and savings to derive the net present value of lifetime housing and energy costs. In both Vermont and Delaware, the Department of Energy Building Life Cycle Cost tool was used to perform this type of analysis.

Vermont Experience with Innovative Financing and Incentives

- The Vermont Housing Finance Agency (VHFA) does not provide mortgage financing to homes on leased land because of restrictions of the sale of such mortgages on the secondary market. However, VHFA allocates a portion of the Vermont Affordable Housing Tax Credit to creating a pool of funds used to make 0 percent, deferred down-payment loans on new manufactured and modular homes located in parks. For income-eligible buyers, $25,000 is available for new manufactured homes and high-performance home buyers are eligible for a $35,000 down-payment loans. The loans are repaid when the home is sold to the next buyer or loans may be assumed by the next buyer if they are income-eligible and meet underwriting criteria.

- Efficiency Vermont provides an incentive for ZNE MHs of $8,500 for buyers with incomes below 80 percent AMI or $2,000 for buyers above this income level.

- Credit-worthy customers (based on standard underwriting criteria) have been able to qualify for reasonable financing terms from local financial institutions. A statewide credit union offers conventional financing for high-performance modular homes and incorporates projected energy savings in the underwriting process. Buyers have received rates and terms as favorable as 4.875 percent (fixed) on a 25-year loan, as opposed to 20-year financing for HUD ENERGY STAR manufactured homes at interest rates as high as 12.5 percent.

- In June 2015, the U.S. Department of Agriculture (USDA) announced a pilot program to allow buyers of ZNE MHs to access long-term, fixed-rate mortgage financing in Vermont and New Hampshire. Under the USDA Energy Efficiency Manufactured Home Pilot Program, a low-income homebuyer purchasing a ZNE MH and placing it in a mobile home park would be eligible for a 30-year mortgage at a 3.25 percent. Very low-income home buyers may be eligible for an interest subsidy down to 1 percent. The park owner must be willing to offer a lease that exceeds the mortgage term by at least 2 years. A comparison of home ownership costs is found in **Figure 8.**

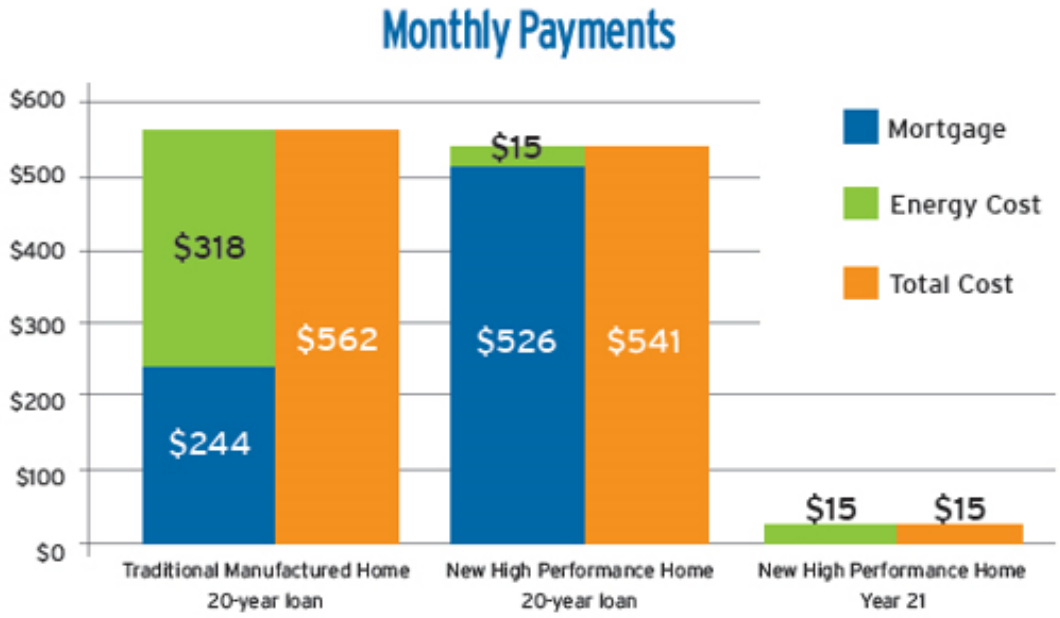

Figure 8. Comparison of monthly home ownership costs between traditional and high-performance manufactured homes.

- The gap between the cost to build and site the ZNE MH and the fair market appraised value has decreased with recent homes appraising for $140,000 and higher. To ensure that ZNE MHs are valued accurately, Efficiency Vermont works with the Vermont Chapter of the Appraisal Institute to both expand the number of certified green appraisers and to educate the local appraisal community on the values of this new durably-constructed home. Using funds from Efficiency Vermont, we have provided incentives for appraisers to complete the courses required to earn inclusion on the Appraisal Institute's *Valuation of Sustainable Buildings Professional Registries.*

Lessons Learned

In Vermont the ZNE MH is not affordable to the originally targeted market of very-low and low-income buyers without public subsidy. Affordable mortgage financing is the key to making ZNE MHs feasible on leased land. Since most lenders do not offer long-term, fixed-rate financing for homes on leased land (regardless of the energy performance), most low-income buyers would not qualify for a mortgage without the $35,000 down-payment loan and the $8,500 Efficiency Vermont incentive. Appropriate mortgage financing that utilizes the substantial energy savings can result in monthly housing costs similar to what a buyer of a new, conventional manufactured home would pay.

- Find a building partner that is committed to high performance and high quality. In Vermont, the builder's—VerMod's—commitment to building **only** this level of performance has helped maintain focus and has given the project the ability to work through the design issues endemic to this type of construction. A builder who will not cut corners and provides construction quality will provide benefits throughout the life of the program.
- Know the market. Understand the economic and demographic profile of potential buyers, including location and design preferences and concerns. Vermont is still working on this. Expect the product to evolve, and include time and funds in the program development schedule to make design adjustments.
- Educate the real estate community about this new housing type. A key element to appraising high performance buildings is ensuring appraisers are provided with all relevant information relating to energy efficient features of a property, so they can more thoroughly analyze and make appropriate judgments for building energy performance and help lenders understand their collateral risk. Moreover, high performance buildings require enhanced competency and the services of highly qualified appraisers.
- Be honest about the key barriers, including high first-cost and confidence in energy savings. Again, Vermont is still working on this. We have discovered that one of the best approaches is to shift the buyers' reference point to focus on the losses they will incur if they do not purchase a ZNE MH. Lack of understanding or belief in the ability to achieve net zero at a reasonable price requires additional education. Promote the full range of benefits. Position these as losses that will accrue if a conventional manufactured home is purchased. These include comfort, quiet, air quality, construction quality, asset appreciation, etc.
- Put a team together that has the breadth of knowledge to deal with full range of tasks and issues that will arise as part of a pilot program: design (architectural,

structural, mechanical, site-work, etc.), permitting and zoning, financing options and appraisals, and partner relations and agreements.

- Develop soft funding sources to help subsidize pilot program sales. Pair with the best possible hard financing options to show "operating cost equivalence" to prospective buyers.

Key Market Actors for a Successful Effort

A critical step in the process of developing a statewide program like this is bringing together diverse organizations and people who share common goals: to increase the quality of low-income housing and decrease energy costs for residents. These groups are:

- electric utilities
- electric efficiency providers
- energy service providers
- modular home manufacturers
- mobile home park owners and residents
- affordable housing providers
- low-income advocates
- financial institutions

Alaska Context. Alaskan housing authorities, non-profits, builders and building science organizations—including CCHRC—have been actively developing and building high performance homes designed for the Alaskan climate. CCHRC's Sustainable Northern Communities (SNC) program supported two prototype high performance buildings in Quinhagak and Anaktuvuk Pass to reduce residents' upfront capital costs, improve health and performance of homes, and support significant reductions in energy use.[20] The collaborative training event hosted by the Association of Alaska Housing Authorities (AAHA), "Developing Alaska Sustainable Housing" (DASH), established a forum for experts and key stakeholders to discuss topics such as housing design, building materials, construction methods, and project financing within the context of building cold-climate, high-performance buildings, in the context of energy affordability in Alaskan communities.

Application in Today and Tomorrow's Rural Alaska. Transportation of modular homes to remote areas of Alaska remains a barrier for many communities, however prototype buildings have established that cost-effective approaches are available to tailor the approach to the individual Alaskan regions and communities. Leveraging the collaboration of key stakeholders and funding sources including HUD, the U.S. Department of Energy's Office of Insular Affairs (DOE OIA), state organizations, housing

authorities, builders and non-profits can support both new construction, as well as the planned replacement of existing buildings to reduce the energy burden on communities in the AkAES area.

Residential Home Performance Efficiency

Nationally 32 states, including Alaska and the District of Columbia, currently offer residential home retrofit services under the Home Performance with ENERGY STAR Program (HPwES).[21] The Home Performance with ENERGY STAR Program is administered by the U.S. Department of Energy. It coordinates this brand with the Environmental Protection Agency (EPA) as a public-private voluntary partnership with utilities, states, municipalities, and nonprofit organizations that promote energy efficiency and renewable energy. In 2013, individual programs reported more than 330,000 completed Home Performance with ENERGY STAR projects nationally. **Table 7** provides a summary comparison of leading state efforts on HPwES, including Alaska.

Table 7. Benchmark summary of leading Home Performance with ENERGY STAR programs

	2013 HPwES projects	Market penetration	Energy audit price	HPwES incentive	Rebates for HVAC	Assisted HPwES[22]	Loan interest rate	Loan term (years)	Loan maxi-mum
AK	**2,550**	**1.01%**	**Varies; $500 rebate**	**Avg: $6,534. Max: $10,000 for identified improvements**	**Yes**	**No**	**3.125%[23]**	**15**	**$30,000**
AZ	2,980	0.24%	$99 co-pay	Measure-based	Yes	No	7.99%	Not listed	Not listed
CT	11,520	1.41%	$99 co-pay	$99 co-pay for DI measures including air sealing	Yes	Yes	Varies; 0% for HVAC	Up to 10	$15,000
MA	25,382	1.85%	Free	75% of insulation cost up to $2,000 plus free air sealing	Yes	No	0%	Up to 7	$25,000
MD	2,542	0.23%	$100 co-pay	50% of cost up to $2,000	Yes	No	9.99%	Up to 10	$20,000
MI	1,956	0.07%	Market pricing; discounts	Measure-based	Yes	No	NA	NA	NA
NJ	4,805	0.27%	Market pricing	Based on total energy savings up to $5,000	No	No	0%	Varies; usually 10	$10,000
NY	8,355	0.26%	Free	10% of cost up to $3,000	No	Yes	3.49%	5,10,15	$25,000
OR	1,309	0.14%	Market pricing	Measure-based	Yes	No	Varies	Varies	Varies
VT	1,187	0.61%	$100 discount	Measure-based up to $2000	Yes	No	Varies	Varies	Varies
WI	2,560	0.17%	Market pricing	33% of cost up to $1,250	No	Yes	10.99-19.99%	Up to 10	$20,000

Home Performance with ENERGY STAR provides a consistent brand and platform for developing an infrastructure of qualified contractors offering home improvement services to address both the efficiency and health of the home. Individual programs have the flexibility underneath this program platform to develop incentives, financing and training to support the growth of the energy efficiency market and quality of services provided to homeowners. To support the quality of services individual programs typically require participating contractors to be certified as BPI Building Analysts or RESNET Home Energy Rating System raters. Additional recommended core elements of a sponsor program are defined as:[24]

- **Program administration.** Program design and strategy, staff management, customer relations management (CRM) software, and quality assurance.
- **Workforce management.** Contractor recruitment, training and certifications, and mentoring.
- **Incentives**. Homeowners, partners, and well-qualified participating contractors.
- **Marketing.** Direct advertising, websites, events, campaigns, and cooperative agreements.
- **Evaluation, measurement, and verification.** Market impact studies, research, surveys, and analysis.

Strategies for supporting long-term energy efficiency improvements in homes typically follow either a prescriptive or performance-based path. A whole-home or a prescriptive program is typically limited to delivering cost-effective improvements with specific savings and rebates for each eligible measure. Alternatively, a performance-based path offers a greater degree of flexibility and schedule for home improvement projects and more closely maps to a homeowner's specific timetable, finances, and needs. However, this also requires additional flexibility from the program to work with a broader array of building contractors and trade allies, and to offer streamlined programs to meet the industry's needs. In both strategies, an assessment of the home by a certified Home Performance contractor identifies the largest and most cost-effective energy savings opportunities in order to develop a scope or plan for the home improvements without compromising the health and safety of the house and its occupants. The Department of Energy is currently engaging with key stakeholders to evaluate the approaches for achieving deeper energy savings of homes in the United States at a faster pace through a multi-faceted approach to Home Performance with ENERGY STAR (**Figure 9**).

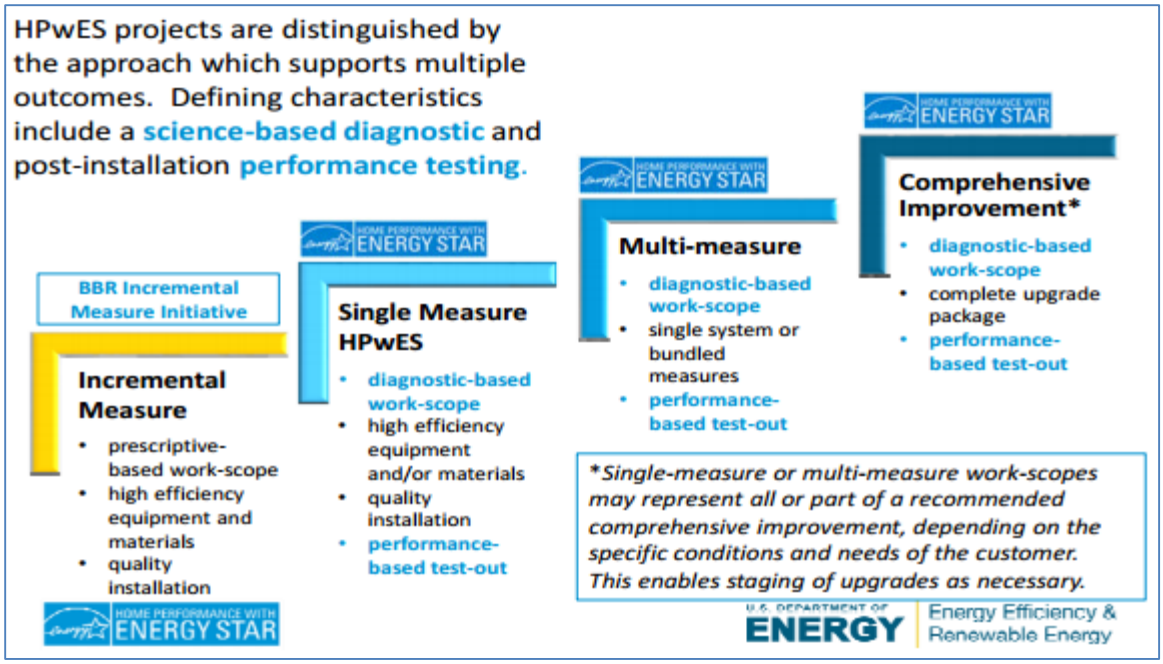

Figure 9. Home Performance project characteristics and their several outcomes.

This proposed shift in strategy reflects the aggressive goal set by the DOE to achieve the "reduction of typical home energy use by an average of 20 percent by 2020, 25 percent by 2025, and 40 percent by 2030, while improving indoor air quality, durability and comfort of the improved homes." A multi-pronged approach established nationally and the state level would seek to tap into the larger opportunity of an estimated 30 million annual home improvement projects, approximately 90 percent of which offered significant energy savings potential. [25]

Lighting, Residential Plug Loads, and HVAC

Lighting and plug loads—appliances and consumer electronics—make up a significant share of residential (35 percent)[26] and commercial (53 percent)[27] energy use. The energy use of plug loads is forecasted to increase by 21 percent over the next several decades in the United States, as gains in lighting efficiency are offset by the proliferation of miscellaneous electric loads and consumer electronic devices. These shifts are presented in **Figure 10. Change in residential electricity consumption, 2012 - 2040 (kWh).** .

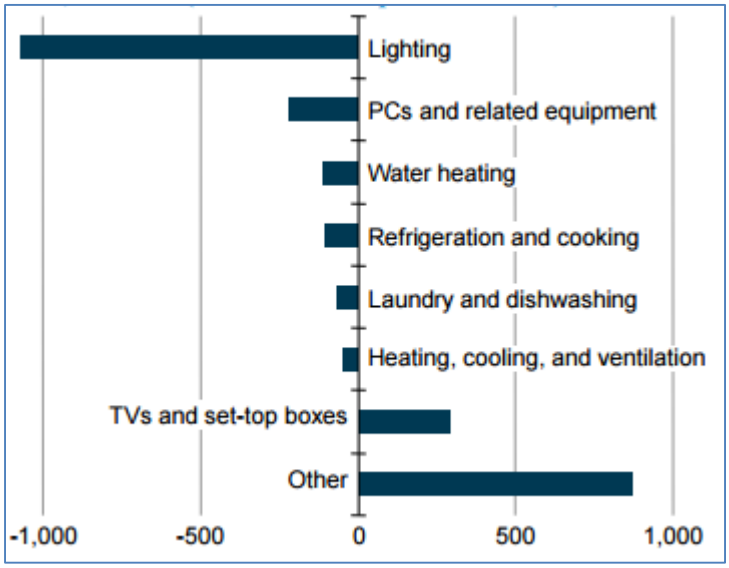

Figure 10. Change in residential electricity consumption, 2012 - 2040 (kWh). [28]

Retail products programs provide targeted rebates and messaging to consumers, community partners, manufacturers and retailers for the purchase/sale of selected energy efficient products. Recently, efficiency programs have transitioned toward greater upstream and midstream program strategies, versus targeted rebates directly to customers, to increase engagement and leverage manufacturer, distributor and retailer incentives and marketing dollars. The objectives of upstream programs are to increase the efficacy and streamline the program process by aligning more closely with the industry and consumer needs by providing instant, point-of-sale rebates, avoiding the costs and barriers to mail-in rebate processing and streamlining the sales process. These programs are designed to be aligned with and to complement other residential and commercial programs, including new construction and Home Performance programs.

Significant gains in market share of higher efficiency products through coordinated voluntary efficiency programs nationwide have resulted in rapid advancements in federal

minimum standards,[29] resulting in long-term energy savings. Utilities or statewide efficiency programs often provide technical support for the development of such upgrades to federal standards, tracking of activities and monitoring developments, and review and modification of program designs to integrate changes to the standards and codes. Regional northern climate efficiency program partnerships—notably the Northwest Energy Efficiency Alliance and the Northeast Energy Efficiency Partnerships—are both active in advancing federal standards to reflect colder climate appliances and performance.

Recent federal legislation enacted through the Energy Independence and Security Act (EISA) in 2007 has rapidly increased the minimum levels of performance for general service lamps, resulting in a transition away from incandescent lighting towards halogens, compact fluorescent and solid state or LED technologies. This legislation established a phased timeline for increasing the performance requirements. During the first phase completed in 2014, general service lamps were to achieve a 27 percent reduction in energy use over conventional incandescent technology. The second phase, referred to as the "backstop," will go into effect in 2020, when general service lamps will be required to be 60 to 70 percent more efficient than the standard incandescent.[30] Currently, only LED products can meet this performance level. Accelerating the consumer awareness of LEDs in the market and penetration in homes in Alaska are key opportunities for avoiding lost opportunities for achieving short-term energy cost savings in residential and commercial buildings.

Lighting has historically offered the most cost-effective and largest share of residential and commercial energy savings for energy efficiency programs.[31] The increase in the federal minimum standard for lighting in 2020 will require programs to rapidly shift strategies in the coming years to focus on a broader array of appliances and plug loads to meet the shortfall in program energy savings.

Upstream program strategies for streamlining and increasing the scale of lighting programs are now being leveraged to great effect in retail appliances, consumer electronics, and HVAC programs. Recently, the EPA announced the launch of the ENERGY STAR Retail Products Platform, a pilot offering a similar public-private partnership to target partnerships between efficiency programs and retailers to accelerate the sale of high efficiency ENERGY STAR products.[32] Pilots are currently planned for 2016 in 13 states and the District of Columbia, with partnerships among three national retailers: Best Buy, Sears, and Home Depot. Similar upstream program strategies are being applied to water

and space heating and cooling technologies to leverage the role of HVAC distributors and dealers in sales to contractors.

Upstream Market Initiatives

Strategy Summary: Adopt streamlined, market-focused incentive programs to address the higher incremental costs, availability and consumer awareness and demand for efficient lighting and space and water heating technologies. These programs target the manufacturer, distributor and retailer channels to accelerate the market for new efficient technologies by offering "upstream" incentives to manufacturers to buy down or distributor / retailers to mark down the cost of the highest efficiency lighting and heating technologies for consumers. This delivery mechanism offers the discount at the time of purchase—for example, at the point of sale, and thus does not require any application or paperwork from the end-use customer or contractor in the case of distributor or dealer sales. Compared to the higher costs of whole-home retrofits, consumer product rebates (dominated by lighting in most residential and commercial programs) offer an average cost of saved energy of $0.021 per kWh, as shown in **Figure 11.**

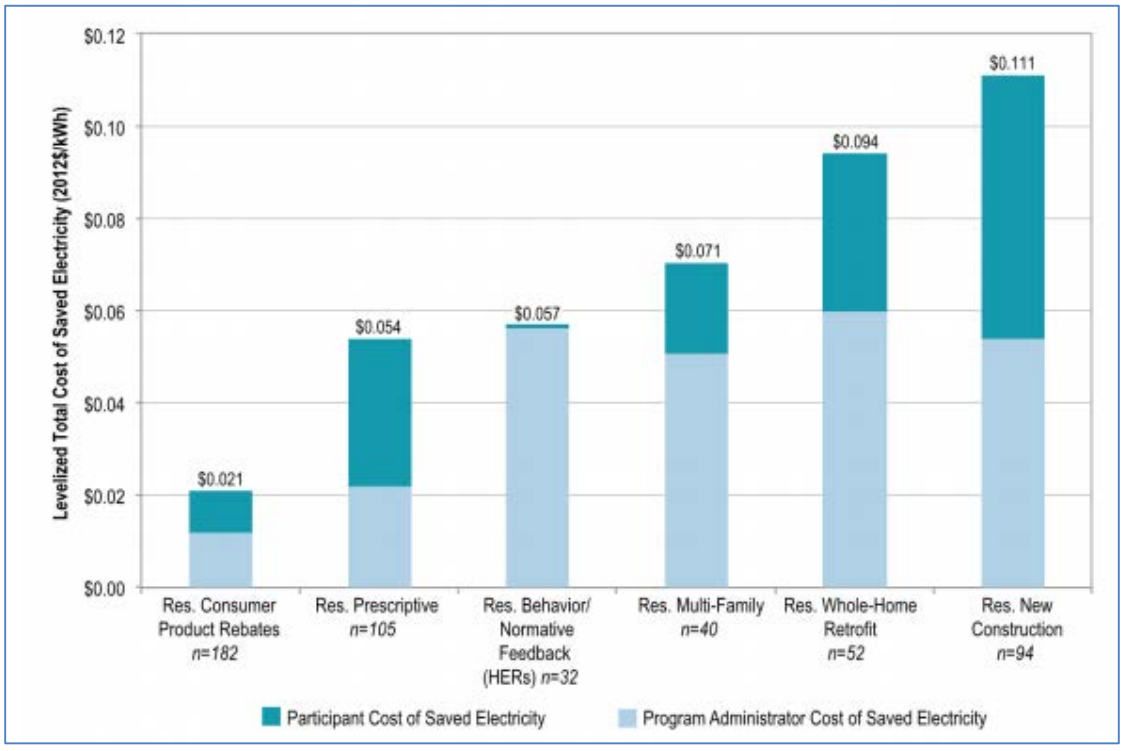

Figure 11. Total cost of saved electricity for various types of residential programs.[33]

The barriers for new, efficient technologies addressed by this strategy are:

High Incremental Cost

The higher incremental cost stands as a barrier until customers have an opportunity to become more familiar with the efficiency value proposition and price competition intensifies between manufacturers, as well as their distributor and retailer partners.

Lack of Consumer Awareness and Demand

Although ENERGY STAR lighting—CFLs and LEDs—have increased dramatically in market share in the U. S. market, Alaska stands out as one of a handful of states without an upstream lighting program. These programs are often critical for raising awareness of customer tradeoffs among product attributes such as price, annual energy costs and product performance.

Availability

There are several dimensions to the availability issue for rural Alaska. First, many Alaskans purchase goods outside of their communities through online stores and other larger retailers in hub communities or large municipalities (for example, Anchorage) that serve as distribution centers. Second, it is important to understand products come in different model types and configurations to match existing installation conditions or preferences. Third, the required timing for delivery, especially in the case of duress purchases in the case of equipment failure.

Duress Purchases

For certain products a large majority of the equipment selection, purchase and installation is made under duress, when the incumbent equipment has failed, and must be replaced immediately so that the building that it serves can continue to fully function. What is in stock at the local distributor is typically what gets purchased and installed.

Split Incentives

There is a split incentive of energy savings in situations where building owners select and purchase equipment, but building lessees or renters pay the utility bills.

Key players in the commercial program are supply channel participants: manufacturers, manufacturer's representatives, dealers and distributors; and contractors, customers, and building owners.

Key areas of opportunity for the supply channel are:

- Supplying energy-efficient products can quickly increase gross margins and net income.
- Increase inventory turns through collaborative sales, marketing, and training strategies.
- Develop agreements with manufacturers to extend accounts payable, and add flexibility to product return policies.
- Decrease distributors' accounts receivable through rapid efficiency program incentive reimbursement.
- Recognize the crucial role of efficiency programs in adding value to the supply chain and engagement with customers.

Typically partnerships with manufacturers, distributors and retailers for an upstream initiative are driven by a request for proposal (RFP) or through negotiated promotions. This allows for manufacturers to provide best pricing in a competitive solicitation in partnership with their retailers, distributors or dealers.

Alaska Context: Although residential and commercial lighting and HVAC upgrades have been supported in Alaska through direct installation, product rebates and grant programs from individual utilities, weatherization agencies and state programs, incentives are typically targeted at the consumer not at the market actors—manufacturers, retailers and dealer / distributors. In addition, absent regulatory mandated efficiency and appropriate cost recovery mechanisms, utilities often have a financial disincentive to develop comprehensive efficiency programs to support their customers. State programs have historically focused on more comprehensive home efficiency (for example, weatherization) instead of incremental efficiency opportunities offered by lighting and HVAC upgrades.

Application in Today and Tomorrow's Rural Alaska: Initial research and stakeholder feedback suggests that an upstream program strategy supporting efficient lighting and HVAC upgrades targeted at larger hub and distribution centers (for example, Anchorage and Fairbanks) would have a large impact on the AkAES communities due to the higher costs and limited product availability in local communities. Targeted strategies for supporting smaller, local community stores and dealers can also be introduced as a complementary strategy to support both planned and emergency purchases, avoiding lost upgrade opportunities. By reducing the incremental cost of more efficient lighting and space and water heating technologies, utility or statewide efficiency programs can accelerate the market in the state through collaborative promotions with the industry – manufacturers, retailers, distributors and contractors.

Non-Residential Efficiency

Approximately 6 million commercial and industrial buildings in the United States expend roughly $400 billion in annual energy costs and represent approximately 45 percent of U.S. greenhouse gas emissions.[34] However, as shown in **Figure12,** commercial and industrial buildings have a large range of building use and associated energy intensity (Btu / square foot). ENERGY STAR provides a framework for supporting individual companies, efficiency program administrators, states and federal agencies with improving the efficiency of buildings and plants. Specific tools and resources, notably ENERGY STAR Portfolio Manager allow for benchmarking of commercial buildings against comparable buildings nationwide.[35]

This framework involves:

- Targeted sector-level marketing.
- Benchmarking of building energy and water usage with ENERGY STAR Portfolio Manager.
- Guidelines for establishing a strategic energy management approach and individual plans.
- Supporting whole-building performance assessments and upgrades.
- Ongoing monitoring and verification to evaluate the continued performance of the building.

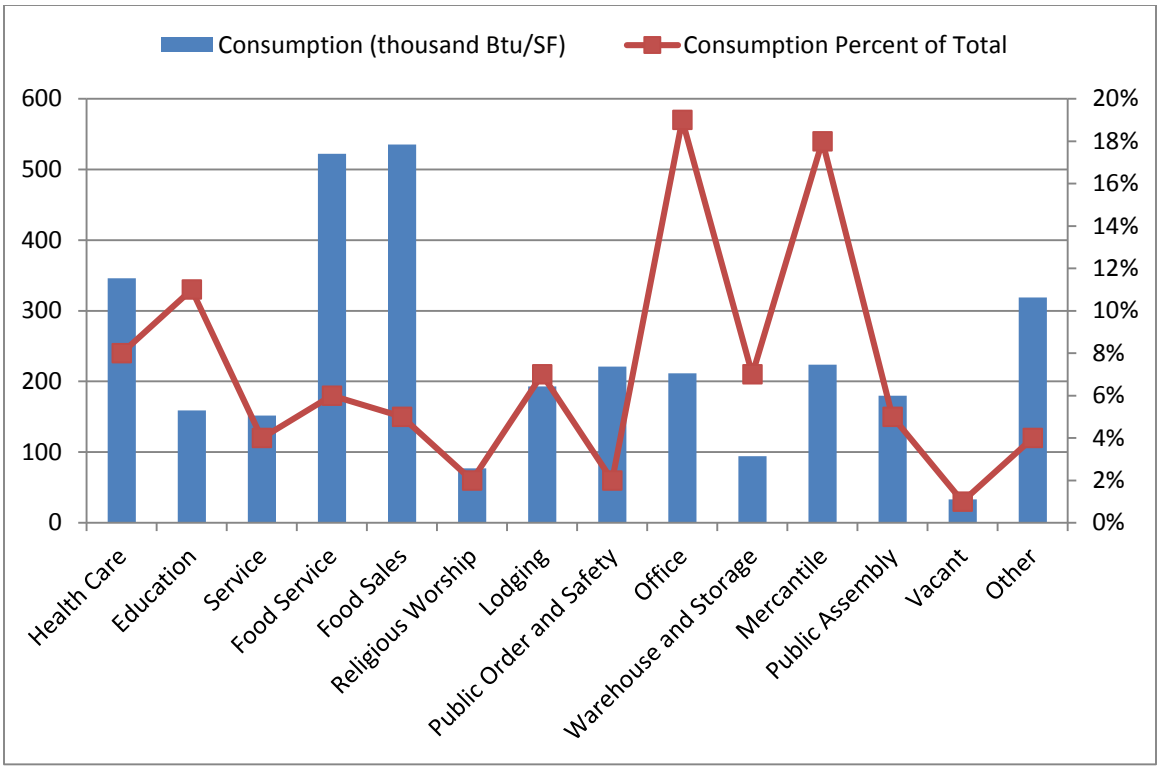

Figure 12. Sector-based commercial building energy use per square foot and percentage of total. [36]

Leading commercial and industrial (C&I) efficiency programs address the diversity of the building use by developing targeted sector-level initiatives and offering both custom and prescriptive savings strategies for customers. A national benchmarking study[37] identified common strategies in non-residential comprehensive efficiency programs that:

- Supplement prescriptive rebates with a focus on custom efficiency measures and projects.
- Target and scale rebates to incentivize custom and comprehensive (whole-building) projects.
- Support customers and energy service companies with competent engineering staff.
- Involve a review and proof of project completion as part of the incentive approval process.
- Provide consistent program funding and efficient application and payment processes.
- Develop effective measurement and verification processes and conduct thorough evaluations to that address process, impact, and net-to-gross issues.
- Support the development of private sector energy efficiency services market.

Although most efficiency programs in the C&I market are implemented directly by utility or statewide efficiency program staff or in-directly by program implementation contractors, ACEEE highlighted the Washington State University (WSU) Extension Energy Program for its innovative partnerships and funding to provide services for industrial customers. The program is supported by a broad mix of funding from federal, state, private, non-profit and individual industrial customers.[38] WSU offers a complimentary service to industrial customers to provide technical training and services and to help develop efficiency opportunities through existing utility efficiency programs.

The DOE Better Buildings program and EPA ENERGY STAR programs have targeted alliances with large companies, state and federal agencies to "lead by example" to scale up efficiency in the C&I sector and provide a roadmap to achieve 20 percent energy savings by 2020.[39] The DOE Better Buildings Alliance provides a framework for corporations to make commitments to achieving energy savings goals and to collaborate with their peers at a sector level to identify best practices in their industry and new strategies for energy reductions.

Commercial building codes have dramatically improved the efficiency of new buildings, but efficiency programs and energy service companies have supported retro-commissioning as a best practice for on-going improvements to energy performance in existing buildings and their operation (**Figure 13**). Retro-commissioning (RCx) is defined as a "process for instituting a rigorous testing, verification, and upgrade protocol to an existing building control system to identify and correct operational inefficiencies."[40] RCx is intended as a critical stage in the process of efficiency improvements to support and complement specific equipment (for example, lighting and HVAC) upgrades. Energy and non-energy benefits are achieved through comprehensive energy improvements that incorporate retro-commissioning.[41] Efficiency programs typically offer low interest loans and direct financial incentives to customers based on the scale of electricity, gas or power demand offset through operational improvements. As an example, Pacific Gas & Electric offers customers $0.08 per kWh, $1.00 per therm, and $100 per on-peak kW, capped at 50 percent of the total project cost.[42]

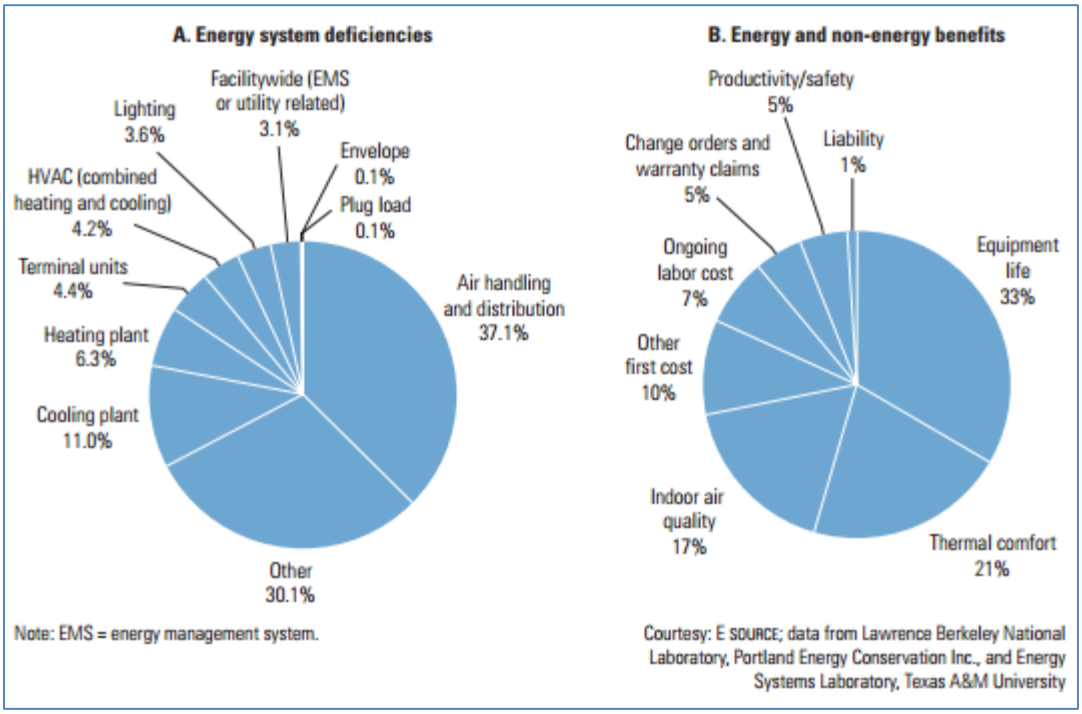

Figure 13. Commercial retro-commissioning in identifying energy system deficiencies.

Energy Efficiency Financing

Nationally and at individual state levels, the aggressive targets set for DSM programs will necessitate significant capital improvements to buildings. Taxpayer and utility ratepayer funding represent a small fraction of the total investment needed.

In the face of this funding gap, many energy efficiency program administrators are seeking to increase their reliance on customer financing with the aim of amplifying the impact of limited program funding.

A few national examples of this increasing reliance on financing:

- In California, the Public Utilities Commission (CPUC) has approved $200 million of pilot programs to test whether transitional ratepayer support can trigger self-supporting (that is, subsidy-free) programs (CPUC 2013).
- In Connecticut, the Connecticut Green Bank's 2013–2015 Strategic Plan notes that its programs "will reflect the strategic transition away from technology innovation, workforce development, formal education, and subsidies toward a focus on low-cost financing of clean energy deployment … [to] seek to leverage ratepayer dollars …" (CEFIA 2013).

- In New York, the $1 billion Green Bank's goals include overcoming disparate one-time subsidies and offering public credit and investment programs that require only a small amount of government funds (Cuomo 2013).[43]

These data must be balanced against the reality that financing programs as stand-alone products rarely, if ever, achieve ambitious goals. For example, despite more than 200 loan programs for residential energy efficiency in the United States, only a tiny fraction of the population has been reached. Many of the programs reached less than 0.1 percent of their potential customers annually, and an annual penetration rate of 0.5 percent is regarded as standard. This points to the need for an integrated approach to offering financing, as one part of a comprehensive approach. Programs that have higher participation rates tend to have networks of engaged and informed contractors who use the financing program as a sales tool.[44]

To expand the scope of energy efficiency programs to a larger audience, and to integrate financing options effectively within overall program design, ACEEE offers the following recommendations: [45]

- Budget for and invest in ongoing marketing of the program.
- Simplify the loan application process.
- Offer attractive loan terms.
- Design the program for a target audience.
- Consider on-bill financing.

Some of the financing strategies being deployed effectively nationally are:

On-Bill Financing and On-Bill Repayment

On-bill financing (OBF) programs are a promising way for utilities to help customers invest in energy efficiency improvements. On-bill financing comes in the form of a loan made to a utility customer—such as a homeowner or small business—pay for energy efficiency improvements to the customer's house or building. Utilities already have a billing relationship with their customers, as well as access to information about their energy usage patterns and payment history. Typically, the criteria for loan approval are based primarily or exclusively on payment history, rather than more traditional measures such as credit scores. In addition, many such programs require no down payment and determine the length of the repayment period based on the energy savings of the investment.

The capital for such loans comes directly from the utility. Utilities' exceptional ability to raise money from capital markets is largely based on their lengthy history of strong repayment performance. In order to rely on this history, on-bill financing payments must "rank *pari passu*" with utility payments, meaning that all customer payments are allocated proportionately between energy use charges and debt service. The regular monthly loan payments are collected by the utility on the utility bill until the loan is repaid.

The possibility of service shutoff in the event of non-payment is frequently put forward as an added security of OBF. However, in a climate such as Alaska's, it is less likely that this would be seen as an available option, especially for residential customers, as utilities might not be willing to be responsible for the hardship caused. A report issued by the State and Local Energy Efficiency Action Network (SEE Action) breaks down existing on-bill financing programs into categories and evaluates their performance.[46]

On-bill repayment (OBR) also requires the customer to repay the loan through a charge on their monthly utility bill as well, but with this option, the capital is provided by a third party, not the utility, which acts only in a collection capacity.[47] Some utilities have been initially reluctant to take on this role, citing new and often costly software requirements, lack of experience in servicing debt, and concern that any negative feelings about the performance of the installed measures will be directed toward the utility as the client-facing entity.

In some on-bill repayment programs, the loan is transferable to the next owner of the home or building—that is, it "stays with the meter." This provision can address the "split incentive" problem for renters because they can benefit from energy-saving measures while they occupy a building, but are not obligated to pay off any remaining loan balance when they move out. Renters are generally most willing to take this option for measures that result in positive cash flow—that is, the energy savings exceed the on-bill payment amount. To make these improvements, renters must obtain permission from the building owner, who will often consent because the improvements to the property will add value to the rental property at little or no cost to them.

It should be noted that the greatest success in on-bill programs have been in "bill-neutral" situations, where the loan repayment is on the same invoice as the reduced energy charge. So, for example, using an electric utility bill to invoice thermal improvements could result in a much larger electric bill and a much smaller fossil fuels bill. There are

currently far fewer data to support the idea that consumers and businesses will pay these bills as reliably as in the bill-neutral scenario.

An example of an OBF program is currently offered through a partnership between Craft3, a Community Development Financial Institution (CDFI) and Energy Trust of Oregon's Savings Within Reach (SWR) or Clean Energy Works (CEW) program.[48]

Alaska Context: Alaska has many small municipal and cooperative utilities and the costs of implementing and servicing an on-bill program might be seen as onerous. If a program were to be successfully implemented in one of the largest utilities in Alaska first, this might serve to alleviate concerns as well as increase demand for this option.

Property Assessed Clean Energy

Strategy Summary: Enact enabling legislation for property-assessed clean energy (PACE), authorizing Alaska government entities to provide financing for energy efficiency and renewable improvements to buildings.

PACE was developed as a new financing mechanism for funding energy efficiency and renewable energy improvements on private property.[49] PACE programs allow local governments, state governments, or other inter-jurisdictional authorities, when authorized by state law, to fund the up-front cost of energy improvements on commercial and residential properties, which are paid back over time by the property owners, typically for up to 20 years. Because property owners pay only the assessment while they own the property and are realizing the energy savings, they can finance projects with much longer paybacks than would otherwise be possible. Although PACE serves only a small portion of the market—the portion of homeowners and business owners with sufficient equity in their buildings—the combination of long loan terms and transferability directly addresses some of the biggest barriers to action. In addition, this option provides an opportunity for access to financing for property owners who might be unwilling or unable to qualify for traditional financial institutions' offerings.

Residential PACE: Federal Housing Finance Agency (FHFA) guidance letters (in 2010 and 2014) have caused many residential PACE programs nationally to suspend operations, as the FHFA has stated that any residential mortgage that has a PACE assessment in a senior position will be determined to be "non-conforming," and therefore ineligible for purchase. Recent announcements by the Federal Housing Administration (FHA) might address the issue by clarifying that PACE assessments will be permitted for FHA mortgages subordinate to primary mortgages. FHA has stated since August 2015 that specific

guidance will be published, but this has not yet happened and it is not clear when this will occur. Some PACE advocates are hopeful that the FHA model will eventually serve as a template for acceptance by Fannie Mae and Freddie Mac, but it is likely to be some time before a clear consensus emerges.

FHFA guidance does not affect commercial PACE programs. FHFA re-asserted their position that mortgages supported by Fannie Mae and Freddie Mac must remain in first-lien position. This precludes PACE financing from taking priority ahead of a Fannie Mae or Freddie Mac mortgage to collect the proceeds from the sale of a foreclosed property. In Vermont, Maine, and Rhode Island, this barrier was addressed by ensuring subordinate lien status for all PACE loans. FHFA has endorsed the junior lien PACE approach.

After a delay caused by regulatory concerns, residential PACE started back up in California in 2014. The State of California established a residential PACE reserve to protect mortgage holders, including Fannie Mae and Freddie Mac, from losses associated with PACE liens. The California PACE reserve is administered by the California Alternative Energy and Advanced Transportation Authority.[50] CA PACE loans remain in senior position and homeowners are required to sign a document stating they understand that the presence of a senior lien might affect their ability to sell their house because the buyer may require a Fannie or Freddie mortgage. In this case, the PACE loan must be repaid in full prior to obtaining a mortgage backed by Fannie or Freddie.[51]

Commercial PACE, by contrast, has experienced tremendous growth in the last two years, as shown in **Figure 14**. Commercial mortgages are not affected by the regulatory concerns that have hindered the growth of residential PACE, for two reasons: (1) Fannie Mae and Freddie Mac purchase only residential mortgages; and (2) commercial mortgages contain a standard provision called the “due-on-encumbrance” clause, which requires written consent from any existing mortgage lienholders before any additional lien-secured debt (whether senior or junior to the mortgage) may be taken on. As a result of this provision, commercial PACE projects typically have excellent economics as measured by the savings-to-investment ratio (SIR), and mortgage holders can view these projects as favorable—both because they reduce the occupants costs of occupancy and because the measures generally involve installation of equipment that increases the value of the property.

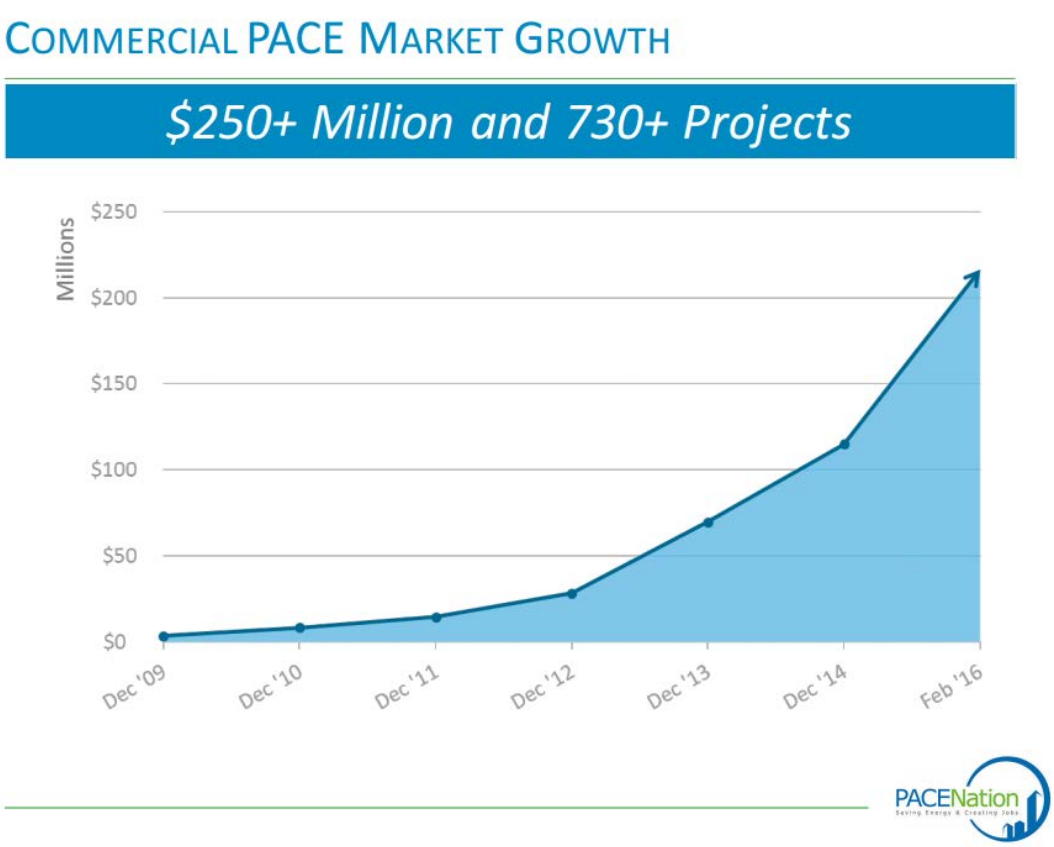

Figure 14. Commercial PACE programs nationally have experienced tremendous growth in the last two years. Source: www.pacenation.us/commercial-pace/

Alaska Context: PACE is essentially an add-on to an existing property tax infrastructure. Although only 36 municipalities in Alaska levy a property tax (out of 168 in the state), they represent approximately 90 percent of the population. Opportunities to implement PACE would need to be targeted to these communities after enabling legislation is in place. Given the uncertain regulatory status of residential PACE, the focus on commercial PACE in currently proposed legislation is well advised. Innovative approaches to PACE in Vermont may provide a template for individual communities to elect to have a centralized, self-funding program administrator who provides the supporting services for implementation.[52]

Public-Purpose Energy Services Company

Strategy Summary: Establish a PPESCO that provides comprehensive energy services:

- Technical assistance, from initial project walk-through to commissioning and verification of savings
- Installation (or oversight) of efficiency and renewables improvements

- Access to financing at favorable rates and terms
- Energy performance contract

A PPESCO allows the owners of the public and private buildings that serve the needs of Alaska's communities, including affordable housing, libraries, state and municipal buildings, small health care facilities, and education facilities, to make their buildings more efficient, with confidence that the future energy savings will be there to finance current energy work, including technical services that are headache-free.

PPESCO is modeled on traditional ESCO services, but they serve underserved markets and unserved buildings that are integral parts of the community. There are four markets of interest:

- Multifamily affordable housing
- Education, including K-12 and colleges and universities
- Health care
- Municipal or community facilities

The barriers that PPESCO addresses:

- **Access to technical capacity:** Too often personnel in the targeted sectors are already stretched too thin with existing job responsibilities.
- **Access to technical capability:** Personnel often are not expert in efficiency and fear making a mistake that could jeopardize ongoing operations.
- **Knowledge of funding sources**: Keeping up to date on utility incentives and local, state, or federal programs that can provide direct funding to a project takes significant resources that many of these organizations do not have.
- **Access to capital financing at reasonable cost**: Although some PPESCO clients might have access to low-cost financing through municipal bonding, tax-exempt leasing, or other sources, PPESCO can help to line up all the documents needed to access such funding or provide additional sources of project financing
- **Lack of certainty in savings to use as basis for financing**: Expertise in building energy systems that goes beyond a single portfolio allows PPESCO to project energy savings with certainty.
- **Project size required by traditional ESCOs**: Although there are a few examples, projects in the range of $200,000 to $800,000 are not normative for ESCOs, and are not served well by current models.
- **Project measures**: Traditional ESCOs tend to concentrate on energy measures that are relatively easy to monitor. A PPESCO will also do these measures, but will

supplement these with additional measures, such as insulation and air sealing, that are cost-effective but not so easily metered.

Although PPESCO as a business entity is a relatively new entrant to the market, the underlying concepts have been in use for 30 years, since many entities completed mission-driven or nonprofit energy performance contracting.

PPESCO is now operational in several states. In 2014, the Vermont Energy Investment Corporation created a wholly owned subsidiary, Commons Energy L3C (www.commonsenergy.com), to provide PPESCO services in Vermont, Ohio, and the DC metropolitan area. Other entities are exploring how they might provide PPESCO services in their local jurisdictions. These organizations are Southface (Southeast) and the Adirondack North Country Association (New York), among others. VEIC, which created the PPESCO concept, has always believed that success is measured in the number of other organizations, each with deep roots in their respective regions, adopting and rolling out this model.

Success is reliant on a few key factors:

- Strong partners with community roots and relationships.
- Unmet need for energy improvements in specific community-oriented sectors.
- Long-term capital at or below market rate with underwriting requirements that value the energy savings of the project.
- Technical knowledge of building energy systems, improvements, and savings calculations.

VEIC partners as a coach and mentor whenever a PPESCO is being established, helping to assess competencies and needs, and developing an appropriate business model and plan. Further information is available at www.ppescohowto.org, the open-source, public-domain site offering the operating details of how to create and deploy a PPESCO model (of which Commons Energy L3C is an example). This accessibility to information is a way of encouraging the proliferation of this type of market model to address the needs of tens of thousands of underserved public-purpose buildings in communities throughout the country.

Alaska Context: Although the challenges to establishing a PPESCO in Alaska are substantial, this model does offer an approach to providing comprehensive energy retrofits to underserved public-serving buildings in many of Alaska's smaller communities. Bundling of multiple public-purpose buildings in to a package for the PPESCO model may

allow individual communities to develop a compelling and cost-effective opportunity with sufficient scale.

Rural Utilities Service Loan Program

Strategy Summary: Determine which of the eligible utilities in Alaska might have the capacity and interest to apply for financing from the USDA Energy Efficiency and Loan Conservation Program. Develop a program to support the use of these funds for energy efficiency and renewable projects.

Through its Rural Development mission area, USDA offers the Energy Efficiency and Conservation Loan Program (EECLP), which can provide funding to rural electric cooperatives and municipal utilities—many of which already have energy efficiency programs in place—that can then re-lend the money to help homeowners or businesses make energy improvements. In addition to energy audits, the loans may be used for upgrades to heating, lighting, and insulation, and for conversions to more efficient or renewable energy sources.

This flexible capital could enable thousands more moderate-income Alaskans, who are not always able to access traditional financing, to save money on their energy bills by completing energy efficiency and renewable energy projects. It would improve economic vitality in Alaska's rural communities, and have a positive long-term impact through ongoing energy cost savings. The capital from RUS is long term and low interest; for example, at current interest rates, a utility could offer a 20-year loan at a fixed interest rate of 3.625 percent.

Eligible applicants are municipal and cooperative regulated utilities whose service area includes rural communities. Investor-owned utilities are excluded from the program. The application process is typical of a federal program of this size, and has several requirements that might prove daunting to a small utility.[53] For example, a borrower must have:

- An Energy Efficiency Business Plan.
- A Quality Assurance Plan, including the use of qualified energy managers or professional engineers to evaluate program activities and investments.
- A risk analysis, including an evaluation of the financial and operational risk associated with the program, including an estimate of prospective consumer loan losses.

The maximum amount that may be borrowed is determined by the financial status of the utility borrower. Once the borrower is approved, the utility has four to five years to disburse funds Loans may be made to any consumer, business, or municipality in the service area of the utility borrower; loan terms are set by project economics and the expected useful life of the measures. Maximum loan terms are in the range of 15 to 20 years. The borrow rate from RUS is fixed for the life of the loan and is determined by the loan term. A maximum of 1.5 percent to cover program administrative costs may be added to this rate when lending to the end user.

Alaska Context: RUS funds could be combined with any of the other financial strategies described above. For example, RUS funds could provide capital for on-bill financing or PACE, or help public-serving entities obtain capital for PPESCO services. The benefit of using this program is not just the capital, but the flexibility to offer underwriting and loan terms that would allow for loans to borrowers who might not be able to qualify for traditional financing products that do not include the economic value of the energy savings.

Loan Loss Reserves and Other Credit Enhancements

Strategy Summary: Consider offering credit enhancements to reduce transaction risk.

A credit enhancement is a financial tool that reduces the risk of a transaction by contributing additional collateral, insurance or guarantees to improve the chances that financing will be repaid. This reduced risk can also result in lower interest rates than might otherwise be available. If the goal is to expand private sector financing for energy efficiency, putting funds toward credit enhancements can be a good option because they:

- Encourage private lenders and investors to put money into unfamiliar markets or products (such as residential energy efficiency lending).
- Can absorb risk of loss and, as a result, be used as a negotiating tool to convince lenders to reduce interest rates or provide longer loan terms.
- Can be to convince lenders to stretch their underwriting criteria in order to lend to individuals or businesses with lower than typical credit profiles.
- Offer the potential for a small amount of program funds to leverage a large amount of private capital, providing much greater savings than from a direct expenditure.

Loan loss reserves (LLRs) put program funds in a “first loss” position, meaning that the program dollars are used to absorb losses from default or non-payment by borrowers,

limiting losses to private capital. The LLR facility reduces risk to lenders by covering a specified amount of losses from possible loan defaults in an energy financing program.

Interest rate buy-downs (IRBs) can be an effective tool to lower the cost of capital, but they are a relatively expensive way to drive consumer demand, especially for longer loan terms, and frequently result in free-ridership, in which participants who could use other financing options choose the lower program-subsidized rate, even though this is not a determinant for going forward with the project. LLRs have been successful in attracting private capital to energy efficiency lending at a lower cost than IRBs.

The major cost barriers to consider are the establishment of LLRs and the cost of directly purchasing interest rate reductions. A loan loss reserve of adequate size for a relatively large energy efficiency or renewable energy program would require a substantial commitment of funds. For example, Michigan's Home Energy Loan Program (HELP)[54] loan loss reserve was originally established with $10 million from federal ARRA funds.

A well-designed energy financing component of an overall program would likely contain elements of each of the credit enhancements described above. An excellent overview of the relationship between these options is available in a 2012 paper by the Lawrence Berkeley National Laboratory.[55]

Alaska Context: As Alaska faces imminent decreases in funding for incentives and other direct expenditures to support energy efficiency and renewables, a review of the potential from financing programs is warranted. Although, as noted earlier, a stand-alone financing program is unlikely to drive substantial demand. Nevertheless, the existence of available financing options within energy programs that can enable cash-flow-positive projects can help some projects move forward, even without substantial subsidies.

Unsecured Lending

The objective of the Warehouse for Energy Efficiency Loans (WHEEL) program[56] is to provide low-cost, large-scale capital for residential energy efficiency loan programs sponsored by states, local governments, and utilities. When fully implemented, WHEEL will be the country's first true secondary market for residential energy loans. WHEEL is designed to create a loan program that can ultimately be sustained without additional, ongoing sponsor subsidy.

WHEEL funds unsecured residential energy efficiency loans originated in participating programs. This addresses an important barrier, as many homeowners are unwilling to accept a lien on their property for energy borrowing. Experience to date suggests that unsecured energy loans have a very similar repayment record to secured loans. The loans are aggregated into diversified pools, secured by LLR funds provided by sponsoring programs, and will be used to support the issuance of rated bonds sold to institutional investors. Proceeds from these bonds allow WHEEL to continue purchasing eligible loans ("warehousing") from state and local programs for future rounds of bond issuance.

Kentucky and Pennsylvania and the Greater Cincinnati Energy Alliance currently have loans in the WHEEL portfolio. Florida has signed a Letter of Intent to join (and has funding committed via the Southeast Energy Efficiency Alliance and elsewhere) and the NY Green Bank is in the diligence phase but has announced that this is expected to be one of their deals in early 2016. Other states are in the final stages of approval or fund commitment. Although the long-term objective is to provide very competitive interest rates for these loans, at this time rates are in the range of 10 percent.

PowerSaver Loans

PowerSaver loans, which are backed by the Federal Housing Administration (FHA), offer single-family homeowners up to $25,000 to make energy efficiency improvements. The PowerSaver program is currently in a pilot phase, and is available in specific target markets through participating lenders.[57]

Although backed by the FHA, PowerSaver loans also include significant investment from private lenders. FHA mortgage insurance covers up to 90 percent of the loan amount in the event of default. Lenders will retain the remaining risk on each loan, incentivizing responsible underwriting and lending standards. FHA provides streamlined insurance claims payment procedures on PowerSaver loans. In addition, lenders may be eligible for incentive grant payments from FHA to enhance benefits to borrowers, such as lowering interest rates.

PowerSaver loans are designed to meet a need in the marketplace for borrowers who have the ability and motivation to take on modest additional debt to realize the savings over time from a home energy improvement. PowerSaver loans are available only to borrowers with good credit, manageable overall debt, and at least some equity in their home (maximum 100 percent combined loan to value).

Notes

[1] Consortium for Energy Efficiency, "Annual Industry Report - 2014 State of the Efficiency Program Industry." 2015. http://library.cee1.org/content/2014-state-efficiency-program-industry

[2] American Council for an Energy-Efficient Economy (ACEEE), *The 2015 State Energy Efficiency Scorecard,* October 2015. http://aceee.org/sites/default/files/publications/researchreports/u1509.pdf.

[3] Maryland was the "Most improved" state in the 2015 ACEEE State Scorecard, largely because the state's Public Service Commission requires utilities to ramp up energy savings targets by 0.2 percent each year to reach the state's 2 percent savings goal and the state's early adoption of the 2015 International Energy Conservation Code® (IECC) standards for commercial and residential buildings.

[4] Institute for Electric Innovation. "State Electric Efficiency Regulatory Frameworks Report." December 2014.

[5] Data from 320 efficiency program administrators in both the United States and Canada; data for the number of U.S. administrators were not given. Consortium for Energy Efficiency, *Annual Industry Report - 2014 State of the Efficiency Program Industry.* 2015, 6. https://library.cee1.org/sites/default/files/library/12193/CEE_2014_Annual_Industry_Report.pdf.

[6] Data from a subset of 320 efficiency program administrators in the United States and Canada. See previous footnote. Consortium for Energy Efficiency, "Annual Industry Report - 2014 State of the Efficiency Program Industry." 2015. https://library.cee1.org/sites/default/files/library/12193/CEE_2014_Annual_Industry_Report.pdf.

[7] Nowak, Seth et al. American Council for an Energy-Efficient Economy (ACEEE)."Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs (June 2013). http://aceee.org/sites/default/files/publications/researchreports/u132.pdf.

[8] A 2010 study by the Institute for Energy Efficiency (IEE) found that 93 percent of energy efficiency programs were delivered by electric and gas utilities.

[9] ACEEE. "Overview: Administrative Structures for Utility Customer Energy Efficiency Programs in the United States."

[10] Northwest Energy Efficiency Alliance 2015-2019 Strategic Plan. http://neea.org/docs/default-source/default-document-library/neea-2015-2019-strategic-plan-board-approved.pdf?sfvrsn=2

[11] Bonneville Power Administration *2014 Fact Sheet*. https://www.bpa.gov/news/pubs/GeneralPublications/gi-BPA-Facts.pdf

[12] Bonneville Power Administration. *2012 Update to the 2010-2014 Action Plan for Energy Efficiency*. March 2012.

[13] Bonneville Power Administration. "Case for Conservation: Helping Public Power Utilities Make the Business Case for Energy Efficiency." 2014 ACEEE Summer Study on Energy Efficiency in Buildings.

[14] ACEEE Fact Sheet: "How Does Energy Efficiency Create Jobs?" November, 2011.

[15] Presentation on Efficiency Smart business services at NASEO Regional Meeting. April, 2015.

[16] Shelter Report 2015 "Less Is More: Transforming Low-Income Communities through Energy Efficiency."

[17] http://weatherization.ornl.gov/pdfs/ORNL_CON-484.pdf, page vi.

[18] Howat and Oppenheim, 1999, page 23.

[19] Colorado PUC, Docket No. 07A-420E, Decision No. C08-0560, page 43.

[20] Garber-Slaght, Robbin. Cold Climate Housing Research Center. *Monitoring and Verification of Sustainable Northern Shelter Building Performance Quinhagak Prototype House Final Report*, December 2011.

[21] Home Performance with ENERGY STAR.

[22] Assisted Home Performance with ENERGY STAR is a variation of the program that increases subsidies for income eligible households – 80% of AMI in the case of NYSERDA and qualifies for up to $5000 per project compared to $3000 for higher income households.

[23] The AHFC offers a Home Energy Loan to compliment the Home Energy Rebate program. The rebate is applied against the remaining balance of the loan.

[24] Home Performance with ENERGY STAR Sponsor Guide and Reference Manual (v1.5), U.S. Department of Energy Building Technologies Office, March 2014.

[25] 2014 ACEEE Summer Study on Energy Efficiency in Buildings. "Is It Time To Move Beyond the Whole House Approach?"

[26] 2009 Residential Energy Consumption Survey (RECS)

[27] National Renewable Energy Laboratory, "Assessing and Reducing Plug and Process Loads in Office Buildings", April 2013.

[28] U.S. Energy Information Administration Annual Energy Outlook 2014, April 2014.

[29] U.S. Department of Energy's (DOE's) Appliance and Equipment Standards Program (Standards Program) covers more than 60 products, representing about 90 percent of home energy use, 60 percent of commercial building energy use, and 30 percent of industrial energy use. (U.S. Department of Energy Appliance & Equipment Standards Program Fact Sheet / February 2016)

[30] Environmental Protection Agency, Energy Independence And Security Act of 2007 (EISA) Backgrounder, April 2011.

[31] The Northeast Energy Efficiency Partnerships (NEEP) Regional Lighting Strategy 2014-2015 Update reported that 67 percent of annual electric energy savings for Massachusetts efficiency programs – 86 percent if behavioral programs are excluded.

[32] Environmental Protection Agency, ENERGY STAR® Retail Products Platform 1-Pager, October 2014.

[33] Lawrence Berkeley National Laboratory, "The Total Cost of Saving Electricity through Utility Customer-Funded Energy Efficiency Programs: Estimates at the National, State, Sector and Program Level". April 2015.

[34] ENERGY STAR 2014 program facts and statistics based on U.S. DOE Better Buildings program and 2012 Commercial Buildings Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS).

[35] https://www.energystar.gov/buildings?s=mega

[36] Analysis of Commercial Sector Energy Consumption from Buildings Energy Data Book: 3.1, March 2011.

[37] California Best Practices Project Advisory Committee, National Energy Efficiency Best Practices Study, Vol. 5, Non-Residential Large Comprehensive Incentive Programs Best Practices Report, December 2004.

[38] ACEEE. States Stepping Forward: Best Practices for State-Led Energy Efficiency Programs. September 2010.

[39] U.S. Department of Energy. Better Buildings Alliance – Winter 2015 Progress Update.

[40] Massachusetts Energy Efficiency Advisory Council (EEAC). Retro-commissioning Best Practice Study. June 2014.

[41] ENERGY STAR Building Upgrade Manual. 2008 Edition.

[42] Pacific Gas & Electric Retrocomissioning Program Fact Sheet. January 2014. https://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/analyzer/retrocommissioning/fs_retrocommissioning.pdf

[43] State and Local Energy Efficiency Action Network. (2014). *Energy Efficiency Financing Program Implementation Primer*. Prepared by M. Zimring, Lawrence Berkeley National Laboratory.

[44] https://www.veic.org/documents/default-source/resources/reports/energy_efficiency_financing_report-merrian_fuller_2008.pdf, 6.

[45] Hayes, S., et al 2011. *What Have We Learned from Energy Efficiency Financing Programs? http://aceee.org/research-report/u115*. Washington, D.C.: American Council for an Energy-Efficient Economy.

[46] https://www4.eere.energy.gov/seeaction/system/files/documents/onbill_financing.pdf

[47] www.aceee.org/sites/default/files/publications/researchreports/e118.pdf

[48] http://www.craft3.org/Borrow/energyore

[49] http://energy.gov/eere/slsc/property-assessed-clean-energy-programs

[50] California First is operating residential PACE in municipalities across California: https://californiafirst.org/.

[51] For the recent FHFA guidance on PACE, see http://www.fhfa.gov/Media/PublicAffairs/Pages/Statement-of-the-Federal-Housing-Finance-Agency-on-Certain-Super-Priority-Liens.aspx

[52] https://www.efficiencyvermont.com/services/financing/homes

[53] http://www.rd.usda.gov/files/UEP_EE_Final_PowerPoint.pdf

[54] http://michigansaves.org/program/help

[55] http://aceee.org/files/proceedings/2012/data/papers/0193-000155.pdf

[56] https://wheel.renewfund.com/

[57] For more information, see http://www.afcfirst.com/info/energy-lending-programs and Pennsylvania – PowerSaver Loans http://www.keystonehelp.com/, and Efficiency Maine, http://www.efficiencymaine.com/at-home/energy-loans/.

4. Alaska Looking Forward

As oil revenues have declined, Alaska is facing a transition in the energy economy and more broadly with relationship to state funding for services and programs. As illustrated in the preceding sections of this report, the State has a wide range of experience and models to draw upon. These come from both Alaska's significant historic activities promoting and supporting efficiency and from other states and regions. To directly address the needs of rural Alaska there are particular opportunities and challenges that need to be considered and addressed.

The remainder of this report examines the opportunities for Alaska looking forward. We start by providing a "snap-shot" gap analysis of current and past initiatives. While it is beyond the scope of this report to conduct a full evaluation of the programs and their efficacy, it is valuable to have a more general assessment. Our objective is not to provide a definitive assessment or analysis of any single program or initiative. Neither is it to evaluate any of the individual organizations that are providing services. Rather, by stepping back, the gap analysis is intended to provide indicators of the areas where there are opportunities and potential to enhance current activities, design and implement new strategies, and target resources to cost effective investments.

Following the efficacy assessment, is an analysis of the current potential for statewide building codes, with a particular focus on the Affordable Energy Strategy Study Area. This is followed by a forecast of the need and opportunity for energy efficiency in rural Alaska, with results presented by region and for the residential and non-residential sectors. The energy, economic and demographic projections and forecasting presented in this section have been completed for the Alaska Energy Authority by contractors under separate contracts.

Efficacy of Past and Current Initiatives

In assessing the efficacy of both current and recent utility, state, and federal energy efficiency and financing programs, the study team expanded the metrics beyond simple cost effectiveness to include the continuity and level of program funding, process and reporting performance, applicability, and energy savings potential in the AkAES regions.

It also looked at long-term market impacts, non-energy benefits in the communities, and job creation.

We have examined 23 initiatives in the residential sector and 24 initiatives in the non-residential sector, across 11 criteria. We provide each with a high, medium, or low score, using quantitative and qualitative data, considered in the context of our team's subjective professional judgment.[1]

The efficacy analysis is not an evaluation of the individual programs or their performance. That type of comprehensive evaluation can provide valuable insights, but it is beyond the scope and resources of the current study. Instead, the efficacy analysis identifies macro-level patterns, gaps, strengths, and weaknesses at the portfolio level of the initiatives that are addressing energy burdens in rural Alaska. This rapid and high level "gap analysis" informs the policy and strategy recommendations presented in **Section 5** of this report. **Table 8** defines the criteria used for assessing efficacy.

Table 8. Definitions used in the efficacy analysis

Term	Definition
Budget	The cumulative total funding received by the program from all sources, from 2008 through 2015.
Percent of buildings in AkAES area served	The estimated (or calculated) percent of structures within the AkAES geographic area that have received assistance from the program.
Job creation	A qualitative metric that evaluates the type of jobs the program creates and whether they might occur in the AkAES geographic area.
Energy savings	The cumulative estimated (or measured) energy savings achieved by the program from 2008 through 2015.
Years of activity	The duration of program availability in the AKAES geographic area.
Steady funding	A qualitative metric indicating whether the program has had steady funding since its inception or since 2008, whichever is more recent.
Future funding	A qualitative metric of current funding, and the method of funding for this program.
Market transformation	A qualitative metric to capture the extent to which the program has additional effects beyond the program, if funded.
Benefit-cost	The benefit-to-cost ratio for the program.

Term	Definition
Process coordination & reporting	A qualitative metric indicating how well the program accommodates in-kind matches and other financial interactions with other programs and funding sources. This metric also contains the programs' reporting and tracking of performance results.
Non-energy benefits	A qualitative metric indicating other effects by category the program might have, beyond energy savings.
Regional cover	A qualitative reference that indicates to what degree the areas of the AkAES geographic area are served by the program.

The full table of efficacy assessment results for the residential and non-residential sectors are presented in **Appendix C.**

Major observations from the efficacy assessment are:

- Of the efficacy criteria identified in **Table 8,** we gave the greatest number of high and medium scores to the benefit-cost and non-energy benefits criteria. This suggests, across most of the initiatives and programs, that investments in energy efficiency in rural Alaska provide net economic benefit from the energy savings, and also provide non-energy benefits for the community and for individual households, businesses, and public entities. Given the high costs of energy in rural Alaska and the challenging environmental conditions, this finding affirms the proposition that energy efficiency investments and initiatives can be expected to provide economic and other societal benefits.
- Some of the initiatives and programs reviewed require codes or minimum performance standards for new construction. Other initiatives and programs, such as participation in a rebate program, are market driven and optional. Because they have an element of mandatory participation, the initiatives with requirements offer a greater opportunity to reach a high percent of rural population. The initiatives that depend on market demand or voluntary participation are more likely to have at least some gaps in the coverage and ability to reach and impact rural Alaska. For example, there are indications that not all rural communities take advantage of weatherization or Power Cost Equalization, to the fullest extent possible.
- The job creation benefits of energy efficiency investment are likely to be associated with direct service programs and training. It is less likely that initiatives based purely on a financing offer (such as low-interest loans), will experience the uptake and concentration required to support job growth. Initiatives involving

consumer-purchased and installed items, such as efficient lighting or electronics, or upstream incentives, will also have lower job creation impacts.

- The energy savings potential for rural communities is likely higher with direct service programs. Financing—and possibly also audit and technical service offerings—are important complementary strategies but might not be sufficient to prompt energy project development and realized savings.
- The portfolio of efficiency services and initiatives in Alaska includes some that have been operating for decades and some that have been initiated in the last several years. Building upon and coordinating with other initiatives will help to avoid undue duplication of services, market confusion, and unneeded complexity or administrative burdens. At times new initiatives and services, may meet specific, unique and unmet market needs, but there also appear to be opportunities to coordinate, bundle and streamline multiple existing efforts rather than launch new initiatives.
- Initiatives driven by availability of specific project funding are challenged to sustain broad and deep market impacts over time. There are indeed circumstances under which the significant funding of demonstration projects may hinder market development, and lead consumers as decision makers to think that if full project funding is not available, they should wait and hope that in the future they can obtain grant funds rather than invest their own resources in efficiency.
- Lack of steady funding is a major issue for some programs and makes the delivery of services on a sustained basis very difficult. Alaska's significant investment of state funds in Weatherization is an example where the decline from annual budgets authorized in the 2008-2015 period (total of $323 million over 7 years) to the current level ($7 million in fiscal year 2016) creates serious issues with regard to sustained workforce training, engagement, impact and service levels.
- Many of the initiatives have potential to help transform energy markets in rural Alaska. Consideration on how to balance the benefits that direct fuel assistance provide against the possible disincentive for efficiency should continue to be considered. In addition, grant funding has been a very important element supporting energy infrastructure and projects in Alaska, but given current budget challenges, the ongoing consideration of how to help transition away from grant funds as the prime motivator for projects needs to be emphasized.
- Energy efficiency in rural Alaska appears to be broadly cost effective, but detailed impact benefit cost analyses have not been completed in many instances. Greater investment in regular and detailed evaluation processes and protocols can help to enhance program delivery and capture the most cost effective savings.

- Process coordination and enhanced reporting across agencies and various levels of activity from the Federal, State, Regional and municipal organizations provides an opportunity to create better results and service delivery. Alaska has a large and diverse set of actors who are active and have valuable experience and expertise in the energy sector. This is a benefit, but underscores the potential need and value of coordination and communication. Information sharing across initiatives is underway, with the Alaska Energy Efficiency Partnership as an example, and could provide a foundation or model for greater cooperation in areas such as service delivery, evaluation, procurement, program design.
- Services that improve energy affordability in rural Alaska are likely to create substantial non-energy benefits. These benefits are relate to health and safety, building durability, reduced environmental impacts, reduced difficulties for customers with bill payment and arrears, and improved comfort and productivity. Coordinated research, testing, and documentation of these impacts will serve only to enhance the benefits resulting from efficiency investments and value returned to the economy.

Rural Alaska is part of the state economy, and statewide initiatives to enhance energy efficiency performance or to build statewide capacity will likely help to improve the situation in rural Alaska. At the same time, some services and initiatives solely or primarily serving rural Alaska might continue to be necessary.

Building Energy Efficiency Codes and Standards in the Affordable Energy Strategy Study Area

Currently there is no mandatory statewide energy efficiency building code in Alaska. However, there is a Building Energy Efficiency Standard (BEES) developed and maintained by the Alaska Housing Finance Corporation (AHFC). This standard is based on the 2012 International Energy Conservation Code and the 2010 ASHRAE 62.2 standard, along with Alaska-specific amendments. In order to better understand the current state of energy efficiency standards and the potential to save energy through mandatory codes and / or stretch code incentives, as part of the AkAES efficiency assessment CCHRC conducted an analysis of the number of homes that have met BEES since 2000 and additionally conducted key-informant interviews with Regional Housing Authorities.

BEES Certified Homes in Alaska

There are two main avenues for certifying a home as meeting BEES: (1) the prescriptive method, in which each component of the home meets a certain minimum, and (2) the performance method, where homes are modeled using AkWarm energy rating software and pass if they meet or exceed a minimum rating score. There are no data on the number of homes that meet BEES prescriptively; however, anecdotally the vast majority of homes are certified to BEES using the performance method. The standard is updated regularly along with the IECC code cycle, however, the performance requirement has only changed once: the minimum rating score was 4 Star Plus / 83 points until 2013, when it changed to 5 Star / 89 points upon adoption of the 2012 IECC-based BEES.[2] Although future funding has been discontinued, there has also been an incentive program for homes meeting the "stretch goals" of 5 Star Plus and the recently added 6 Star designation.

CCHRC conducted an analysis comparing the number of homes with BEES AkWarm ratings to new construction numbers collected by the Alaska Department of Labor's annual survey. Based on this analysis, while 36 percent of new construction in Alaska has been certified to meet BEES, only approximately 22 percent of new construction in the Affordable Energy Strategy area was certified as meeting BEES. **Figure 15** shows the regional breakdown of these numbers for the period from 2000 to 2015.

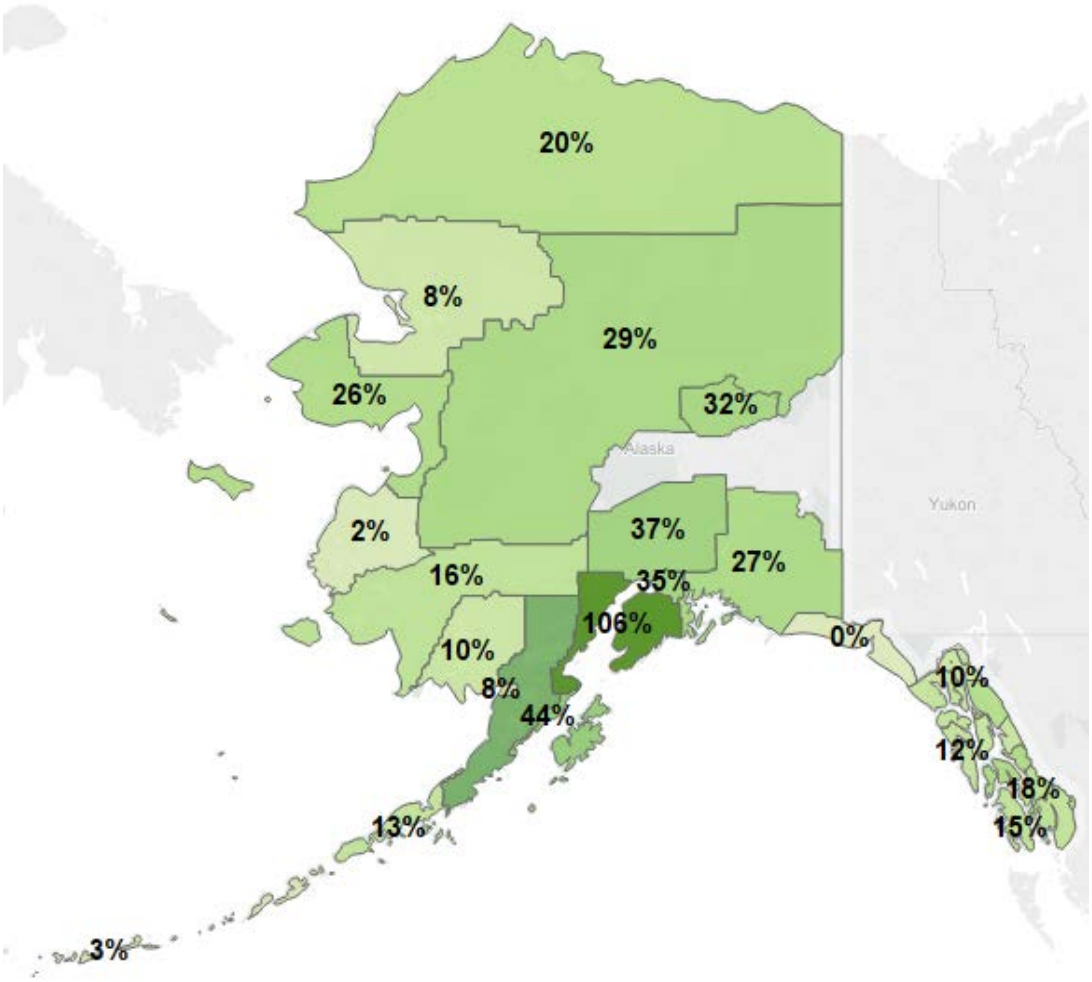

Figure 15. Percentage of new construction that is BEES-certified, by Census Area, from 2000 to 2015.[3]

Table 9 shows the actual numbers of BEES-certified homes for each region as compared to the total new construction estimates from the Department of Labor for the period between 2000 and 2015.

Table 9. BEES-certified homes, compared to new construction estimates, by Census area

Census Area	BEES-certified homes (ARIS)	New construction estimate (DOL)
Aleutians East Borough	3	23
Aleutians West Census Area	5	145
Anchorage municipality	6,350	17,914
Bethel Census Area	83	510
Bristol Bay Borough	2	25
Denali Borough	22[4]	5

Census Area	BEES-certified homes (ARIS)	New construction estimate (DOL)
Dillingham Census Area	12	118
Fairbanks North Star Borough	2,234	6,913
Haines Borough	17	177
Hoonah-Angoon Census Area	8	62
Juneau City and Borough	364	1,645
Kenai Peninsula Borough	1,737	1,636
Ketchikan Gateway Borough	82	521
Kodiak Island Borough	276	622
Lake and Peninsula Borough	8	11
Matanuska-Susitna Borough	6,689	18,104
Nome Census Area	57	222
North Slope Borough	34	168
Northwest Arctic Borough	23	279
Petersburg Census Area	45	168
Prince of Wales-Hyder Census Area	30	202
Sitka City and Borough	79	668
Skagway Municipality	20	159
Southeast Fairbanks Census Area	144	5
Valdez-Cordova Census Area	85	310
Wade Hampton Census Area	4	203
Wrangell City and Borough	14	77
Yakutat City and Borough	-	9
Yukon-Koyukuk Census Area	51	173
TOTAL	**18,478**	**51,074**
Affordable Energy Strategy Area	1,446	6,502
Railbelt Area	17,032	44,572

Regional Housing Authorities

Regional Housing Authorities are the primary builders of new homes in rural Alaskan communities that are off the road system. All of the housing authorities interviewed receive Supplemental Housing Development Grant funding from AHFC, and are thus required to meet the latest version of BEES. Correspondence with seven of the regional housing authorities found that many of them are exceeding the BEES standard, regularly building 6 Star Homes, as can be seen in **Table 10.** A primary motivator for the majority of these housing authorities is to reduce the long term energy costs for their occupants, as fuel prices in these remote areas are typically significantly higher than those found in urban Alaska.

Table 10. Summary of regional housing authority interviews

Housing authority name	Current building standard	Super-efficient pilots?	Would build to stretch code?	Estimated % of homes not built by housing authority
Aleutians HA	6 Star, moving towards Net Zero	Yes, Living Building Challenge	If there is incentive	5-10%
NW Inupiat HA	5 Star Plus (would be 6 Star w/ HRV)	Yes, CCHRC home in Buckland	If there is incentive	5-10%
Bristol Bay HA	6 Star (all but 2 homes)	No	Not sure; already meeting 6 star	< 5%
Native Village of Kotzebue	BEES (>=R30 walls, R38 ceiling/floors)	No	Yes, if the incentive were sufficient	Few units; mostly native non-profit
TNHA (Arctic Slope)	6 Star	Yes, partnership with CCHRC	Maybe, but worried about restricting innovative solutions	Build 90% in villages, 3% in Barrow.
Copper Basin Regional HA	BEES, 2012 IRC	No	Unsure; may increase costs too much	<5 %
Bering Straits Regional HA	BEES, some 6 Star	No	Would be encouraged by performance targets, especially if there were additional funding opportunities	Few, mostly teacher housing and some through Native Corp. Non-profit
IRHA	BEES, most recent homes reach 6 Star	Yes, built a Fairbanks Pilot and two 6 Star cabins in Tetlin	Would need to carry a significant financial incentive	~ 10% in villages are building their own homes

Information from the interviews in some cases conflicted with the estimates of new construction meeting BEES obtained from AHFC and the Alaska Department of Labor. For example, the Aleutians Housing Authority appears to be building well above the BEES standard, and estimates they are building 90 percent or more of the new housing units in the region, and yet the data shows that only approximately 5 percent of the homes in the

Aleut ANCSA region have been certified to meet BEES. According to AHFC, this is likely due to missing data in the ARIS database, as while housing authorities have always been required to meet BEES by turning in compliance forms signed by the builder and the energy rater, it is only in the past one to two years that they have been required to upload their home energy ratings as proof of this.

CCHRC obtained records showing the total number of housing units built by four housing authorities between 2000 and 2011 to better estimate the number of homes meeting the BEES standard in these areas. A comparison of these construction numbers to the Alaska Department of Labor's new construction estimates for the region showed that while the numbers varied from region to region, approximately 63 percent of the estimated 1,050 homes built in these areas were constructed by the regional housing authorities. **Table 11** shows the total number of new housing units built according to the Department of Labor, the number of homes that were recorded as being BEES-certified, and the housing authorities' construction numbers. While regional housing authorities are required to meet BEES, there are significantly fewer BEES records than the numbers reported by housing authorities, supporting AHFC's suggestion that BEES certifications have simply been under-reported in these areas.

Table 11. Reported new construction from 2000 to 2011, for four rural regions

ANCSA region	AK-DOL	BEES	Housing authority	% units built by regional housing authorities
Arctic Slope Regional Corporation	113	13	60	53%
Bering Straits Native Corporation	181	55	77	43%
Bristol Bay Native Corporation	137	11	83	61%
Calista	619	80	443	72%
Total	**1,050**	**159**	**663**	**63%**

Building Code Gaps

While the BEES standard covers the regional housing authorities, which are the primary builders in the remote communities throughout the state, there are several notable gaps where information is lacking about the relative energy efficiency of new construction. The first and likely most important of these is the village and tribal housing entities that are building using a combination of funding sources including BIA grants and others, but

that aren't receiving supplemental housing development grants from AHFC. It is unknown how many units these various groups are building, but according to some of the interviewed regional housing authority staff and one interview with one of these entities, they are not *required* to meet any kind of energy efficiency standard. That said, the primary motivator for all those interviewed was to reduce the cost of operating buildings, which is particularly expensive in these remote areas. The Native Village of Kotzebue, the primary builder in their community, meets the BEES standard prescriptively despite not being required to.

Another potential gap in new construction meeting an energy efficiency standard is private builders. Interviews indicated that the private construction market varied significantly from region to region. For example, there are very few private builders in the Bristol Bay, Northwest Arctic, and Copper Basin regions, whereas in the hub community of Barrow there are a variety of for-profit and non-profit organizations building homes apart from the regional housing authority.

The final sector of new homes that haven't been verified to meet an energy efficiency standard are owner-built homes. Interviews indicated that while there generally are homes built this way, it is a relatively small number.

Assuming the construction data from the four Regional Housing Authorities are representative of the Affordable Energy Strategy region as a whole, these building code gaps represent approximately 37 percent of the new construction in the area. Since 2000, an average of 414 new homes have been built in this area each year. Thus, if the trend continues, an estimated 153 non-BEES homes will be built every year. Assuming that these homes are being built to the old BEES standard of 4 Star Plus, this represents missed energy savings of approximately 2.7 billion BTUS annually, or the energy equivalent of 19,700 gallons of fuel oil per year. If the current homes are being built to a level that is less efficient than 4 Star Plus, these annual savings would be correspondingly higher.

Stretch Code Potential

One significant finding from the interviews was that many housing authorities already appear to be either meeting or aiming to meet the 6 Star standard, which is roughly equivalent to a HERS score in the low 30s. These regional housing authorities currently do not qualify for the $10,000 rebate from AHFC, so the motivations are primarily from operating costs. The number of new homes in the study area that have received one of these rebates is very low, with only 255 that are on record as being paid out. This is

approximately 8 percent of the total number of rebates paid throughout the state, which means that rural areas have a lower participation rate, because approximately 19 percent of new homes have been built in the area since the program's inception.

The amount of energy saved by moving from a BEES home to a 6 Star home will vary. Nevertheless, an analysis of all homes that have been certified to meet BEES in the Affordable Energy Strategy area showed that on average, a 6 Star home will use approximately 31 percent less energy than a home that meets the BEES minimum standard. Using the median size of new construction in the area, this 31 percent reduction equates to approximately 36 million Btus annually, the energy equivalent of 267 gallons of fuel oil. Given these savings estimates, increasing by 30 percent the proportion of new homes that meet 6 Star instead of the current BEES minimum would save 4.5 billion BTUs annually, the equivalent of 33,160 gallons of fuel oil.

Both building costs and heating fuel prices are much higher in rural areas of the state. The additional costs and the estimated fuel savings from building to 6 Star instead of the current BEES standard were modeled in order to determine the cost-effectiveness of building to this higher standard. The baseline home was modeled using the average component size of homes in Western and Northern Alaska and the efficiency levels from a sample of 10 homes with AkWarm energy ratings near the BEES minimum requirement of 89 points. A sample of homes in these same regions that had met 6 Star was then analyzed to determine which types of upgrades would be reasonably familiar to organizations building in the area. The energy cost savings for these models were estimated using AkWarm energy modeling software, with Nome as the baseline for fuel prices and climate. The additional up-front labor and material costs required to implement the upgrades necessary to meet 6 Star were estimated for urban areas of Alaska using a combination of RS Means and local contractor estimates. These costs were then adjusted using factors for Nome from the annual construction cost survey conducted by AHFC.[5]

The results of the economic and energy modeling showed that overall, moving from the BEES minimum requirements to 6 Star is cost effective. The additional incremental cost of going to 6 Star is estimated to be $10,120, with a modeled annual energy savings of approximately $890 at current fuel prices. These cost savings are a result of annual fuel savings of 192 gallons of heating oil and 240 kWh of electricity (mostly due to decreased use of mechanical equipment). Using the DOE real discount rate and fuel escalation factors, the calculated savings-to-investment ratio over the 30 year life of the upgrades is

2.1, meaning the net present value of the savings are more than double the initial capital costs.

Given the favorable economics of moving from the BEES minimum standard to the 6 Star stretch goal, it should be supported. The fact that many of the regional housing authorities are already meeting this high standard suggests that it is achievable even with the high costs of construction in rural Alaska. We recommend that the 6 Star stretch goal be supported via a combination of: additional outreach and publicity efforts, providing free technical assistance to builders looking to reach 6 Star, and by reinstating some amount of financial incentive.

Assuming that the construction data from the four Regional Housing Authorities in **Table 11** is representative of the Affordable Energy Strategy Area as a whole, 63 percent of new construction in this area is already meeting the BEES minimum standard. The energy efficiency of the other 37 percent of new construction is unknown; while reducing energy costs was a strong reason for all of the regional housing authorities surveyed to build efficient homes, the high cost of construction in these areas may lead other builders that are not required to meet BEES to build less efficient housing. Statewide building codes would ensure that all new construction would meet minimum energy efficiency requirements, reducing the energy cost burden to future occupants. The BEES standard is currently administered efficiently, with methods in place to reduce the reporting costs in rural areas; the flexibility of the standard also drives innovation, with several of the Regional Housing Authorities using the free AkWarm software as a design tool to help reduce the cost of construction while maintaining energy savings.

While BEES provides a floor for energy efficiency, building to the even more efficient 6 Star stretch goal is also cost effective. This goal is already being pursued by many Regional Housing Authorities, and it should be supported to help continue to cost-effectively increase the efficiency of new construction in the study area and throughout the state. Additional publicity efforts might help to encourage other builders to attempt to meet the goal, providing technical assistance to builders to help them meet the goal more cost-effectively. Reinstating some amount of financial incentive for buildings that have been certified as 6 Star might also be necessary.

Forecast

The community energy consumption and project evaluation model developed by AEA to support the Alaska Affordable Energy Strategy study has characterized the residential and non-residential opportunity for energy efficiency in the AkAES area. Although the AEA forecast model was developed independently, the VEIC / CCHRC Team provided supporting review during its development and received community-level summary data for this assessment.

The AEA community energy model provides the current energy use (fuel oil, electricity, and total heating fuels), remaining building stock to be served, estimated first-year savings, and a 15-year projection of the net present value of the forecasted costs and benefits to the communities—for all cost-effective energy efficiency improvements. Additional PCE program data allowed estimates of total residential electric use by community, and costs based on the average residential electric rate and effective electric rate with PCE.

The community energy forecast model incorporates data from various databases, including ARIS, reported weatherization and new construction activity through AHFC programs, AEA Village Energy Efficiency Program (VEEP), ANTHC water and wastewater projects, and individual reported commercial and residential projects.

These data can be gauged in the context of Alaska's consumption and expenditures for energy, as shown in **Figure 16.**

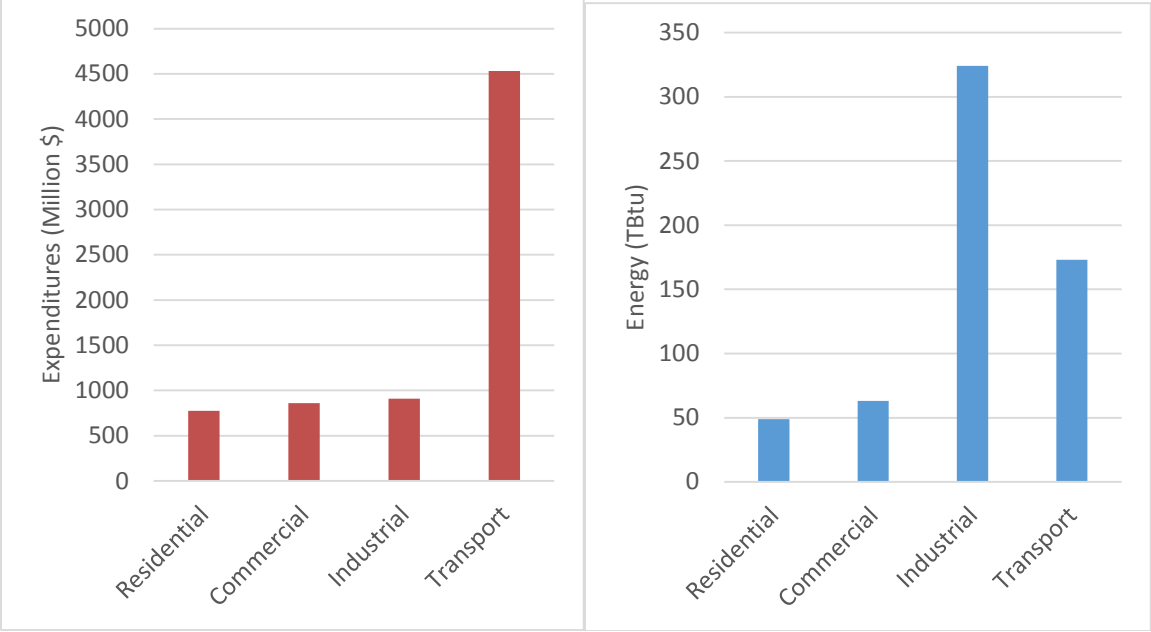

Figure 16. Energy Information Administration energy and expenditure data in Alaska, by energy sector.

Although energy consumption across Alaska is dominated by the industrial and transportation sectors,[6] commercial and residential energy consumption and expenditures have significant direct impacts on rural Alaskan communities and households. Because jet fuel and oil extraction accounts for a significant portion of energy use in Alaska, previous policy recommendations have suggested that Alaska's efficiency goals exclude these end-uses.[7] With this assumption, each of the four sectors accounted for approximately one-quarter of the remaining energy use in 2010, as can be seen in **Table 12.**

Table 12. Modified net statewide energy consumption, by sector (TBtu)

Energy Use Sector	Energy Consumption (TBtu)
Residential	75.3
Commercial	85.4
Industrial	72.8
Transportation	83.4
Total Energy Consumption	**316.9**

Data applied to the AEA forecast model show that the AkAES regions is estimated to have total annual expenditures of $843 million for electricity and fuel oil in 2017. Expenditures

in the residential and non-residential sectors are split almost equally, with annual expenditures of $397 million and $446 million respectively. The breakdown of these sector expenditures is presented as **Figure 17.**

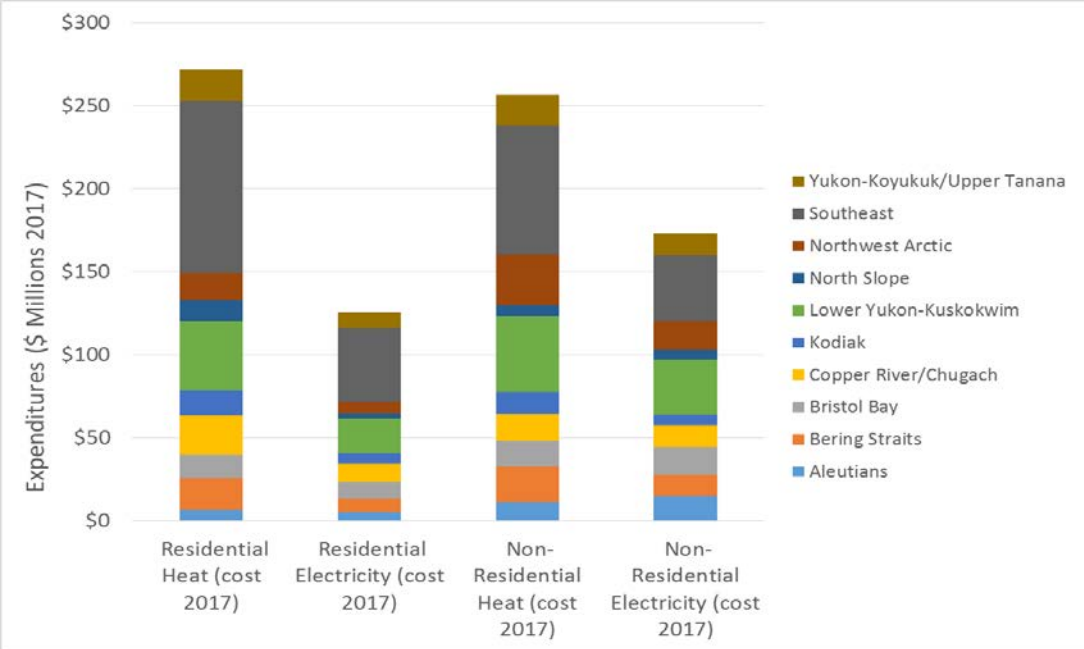

Figure 17. AkAES regional annual expenditures on electricity and heat.

Residential Energy Efficiency Forecasted Opportunity

The regional distribution of the 41,000 residential homes that have not participated in energy efficiency services between 2008 and 2014 are geographically concentrated, with Southeast Alaska representing half the total remaining potential households, and only one other region, Lower Yukon-Kuskokwim, accounting for more than a 10 percent share of remaining potential, as shown in **Figure 18.**

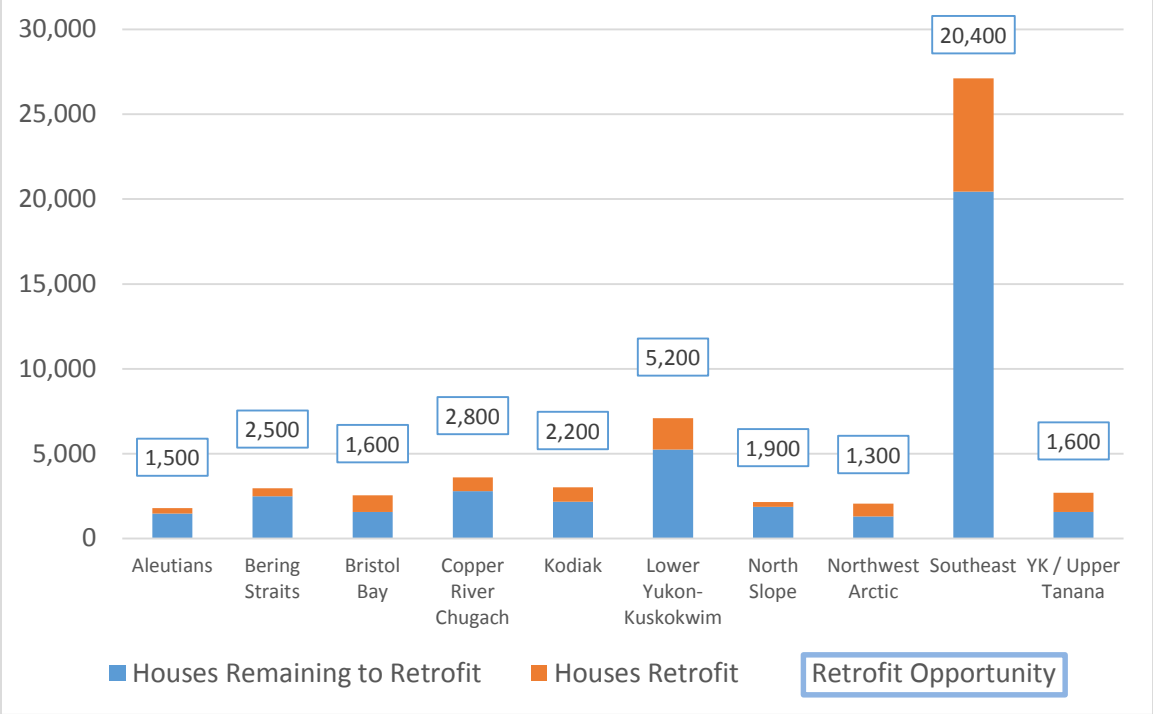

Figure 18. Remaining residential efficiency opportunity in the AkAES area.

Although representing a smaller share of the total remaining potential, other regions—Bristol Bay, Northwest Arctic, and Yukon-Koyukuk / Upper Tanana—have approximately 40 percent of their households remaining to be weatherized.

Table 13 offers the forecasted costs and benefits in residential buildings over a 15-year period for the AkAES regions. The costs and savings for individual communities are based on reported data of homes that have historically participated in AHFC Weatherization and Home Energy Retrofit programs between 2008 and 2014. These residences represent a high potential for energy efficiency savings, on the order of 24 percent average annual savings. Consistent with the distribution of remaining residential units that haven't yet been served, the majority of the potential energy savings are concentrated in Southeast (**Figure 19**). However, the higher cost of fuel oil and electricity in other regions[8] outside the Southeast offer a disproportionately higher share of net benefits (70 percent) from energy efficiency.

Table 13. Potential for residential energy savings and benefits, by Alaska region

Region	NPV benefit	NPV cost	NPV net benefit	Bene-fit – cost ratio	Heating oil price (per gallon)	Electricity rate (non-PCE)
Aleutians	$21,879,130	$19,001,089	$2,878,041	1.38 : 1	$4.81	$0.63
Bering Straits	$56,167,870	$41,110,927	$15,056,945	1.81 : 1	$6.06	$0.58
Bristol Bay	$25,085,433	$16,250,931	$8,834,502	1.55 : 1	$6.20	$0.71
Copper River / Chugach	$69,820,875	$29,293,108	$40,527,766	2.61 : 1	$4.91	$0.71
Kodiak	$38,141,675	$24,343,109	$13,798,566	1.40 : 1	$5.15	$0.54
Lower Yukon-Kuskokwim	$104,897,233	$71,516,480	$33,380,756	1.72 : 1	$6.42	$0.72
North Slope	$31,630,796	$22,338,423	$9,292,373	1.42 : 1	$0.22	$0.14
Northwest Arctic	$36,072,225	$21,032,632	$15,039,592	2.20 : 1	$7.74	$0.68
Southeast	$254,357,484	$184,109,119	$70,248,365	1.32 : 1	$4.20	$0.50
Yukon-Koyukuk / Upper Tanana	$42,749,206	$20,734,520	$22,014,689	1.99 : 1	$5.76	$0.73
AkAES	**$680,801,927**	**$449,730,338**	**$231,071,595**	**1.74 : 1**	**$5.15**	**$0.59**

The AkAES region is estimated to have total annual expenditures of $272 million for heating fuels, and $125 million in electricity in residential households. Although other fuel (for example, wood and kerosene) costs are not broken out separately in these estimates, they represent 20 percent of the total heating fuels used in the AkAES region and offer targeted opportunities for efficiency for different heating sources. The AkAES area has a forecasted net benefit from energy efficiency savings in the residential sector of $231 million over a 15-year period.

Non-Residential Energy Efficiency Forecasted Opportunity

Non-residential buildings data in the AEA community forecast model represent a combination of sources, including documentation from building benchmarking, regional planning, ARIS, and direct reporting from state agencies.

Non-residential buildings in AkAES communities account for one-fifth—approximately 10,000—of the total residential and non-residential building stock. However, the significantly higher energy intensity of non-residential buildings and larger square footage results in an outsized opportunity for reducing heating fuels and electricity consumption in AkAES communities. Evaluation of energy audits for commercial efficiency projects on public buildings in rural Alaska and of completed projects shows rapid paybacks are possible, averaging five years for investments in energy efficiency (see **Figure 3).**

Additionally, the forecast model data identify a specific opportunity for efficiency in water and wastewater systems in the AkAES regions. The total heat and electricity consumption of approximately $16 million in AkAES communities for water and wastewater services creates an opportunity for targeted efficiency for equipment replacement—and for improved operating efficiency of the existing water and wastewater systems, as shown in **Table 14.**

Table 14. Benefits, costs, and scope of energy savings opportunities for non-residential buildings and water and wastewater facilities in AkAES regions

Region	NPV benefit	NPV cost	NPV net benefit	Bene-fit-cost ratio	Heating oil price (per gallon)	Electricity Rate $ (per kWh)	Number of buildings
Aleutians	$54,050,171	$28,924,901	$25,125,271	1.74 : 1	$4.81	$0.49	541
Bering Straits	$71,570,227	$32,016,624	$39,553,603	2.23 : 1	$6.06	$0.50	587
Bristol Bay	$68,937,126	$26,357,863	$42,579,262	2.67 : 1	$6.20	$0.70	841
Copper River / Chugach	$62,118,444	$23,661,129	$38,457,315	2.58 : 1	$4.86	$0.47	613
Kodiak	$41,741,914	$22,352,444	$19,389,469	1.70 : 1	$5.15	$0.31	540
Lower Yukon-Kuskokwim	$168,977,364	$72,428,319	$96,549,045	2.18 : 1	$6.42	$0.55	1,523
North Slope	$27,586,736	$41,527,644	$13,940,908	0.34 : 1	$0.22	$0.15	670
Northwest Arctic	$99,873,900	$35,070,998	$64,802,902	3.08 : 1	$7.74	$0.59	691
Southeast	$247,647,518	$148,931,655	$98,715,864	1.54 : 1	$4.20	$0.29	2,994
Yukon-Koyukuk / Upper Tanana	$67,131,278	$26,611,524	$40,519,753	2.58 : 1	$5.76	$0.65	896
AkAES Area	**$882,047,943**	**$416,355,457**	**$465,692,486**	**2.26 : 1**	**$5.14**	**$0.47**	**9,896**

The AkAES non-residential building stock is estimated to have total annual expenditures of $265 million for heating and $181 million in electricity, with consumption values of 52 million gallons of fuel oil and 596 million kilowatt-hours. The AkAES area has a forecasted net benefit from all cost-effective energy efficiency savings of $466 million across a 15-year period. These energy savings involve a reduction of more than 13 million gallons of fuel oil and 155 million kWh annually. Total residential costs and benefits are shown in **Table 15.**

The resulting average cost of fuel and electricity saved in the energy efficiency forecast model is equivalent to $2.75 per gallon of fuel oil for residential weatherization and $2.35 per gallon of fuel oil and $0.14 per kWh for non-residential efficiency improvements. The levelized cost of efficiency is significantly lower than the average cost of heating ($4.52 per gallon fuel oil) and electricity ($0.27 per kWh).

Table 15. Total residential and nonresidential benefits, costs, and scope of energy savings opportunities in AkAES regions

Benefit or cost	Units	Non-residential	Residential	Total
NPV benefit	2017 $	$882,047,943	$680,801,927	$1,562,849,870
NPV cost	2017 $	$416,355,457	$449,730,338	$866,085,795
NPV net benefit	2017 $	$465,692,486	$231,071,595	$696,764,081
Benefit – cost ratio		2.12 : 1	1.51 : 1	1.80 : 1
Heating oil saved	Gallons / year	12,060,240	14,021,062	26,081,301
Electricity saved	kWh / year	144,523,827		144,523,827
Heating fuels saved	Mmbtu / year	1,670,343	1,941,917	3,612,260
Electricity saved	Mmbtu / year	493,115		493,115
Heating fuels saved	$ / year	$59,943,689	$58,289,646	$118,233,335
Electricity saved	$ / year	$42,485,618		$42,485,618
Measure lifetime	Years	9	12	10
Cost of fuel saved	$ / gallon	$2.35	$2.75	$2.51
Cost of electricity saved	$ / gallon	$0.14		$0.14

In addition, the study team has evaluated the effect of workforce development and economic development as further benefits of energy efficiency implementation. The Institute of Social and Economic Research has estimated that 7 direct retrofit jobs and 5 indirect jobs are created for every $1 million of public spending, and that 11 jobs are generated by every $1 million dollars of annual fuel savings. Based on the June 2015 estimate of public spending, the study team estimates 2,381 direct jobs have been created. Using 2012 savings, at least 250 induced jobs are estimated to have been created because of increases in available income from reduced energy costs.

Notes

[1] The Efficacy Assessment Spreadsheets are contained in **Appendix C**.

[2] The performance standard of 89 points was determined by modeling the 2012 BEES prescriptive requirements for each of the climate zones found in Alaska.

[3] See following table and notes that address the factors accounting for the fact that there are more BEES records than estimated homes built – resulting in BEES-certified percentages exceeding 100%.

[4] Several factors could account for the fact that there are more BEES records than estimated homes built. The Alaska Department of Labor annually surveys all communities, including those outside areas with property assessment records. This survey might miss homes being built outside well-established communities. Further, although there are automated and human checks built into the accounting system for BEES records, there is still the possibility that some records were counted more than once.

[5] https://www.ahfc.us/files/7714/2793/1526/constcosts_2015final.pdf

[6] Neil McMahon noted that industrial energy is primarily based on the North Slope and that transport energy is heavily impacted by international air travel.

[7] Davies, John, and Kathryn Dodge. *Energy Efficiency Policy Recommendations for Alaska.* Fairbanks: CCHRC for AEA. 2012. http://www.akenergyauthority.org/Content/Efficiency/Efficiency/Documents/EfficiencyPolicyRecommendations2012.pdf.

[8] Subsidized fuel oil costs and electricity in the North Slope region dramatically reduce the participant benefits and net benefits for energy efficiency. However, societal benefits – recognizing the fuel subsidies as a transfer payment – would more closely reflect those of other regions in rural Alaska.

5. Policy and Strategy Recommendations

This section contains recommendations on realistic and achievable policy and strategies that will help Alaska capture cost-effective energy efficiency savings in rural communities. The outcomes will be improved energy affordability, and more resilient and healthy local rural economies. Investments in cost-effective energy efficiency will save money for households, public facilities, and private commercial facilities, and that the retained dollars will provide benefits to the local communities.

The recommendations consider the difficult situation that Alaska's Legislature and public officials face in addressing the reductions in State funds due to declining oil revenues. In the face of this challenge, the benefits of prudent investments in energy efficiency, and in continued state services to serve the priority needs of rural Alaskan communities should not be overlooked. Alaska's leaders have the possibility of turning the current situation into one where the long-term economic performance of the State's energy economy will be improved by strategically directed investments and initiatives. With ongoing oversight, clear policy directions, and coordination among the many actors and organizations, there is real potential to benefit all.

A portfolio of policy, supporting regulations, investment, and implementation services is the best approach to unlocking the economic potential of efficiency for Alaska. This is consistent with experience in other jurisdictions. The sustained capture and promotion of energy efficiency is not the result of a single approach or single policy. It is also not the result of a static approach, but requires consistent evaluation and re-evaluation on progress and gaps that might arise among priority objectives, milestones, and implementation. The activities occur across a broad range of market actors and in various segments of the economy. No single agency or entity will deliver the goods.

The policy and strategy recommendations presented in this section provide a foundation upon which the state can build, taking advantage of past activity, and also setting the stage for deeper and more consistent future energy efficiency savings. The recommended portfolio, summarized in **Table 16,** offers a mix of direct state funding, indirect state funding, and requirements and mandates.

Table 16. Rural Alaska energy affordability energy efficiency portfolio components

Direct state funding	Indirect state funding	Requirements
Sustained **Weatherization** Program support	Continue **with technical services, training, and research**	Establish an energy efficiency resource standard (**EERS**)
Market-based programs and incentives	Join and/or create regional **coalition(s)**	Expand **building codes**, support and enforcement statewide; identify and implement "stretch" code
Upstream product initiatives and incentives		Participate in and adopt **minimum product standards**
Support **energy service contracts** via public and private channels		Create **targets or requirements for investment** of a portion of assistance, endowment or public benefit corporate portfolios to support energy efficiency

The annual funding needs to support these recommendations are estimated to be $61 million as illustrated in **Table 17.**

Table 17. Study area funding recommendations

Direct state funding	Annual study area budget
Weatherization services reaching 80% or more of all eligible rural Alaskan Households within the next 10 years	$36 million
Market-based direct incentives, services, upstream incentives, and support for performance contracting	$17 million
Study area direct funding subtotal	**$53 million**
Indirect state funding	
Research, technical support, and training	$6 million
Regional collaboration (in state) and cooperation with out-of-state regional networks or alliances	$1 million
Study area indirect funding subtotal	**$7 million**
Requirements funding	
EERS, code enhancements, product and procurement standards	**$ 1 million**
Total recommended study area annual funding	**$61 million**

The net benefits of the proposed spending are estimated to be $40 million per year. Three-fourths (75 percent) of State expenditures presented in **Table 17** are direct

measure costs and incentives. The remaining 25 percent are non-measure costs, such as technical assistance and program delivery costs. The State's total expenditures of $61 million leverage additional participant investments of $24 million in installed efficiency measures, resulting in total annual expenditures of $69 million on measure costs and $16 million on non-measure costs, as presented in **Table 18**.

Table 18. Benefit-cost estimates for recommended portfolio

Annual costs	
Program: Measure costs (direct incentives)	$45 million
Program: Non-measure costs (non-incentive costs, market services, support, administration)	$16 million
Participant: Leveraged customer investments in measures	$24 million
Total annual costs	**$85 million**
Annual benefits	
Residential buildings	$54 million
Non-residential buildings	$71 million
Total annual benefits	**$125 million**
Total annual study area energy expenditures	$397 million
Savings as a share of annual energy expenditures	**31%**
Net benefits	
Estimated net benefits (total annual benefits minus annual costs)	**$40 million**

Capturing 30 percent or more savings from energy efficiency is an aggressive, yet attainable, objective. It will require sustained funding, organizational development, training, commitment, and information sharing for consumers. As detailed throughout this report, Alaska has valuable experience and resources to draw upon across all of these segments.

Alaska is facing significant challenges with declining oil revenues and pressure on state budgets. This study identifies an economic investment opportunity for the State to improve energy efficiency in rural Alaska and to create significant net economic benefits. These benefits will help alleviate, rather than exacerbate, the current economic challenges. The Legislature and other policy / decision makers will need to determine the most appropriate means for funding the recommended expenditures. **Table 19** shows how investment of this magnitude might be structured and sustained.

Table 19. Illustrative funding profile

Source	Approximate annual funding
Gross receipts tax / system benefits charge for electric and fossil fuel. Based on 4% of annual expenditures	$16 million
A portion of annual fuel assistance expenditures allocated to support energy efficiency investments	$20 million
Coordinated allocation of U.S. Department of Housing and Urban Development, USDA, BIA, other federal and foundation / private support	$15 million
Long-term (10-year) state appropriation / authorization, allocation from permanent fund, pipeline gas surcharge, etc.	$10 million
Total	**$61 million**

The remainder of this section offers further detail on elements of the recommended portfolio.

Direct State Funding

Weatherization Program Services

These are the most direct and impactful means for improving energy affordability for rural Alaska. There is a history of direct state investment in Weatherization, and we strongly recommend that future strategies include sustained Weatherization Program support, as a cornerstone of the portfolio. Sustained funding will help to build and maintain workforce skills, and will contribute to more healthful and durable buildings. As in the past, Alaska will need to rely primarily on investment of State funds, with federal funds providing supplemental support.

We recommend the Alaska Affordable Energy Strategy contain a target of supporting comprehensive Weatherization services to all eligible households in rural Alaska over the next ten years. This will require providing service to between 4,000 and 5,000 households per year. This is a significant target, and one that will not be easily achieved or maintained; but with consistent funding and policy support it is attainable. Of the strategies recommended in this report, it is perhaps the most central for improving energy affordability for rural Alaska.

Market-Based Statewide Incentive Programs and Services

These services are a second pillar in the portfolio of direct services. Not all rural Alaskan households qualify for Weatherization Program services. In addition, public and private

non-residential facilities represent important opportunities for cost-effective energy efficiency savings in rural communities. Market-based incentive programs are designed and implemented to identify and reduce barriers to improved energy efficiency. At times, direct incentives are the most suitable strategy for catalyzing investments in cost-effective efficiency. In other cases, consumer information, technical advice from a trusted third-party advisor, or a "concierge" type service that helps consumers pull together available incentives will help consumers understand and compare investment opportunities.

Alaska has prior experience with market-based incentive programs and services (the Home Energy Rebate Program and the New Home Rebate Program, for example). Programs that address the opportunity and needs of the non-residential sector can be designed on the template of small commercial direct install, equipment replacement, and retrofit initiatives in other markets. Ideally, to take advantage of scale, and to broaden market awareness and uptake, market-based services for rural Alaska will not be separate from initiatives that support energy efficiency statewide. When necessary, there might be a need for supplemental incentives or services to overcome barriers that are particular to rural Alaska. These can be created, tested, evolved, and retired over time, in response to the particular circumstances regarding barriers to energy efficiency in rural Alaska. We recommend the market-based incentive programs and services for rural Alaska be part of a larger, coordinated statewide effort, and that the savings and program expenditures in rural Alaska be counted toward contributions to broad statewide savings targets and performance metrics.

Upstream Product Initiatives and Incentives

Initiatives and incentives to the efficient-product supply channel complement the direct market services described above. Direct services interact at the retail level with consumers and provide energy efficiency services and products to households and non-residential consumers. But "upstream" initiatives and incentives positively influence the availability, visibility, marketing, and consumer support for high-efficiency products and technologies at the distribution and wholesale levels of the market. This is done by working with contractors, distributors, and manufacturers to offer them direct incentives, for example, to increase the share of efficient products and services above baseline. Upstream initiatives and incentives are suitable for lighting, HVAC, appliances, and electronics.

Similarly to the direct services, to capture scale and administrative efficiency, and to build market acceptance and awareness, upstream initiatives serving rural Alaska should be coordinated and implemented as part of broad statewide or regional efforts. Once again, a particular incentive or support service might need to be tailored or increased to overcome the logistic and supply chain challenges common in rural Alaska.

Support Expanded Use and Models for Energy Services Contracts

The State should also create a formal initiative to encourage public- and private-sector actors who want to offer energy service contract services for rural Alaska. Financing is often a key component of such services. In the best situations, comprehensive energy efficiency retrofits and upgrades provide savings that more than offset the required monthly financing costs, making the project "cash-flow positive" from the start. The work does not stop only with projects that are cash-flow positive, however. There are many instances in which a prudent investment, with manageable financing and cash flow profiles, provides very positive lifetime financial returns.

The initiative's objectives, from the State's perspective, is to help well-qualified private and public firms to deliver appropriate (durable, technically sound) cost effective solutions to residential and non-residential consumers. At times, these providers will rely on incentives or support services to help make a project viable, or to help "sell" a project. The **Energy Efficiency National Strategies and Best Practices** section of this report discusses the particular requirements and applicability of a PPESCO in Alaska. There are many possible pathways for the development of public or private energy service companies in Alaska. Rural Alaska faces logistical challenges and projects that are typically smaller and potentially more risky than those the private sector will take on, and therefore there may be a need for incentives to reduce risk or enhance the returns. Alternatively, the PPESCO model can provide services to improve energy affordability and a lower rate of return or a higher risk threshold. Organizations with strong potential to help initiate, invest in, or operate ESCO services—either as public-purpose or as for-profit entities—are fuel distributors in Alaska, and the native corporations.

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Indirect State Funding

Technical Services, Training, and Research

Alaskans have been addressing the challenges of creating and maintaining durable, efficient, affordable, and environmentally sustainable buildings and facilities for generations. Much knowledge of and experience with practical applications and adaptation of what does and doesn't work are prevalent throughout the state. Reliability,

durability, adaptability, simplicity and proven solutions are highly valued in environments where access and logistics are very expensive and limited for much of the year.

Over the years, Alaskans have developed strong applied research, training, and supporting institutions that serve energy and other sectors such as health care, public safety, water and wastewater, and education. Making the best use of existing applied knowledge and combining this with new technologies, communications, and sensible approaches provide rich opportunities for advancing solutions that benefit rural Alaska. In many cases, there is potential for the export of knowledge, services, and business models. For example, today's evolution of the electric grid and networked distributed energy resources are leading many jurisdictions toward higher interest and investment in micro-grids, storage, combined heat and power, and distributed renewable generation. These are all components of a total energy portfolio for which Alaska is in a good competitive position to create solutions and test new approaches.

Building and maintaining the workforce to provide integrated energy services in rural Alaska require ongoing commitment to research and training. Funding for the technical services, training, and research elements of the portfolio can be leveraged and coordinated with other state funds directed to services in other sectors. In this sense, funding for research and development through academic institutions, with federal funds, and with private support from foundations, and in some cases with private investment, are all possible.

Regional Coalition

Some important elements of market development remain, in which Alaska can benefit from collaboration with other entities. Without specifying any particular partnership or organization, we provide examples of the topic areas in which collaboration is expected to enhance services and lead to the more efficient capture of savings opportunities. If the available opportunities for a partnership or coalition membership do not, upon further investigation, prove to be suitable or viable for Alaska's needs, then we recommend that Alaska strongly consider taking the lead in forming a partnership or coalition that would directly match the needs of northern climates and the need for services in remote communities.

Technical reference manuals, evaluation and monitoring protocols, and coordinated procurement are three areas in which collaboration has helped programs elsewhere attain greater efficiencies over what individual efforts can attain. Technical reference

manuals (TRMs) take into account particular market, environmental, and technical characteristics to document the typical savings for measures. TRMs usually offer data on measure lifetimes, associated non-fuel savings, measure incremental costs, the peak savings for electric measures, estimates for operation and maintenance savings, and information on non-energy benefits. Rather than have each implementing organization research, document, and maintain this valuable information, there is significant benefit in having coordinated TRM development, review, and updates.

Regional partnerships and collaborations also help members coordinate and learn about monitoring and evaluation protocols and research planning. Items such as methods for cost-benefit testing and accounting, and evaluation and cost effectiveness testing methods are examples. Partnerships have also coordinated procurement standards (for example, for state procurement) and activities such as upstream incentive program design and procurement.

Requirements and Codes

Establish a Statewide EERS

Efficiency is a cost-effective resource statewide, not just in rural Alaska. We recommend Alaska establish a formal EERS with savings targets for total energy savings for at least the residential and non-residential building sectors, over the 5- and 10-year horizons. This policy guidance at the statewide level can be a logical extension of or complementary to the Legislature's action from House Bill 306. That resulting law set the target of reducing per-capita energy consumption by 15 percent by 2020. Establishing the policy directive, and a process for tracking and reporting progress statewide, will enable many of the savings and activities that are identified in this report for rural Alaska. The Statewide EERS can establish the overall, sectoral, and geographic distribution of savings targets. Defining the roles and responsibilities of various parties under the EERS will require further planning and negotiations, and multiple parties will need to be engaged. Setting the target levels of savings could be done by the Legislature as a top-down directive, or determined by a regulatory / stakeholder process.

This study is limited to an assessment of the efficiency and financing needs for the rural Alaska study area, and so no specific recommendation on an appropriate level for a statewide EERS is offered. However, we observe that the savings potential for the rural residential and non-residential sectors identified in this report can contribute useful information to an eventual statewide standard and the development of programs and strategies to achieve the statewide savings targets. We recommend consideration of this

information, in support of a standard. It is also critical that a statewide standard give appropriate attention to the costs and benefits and needs for efficiency in rural Alaska, to avoid the potential for designing a standard or initiatives that do not address the needs of rural communities.

Statewide Building Code Adoption, Support, and Enforcement

Codes for residential and non-residential buildings, along with technical support and enforcement, help establish and build consistent statewide practices that can improve building safety, durability, affordability, comfort, and efficiency. The analysis documented in earlier sections of this report indicate that a good share of the new construction and major rehabilitation work in rural Alaska is either already required or is voluntarily meeting advanced code requirements. (See **Building Energy Efficiency Codes and Standards in the Affordable Energy Strategy Study Area.**)

Expanding code coverage to be statewide will encourage contractors and service providers to invest in the necessary design, procurement, workforce training and building practices that are required to meet code. It can also be a platform for consumer education and improve understanding of the minimum levels of building efficiency and performance that can be expected. Therefore, we recommend that the State expand code coverage to be statewide, create an environment in which technical support is provided, and standardize enforcement protocols.

Procurement and Product Minimum Performance Standards

We recommend that the State establish standard purchasing / procurement requirements for energy-efficient equipment and other measures, ensuring that each energy-efficient product installed in Alaska meets or exceeds minimum performance standards established by nationally recognized rating organizations.

Targets for Assistance and Portfolio Investments to Support Energy Efficiency Investment

The State should establish legislative targets and guidelines for ensuring revenues, assistance, and other forms of investment are dedicated to energy efficiency, for the benefit of Alaska residents and businesses, statewide.

Appendix A: Catalog of Alaska Programs

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
Alternative Energy Conservation Loan Fund	Loan program	AK	AK Division of Economic Development, DCCED	Commercial (All)	Furnaces, boilers, caulking / weather-stripping, duct / air sealing, building insulation, windows, doors, custom / others pending approval	$50,000.00. / 20 years. / 5% (eff July 1, 2015)
Association Loan Program	Loan program	AK	Alaska housing finance corporation	Residential (multi-family)	Custom / others pending approval	15 year term / fixed rates
Building Energy Code	Building energy code	AK	Alaska housing finance corporation	Commercial, construction, installers/contractors, residential (all)	Comprehensive measures / whole building	Not applicable.
Commercial Building Energy Audit Program	Rebate program	AK	Alaska energy authority	Commercial (all)	Energy audits	Not applicable.
Energy Efficiency Improvement Program	Internal loan program	Varies	Alaska Department of Transportation and Public Facilities	Government (State), Commercial (Institutions)	Yes; specific technologies not identified	Not specified.
Energy Efficiency Interest Rate Reduction Program	Loan program	AK	Alaska Housing Finance Corporation	Residential (single family or low-income)	Comprehensive measures/whole building, custom/others pending approval	Rate reduction applies to first $200,000; after this amount, a blended interest rate applies. / rate reductions vary from -0.125% to -0.750%.

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
Energy Efficiency Revolving Loan Fund Program	Loan program	AK	Alaska Housing Finance Corporation	Government (local, state or schools), institutional	Custom / others pending approval, yes; specific technologies not identified	Not specified.
Fannie Mae Green Initiative- Loan Program	Loan program	US	Fannie Mae	Residential (multi-family)	Clothes washers, dishwasher, dehumidifiers, water heaters, lighting, furnaces, boilers, heat pumps, air conditioners, caulking/weather-stripping, duct/air sealing, building insulation, windows, roofs, comprehensive measures/whole building, custom/others pending approval, insulation, tankless water heater	Not specified / not specified / up to 10 basis points lower than standard
Home Energy Rebate Program	Rebate program	AK	Alaska Housing Finance Corporation	Residential (Single Family or Low-Income)	Comprehensive Measures/Whole Building, Custom/Others pending approval	Varies / $10,000 for energy efficiency improvements (plus $500 for energy audit);
Loan Participation Program	Loan program	AK	Alaska Industrial Development and Export Authority	Commercial (all)	Custom/others pending approval	Not specified.
New Home Rebate	Rebate program	AK	Alaska Housing Finance Corporation	Residential (all)	Comprehensive measures/whole building	$7,000 - $10,000
Power Project Loan Fund	Loan program	AK	Alaska Industrial Development and Export Authority	Government (Local), Utilities (Municipal or Cooperative)	Custom/Others pending approval	No maximum / 50 years. / Varies

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
Second Mortgage Program for Energy Conservation	Loan program	AK	Alaska Housing Finance Corporation	Residential (Single Family or Low-Income)	Comprehensive Measures/Whole Building	$30,000 / 15 years. / Varies
Small Building Material Loan	Loan program	AK	Alaska Housing Finance Corporation	Residential (all)	Custom/others pending approval, other ee	$100,000 / 15 years. / 15 year rural loan program plus 0.5%
Sustainable Energy Transmission and Supply Development Fund	Loan program	AK	Alaska Industrial Development and Export Authority	Commercial (all)	Custom/others pending approval	$20 million / varies. / fixed rate
Technical Assistance and Training Grants	Training	AK	Association of Alaska Housing Authorities	Government (local, tribal), residential (all)	None specified.	Not applicable.
USDA - Community Facilities Direct Loan and Grant Program	Grant / loan program	US	U.S. Department of Agriculture	Public Facilities	Yes; specific technologies not identified	Varies. / 40 years. / Fixed rate.
USDA - Energy Efficiency and Conservation Loan Fund	Loan program	US	U.S. Department of Agriculture	Utilities	Yes; specific technologies not identified	Varies. / 15 years. / Varies.
USDA - High Energy Cost Grant Program	Grant program	US	U.S. Department of Agriculture, Rural Utilities Service	Government (local, state, tribal, schools) Commercial (nonprofit, institutional) Industrial (all), Residential (all)	Yes; specific technologies not identified	$50,000-$3,000,000 / $3 million

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
USDA - Rural Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance (EA/REDA) Program	Grant program	US	U.S. Department of Agriculture	Government (local, state, or federal), Schools Commercial (institutional) Industrial (agricultural)	None specified	Not specified
USDA - Rural Energy for America Program (REAP) Grants	Grant program	US	U.S. Department of Agriculture	Commercial (all) Industrial (agricultural)	Yes; specific technologies not identified	Renewable grants: $2,500-$500,000 Efficiency grants: $1,500-$250,000 Loan and grant combination: grant portion must exceed $1,500 / 25% of project cost
USDA - Rural Energy for America Program (REAP) Loan Guarantees	Loan program	US	U.S. Department of Agriculture	Commercial (all) industrial (agricultural)	Yes; specific technologies not identified	$25 million per loan guarantee / loans guaranteed 60%-85% depending on loan amount
USDHSS - Low Income Home Energy Assistance Program (LIHEAP)	Grant program	US	U.S. Dept. of Health and Human Services	Government (tribal), Residential (low-income)		Varies
USDOE - Energy Goals and Standards for Federal Government	Energy standards for public buildings	US	U.S. Department of Energy	Government (federal)	Comprehensive measures/whole building, yes; specific technologies not identified	Not applicable

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
USDOE - Federal Appliance Standards	Appliance / equipment efficiency standards	US	U.S. Department of Energy	Industrial (all)	Clothes washers, dishwasher, refrigerators/freezers, dehumidifiers, ceiling fan, water heaters, lighting, furnaces, boilers, heat pumps, air conditioners, motors, other energy efficiency	Not specified
USDOE - Loan Guarantee Program	Loan program	US	U.S. Department of Energy	Government (local, state or schools) Commercial (nonprofit, institutional), industrial (agricultural)	Yes; specific technologies not identified	Not specified / 30 years or 90% of the projected useful life
USDOE - Strategic Technical Assistance Response Team	Training	US	U.S. Department of Energy	Government (tribal)	Yes; specific technologies not identified	Varies by solicitation
USDOE - Tribal Energy Program Grant	Grant program	US	U.S. Department of Energy	Government (tribal)	Refrigerators / freezers, water heaters, lighting, lighting controls/sensors, chillers, furnaces, boilers, air conditioners, programmable thermostats, energy management systems / building controls, caulking/weather-stripping, duct/air sealing, building insulation, windows, siding, roofs, comprehensive measures/whole building, other energy efficiency	Varies by solicitation

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
USDVA - Energy-Efficient Mortgages	Loan program	US	U.S. Department of Veterans Affairs	Residential (all)	Yes; specific technologies not identified	$8,000, maximum loan limits can be exceeded by the energy improvements being financed
USHUD - FHA PowerSaver Loan Program	Loan program	US	U.S. Department of Housing and Urban Development	Residential (single family or low-income)	Water heaters, furnaces, air conditioners, programmable thermostats, energy management systems / building controls, caulking / weather-stripping, building insulation, windows, doors, comprehensive measures / whole building	Powersaver Home Energy Upgrade: $7,500 Powersaver Second Mortgage: $25,000 Powersaver Energy Rehab (203(k)): $217,500 to $625,000 / Maximum of 20 years / 4.99% to 9.99%
USHUD - Supplemental Housing Development Grant Program	Grant program	AK / US	Alaska Housing Finance Corporation	Residential (all)	Varies; specific technologies not identified	Not specified

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
USIRS - Energy-Efficient Commercial Buildings Tax Deduction	Corporate tax deduction	US	U.S. Internal Revenue Service	Government (State or Federal), Commercial (Construction)	Equipment insulation, water heaters, lighting, lighting controls / sensors, chillers, furnaces, boilers, heat pumps, air conditioners, caulking / weather-stripping, duct / air sealing, building insulation, windows, siding, roofs, comprehensive measures / whole building, other energy efficiency, tankless water heater	$0.30-$1.80 per square foot
USIRS - Energy-Efficient New Homes Tax Credit for Home Builders	Corporate Tax Credit	US	U.S. Internal Revenue Service	Commercial (construction)	Comprehensive measures/whole building	$1,000 - $2,000 / $2,000
USIRS - Qualified Energy Conservation Bonds (QECBs)	Loan Program	US	U.S. Internal Revenue Service	Government (local, state, or tribal)	Yes; specific technologies not identified	Not specified.
USIRS - Residential Energy Conservation Subsidy Exclusion (Corporate)	Corporate Tax Exemption	US	U.S. Internal Revenue Service	Residential (single family or multifamily)	Yes; specific technologies not identified	100% of subsidy
USIRS - Residential Energy Conservation Subsidy Exclusion (Personal)	Personal Tax Exemption	US	U.S. Internal Revenue Service	Residential (single family or multifamily)	Yes; specific technologies not identified	100% of subsidy

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
USIRS - Residential Energy Efficiency Tax Credit	Personal Tax Credit	US	U.S. Internal Revenue Service	Residential (all)	Water heaters, furnaces, boilers, heat pumps, air conditioners, building insulation, windows, roofs	Varies / for purchases made in 2011 - 2016: aggregate amount of credit is limited to $500. Taxpayer is ineligible for this tax credit if this credit has already been claimed by the taxpayer in an amount of $500 in any previous year. For purchases made in 2009 or 2010: aggregate amount of credit for all technologies placed in service in 2009 and 2010 combined is limited to $1,500
Village Energy Efficiency Program	Grant Program	AK	Alaska Energy Authority	Government (local, state, tribal, or schools)	Electrical efficiency measures	Not applicable.

Name	Incentive type	Funding source	Administrator	Sector	Eligible efficiency technologies	Incentive / maximum
Weatherization Assistance Program (WAP)	Grant Program	US	Alaska Housing Finance Corporation	Government (tribal) Residential (low-income)	Furnaces, heat pumps, air conditioners, caulking / weather-stripping, duct / air sealing, building insulation, doors, other energy efficiency, insulation	Free; specific improvements will be determined case by case, depending on the specific needs of the home / the adjusted average expenditure limit for program year 2015 is $7,105

Appendix B: Bibliography

Agne, Juliet. *ENERGY STAR Rebate Program, Final Report.* Sitka: City and Borough of Sitka Electric Department, 2013. http://www.cityofsitka.com/government/departments/electric/documents/EnergyStarRebateProgramFinalReportwithAppendices.pdf.

Alaska Building Science Network. *Village Energy Efficiency Program, '10-'12.* Executive Summary. Juneau: ASBN, 2013. http://www.akenergyauthority.org/Content/Efficiency/EEC/Documents/ABSN%20VEEP%20Executive%20Summary_Final.pdf.

Alaska Department of Commerce, Community & Economic Development. *Alternative Energy Conservation Loan Fund* (Loan Programs). Juneau: State of Alaska, 2016. https://www.commerce.alaska.gov/web/ded/FIN/LoanPrograms/AlternativeEnergyLoanProgram.aspx.

Alaska Department of Transportation & Public Facilities and the Department of Administration. *Alaska Sustainable Energy Act Annual Report: 2014 Progress Report*. Juneau: State of Alaska, 2015.

Alaska Energy Authority. *Alaska Energy Pathway: Toward Energy Independence.* Anchorage: AEA, 2010. ftp://ftp.aidea.org/2010AlaskaEnergyPlan/2010%20Alaska%20Energy%20Plan/Narrative/Narrative%202010%20Energy%20Plan.pdf.

Alaska Energy Authority. *Energy Efficiency in Alaska* (Alaska Energy Efficiency Map). Anchorage: AEA, 2016. http://akenergyefficiencymap.org.

Alaska Energy Authority. *Regional Energy Planning Fact Sheet.* Anchorage: AEA, 2015. http://www.akenergyauthority.org/Policy/RegionalPlanning.

Alaska Energy Authority. *Regional Energy Planning Overview.* Anchorage: AEA, n.d. http://www.akenergyauthority.org/Content/Policy/RegionalPlanning/Documents/AEARegionalPlanning.pdf.

Alaska Housing Finance Corporation. *2014 Alaska Housing Assessment*. Anchorage: AHFC, 2014. https://www.ahfc.us/efficiency/research-information-center/housing-assessment/

Alaska Housing Finance Corporation. *Alaska-Specific Amendments to IECC 2012.* Anchorage: AHFC, 2014.

https://www.ahfc.us/files/5014/0328/1907/final_AK_Spec_Amendments_to_IECC_2012_061814.pdf.

Alaska Housing Finance Corporation. *Energy Efficiency of Public Buildings in Alaska: Metrics and Analysis.* Anchorage: AHFC, 2014. https://www.ahfc.us/efficiency/non-residential-buildings/reports-publications-resources/

Alaska Housing Finance Corporation. *Potential Paybacks from Retrofitting Alaska's Public Buildings,* Appendix A. Anchorage: AHFC, 2014. https://www.ahfc.us/files/7214/1867/0077/Potential_Paybacks_from_Retrofitting_Appendix_A.pdf.

Alaska Housing Finance Corporation. *Supplemental Housing Development Grant Program.* Anchorage: AHFC, 2016. https://www.ahfc.us/pros/grants/development-grants/supplemental-housing-development-grant-program/.

Alaska Housing Finance Corporation. *Weatherization Operations Manual*. Anchorage: AHFC, 2016. https://www.ahfc.us/efficiency/research-information-center/manuals-forms-and-workbooks/weatherization-operations-manual/.

Alaska Housing Finance Corporation. *A White Paper on Energy Use in Alaska's Public Facilities.* Anchorage: AHFC, 2012. https://www.ahfc.us/efficiency/non-residential-buildings/reports-publications-resources/

Alaska Industrial Development and Export Authority (AIDEA). *Sustainable Energy Transmission and Supply Development Fund (SETS).* Anchorage: AIDEA, 2016. http://www.aidea.org/Programs/EnergyDevelopment.aspx.

American Community Survey. *Selected Housing Characteristics (Alaska),* Table DP04. Washington, DC: U.S. Census Bureau, 2013. http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk

American Council for an Energy-Efficient Economy. *Fact Sheet: How Does Energy Efficiency Create Jobs?* Washington, DC: ACEEE, 2011. http://aceee.org/files/pdf/fact-sheet/ee-job-creation.pdf.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). *Procedures for Commercial Building Energy Audits.* Atlanta: ASHRAE, 2016. https://www.ashrae.org/resources--publications/bookstore/procedures-for-commercial-building-energy-audits.

Analysis North. *Home Energy Rating AkWarm Download,* for Alaska Housing Finance Corporation. Fairbanks: CCHRC, 2014. http://www.analysisnorth.com/AkWarm/AkWarm2download.html.

Association of Alaska Housing Authorities. *Training and Technical Assistance.* Anchorage: AAHA, 2016. http://www.aahaak.org/training.php.

Bell, Catherine, Steven Nadel, and Sara Hayes. *On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices.* Report Number E118. Washington, DC: ACEEE, 2011. www.aceee.org/sites/default/files/publications/researchreports/e118.pdf.

Bonneville Power Administration. *2015 Fact Sheet.* Portland, Ore.: BPA, 2016. https://www.bpa.gov/news/pubs/GeneralPublications/gi-BPA-Facts.pdf.

Bonneville Power Administration. *2012 Update to the 2010-2014 Action Plan for Energy Efficiency.* Portland, Ore.: BPA, 2012. https://www.bpa.gov/EE/Policy/EEPlan/Documents/BPA_Action_Plan_FINAL_20120301.pdf.

Borgeson, Merrian, Mark Zimring, Charles Goldman. "The Limits of Financing for Energy Efficiency." *Proceedings of the 2012 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: ACEEE, *2012.* http://aceee.org/files/proceedings/2012/data/papers/0193-000155.pdf.

Building Codes Assistance Project. *Alaska Gap Analysis.* Anchorage: AHFC, 2012. http://energycodesocean.org/sites/default/files/resources/Alaska_Gap_Analysis_FINAL_November_2012.pdf

Chiodo, Jennifer, Cliff McDonald, Adam Jennings, Amit Kulkami, Doug Baston, Matt Zenni, and Nicole Price Voudren. *Retro-commissioning Best Practice Study*. For the Massachusetts Energy Efficiency Advisory Council. Boston: Massachusetts Department of Energy Resources, 2014. http://ma-eeac.org/wordpress/wp-content/uploads/EEAC_CT_RetroCommissioningBestPracticesStudy.pdf.

Cold Climate Housing Research Center. *GVEA Energy$ense: Program Review and Recommendations.* Fairbanks: CCHRC, 2014. http://www.gvea.com/images/bod/agendas/January_27_2014_Board_Mtg_Member_Book.pdf (Attachment 2).

Colt, Steve, Ginny Fay, Matt Berman, and Sohrab Pathan. *Energy Policy Recommendations: Draft Final Report to the Alaska Legislative Affairs Agency and the State Senate Energy Working Group.* Anchorage: Institute of Social and Economic Research, University of Alaska Anchorage, 2013. http://www.iser.uaa.alaska.edu/Publications/2013_01_25-EnergyPolicyRecommendations.pdf

Compliance Planning Assistance Program. *Alaska Strategic Compliance Plan*: *Improving Energy Code Compliance in Alaska's Buildings.* Washington, DC: BCAP, 2012. In partnership with AHFC and CCHRC. http://bcap-energy.org/wp-content/uploads/2016/01/Alaska-Strategic-Compliance-Plan.pdf.

Consortium for Energy Efficiency. *2014 State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts.* Boston: CEE, 2015. https://library.cee1.org/sites/default/files/library/12193/CEE_2014_Annual_Industry_Report.pdf.

Corbin, Randy, and David Cawley. "Moving Beyond a Concept to Energize the Future." NASEO (Midwest) Regional Meeting presentation. Arlington, Va.: NASEO, 2015. http://www.naseo.org/Data/Sites/1/events/regional/midwest/2015/Corbin-Efficiency-Smart.pdf.

Craft3. *Home Energy Loans in Oregon.* Ilwaco, Wash.: Craft3, 2016. http://www.craft3.org/Borrow/energyore.

Davies, John, and Kathryn Dodge. *Energy Efficiency Policy Recommendations for Alaska.* For the Alaska Energy Authority. Fairbanks: CCHRC, 2012. http://www.akenergyauthority.org/Content/Efficiency/Efficiency/Documents/EfficiencyPolicyRecommendations2012.pdf.

Davies, John, and Kathryn Dodge. *Statewide Codes White Paper.* Fairbanks: CCHRC, 2012. https://www.ahfc.us/files/7614/5333/9720/Claiborne_Porter_-_Statewide_Codes_White_Paper.pdf.

Dixon, Gavin, Dan Reitz, Carl Remley, and Mike. Black. *Energy Use and Solutions in Rural Alaskan Sanitation Systems.* Anchorage: Alaska Native Tribal Health Consortium, 2013.

Dodge, Kathryn, Nathan Wiltse, and Virginia Valentine. *Home Energy Rebate Program Outcomes.* Report prepared for AHFC. Fairbanks: CCHRC, 2012. http://www.cchrc.org/sites/default/files/docs/HERP_final.pdf

Dodge, Kathryn, Y. Hossain, and Nathan Wiltse. *A Report on the Effectiveness of Alaska Craftsman Home Program Consumer Education Classes and Recommendations for Improvements.* Fairbanks: CCHRC, 2013.

Efficiency Maine. *Financing Solutions.* Augusta, Maine: Efficiency Maine, 2016. http://www.efficiencymaine.com/at-home/energy-loans/

Efficiency Vermont. *Financing for Homeowners.* Burlington, Vt.: VEIC, 2016. https://www.efficiencyvermont.com/services/financing/homes

Federal Housing Finance Agency. *Statement of the Federal Housing Finance Agency on Certain Super-Priority Liens.* Washington, DC: FHFA, 2014. http://www.fhfa.gov/Media/PublicAffairs/Pages/Statement-of-the-Federal-Housing-Finance-Agency-on-Certain-Super-Priority-Liens.aspx.

Fuller, Merrian. *Enabling Investments in Energy Efficiency: A Study of Programs that Eliminate First-Cost Barriers for the Residential Sector.* Burlington, Vt.: Vermont Energy Investment Corporation, 2008. https://www.veic.org/documents/default-source/resources/reports/energy_efficiency_financing_report-merrian_fuller_2008.pdf

Garber-Slaght, Robbin. *Monitoring and Verification of Sustainable Northern Shelter Building Performance Quinhagak Prototype House Final Report.* Prepared for the National

Renewable Energy Laboratory. Fairbanks: Cold Climate Housing Research Center, December 2011. http://www.cchrc.org/sites/default/files/docs/NREL_DEC2011_Quinhagak.pdf.

Gilleo, Annie, Seth Nowak, Meegan Kelly, Shruti Vaidyanathan, Mary Shoemaker, Anna Chittum, and Tyler Bailey. *The 2015 State Energy Efficiency Scorecard.* Washington, DC: ACEEE, 2015. http://aceee.org/sites/default/files/publications/researchreports/u1509.pdf.

Golden Valley Electric Association (GVEA). *Rates.* Fairbanks: GVEA, 2016. http://www.gvea.com/rates/rates.

Habitat for Humanity. *Shelter Report 2015: Less Is More: Transforming Low-Income Communities through Energy Efficiency.* Atlanta: Habitat for Humanity, 2015. http://www.habitat.org/sites/default/files/2015-habitat-for-humanity-shelter-report.pdf.

Hayes, Sara, Steven Nadel, Chris Granda, and Kathryn Hottel. *What Have We Learned from Energy Efficiency Financing Programs?* Research Report U115. Washington, DC: American Council for an Energy-Efficient Economy, 2011. http://aceee.org/research-report/u115.

Hoffman, Ian, Gregory Rybka, Greg Leventis, Charles Goldman, Lisa Schwartz, Megan Billingsley, and Steven Schiller. *The Total Cost of Saving Electricity through Utility Customer-Funded Energy Efficiency Programs: Estimates at the National, State, Sector and Program Level*. Technical Brief. Berkeley, Calif.: Lawrence Berkeley National Laboratory Electricity Markets & Policy Group, 2015. https://emp.lbl.gov/sites/all/files/total-cost-of-saved-energy.pdf.

Homer Electric Association, Inc. *Line of Credit Program.* Homer: HEA, 2016. http://www.homerelectric.com/line-of-credit-program/.

Howat, John, and Jerrold Oppenheim. "Analysis of Low-Income Benefits in Determining Cost-Effectiveness of Energy Efficiency Programs." Boston: National Consumer Law Center, 1999. www.democracyandregulation.com/attachments/18/c-e_of_dsm_paper_-_final.doc.

Institute for Energy Efficiency. *Implementing Energy Efficiency: Program Delivery Comparison Study*. Washington, DC: IEE, 2010. http://www.edisonfoundation.net/IEE/Documents/IEE_EEProgDeliveryComparison.pdf

Institute for Electric Innovation. *State Electric Efficiency Regulatory Frameworks Report.* Washington, DC: IEI, 2014. http://www.edisonfoundation.net/iei/Documents/IEI_stateEEpolicyupdate_1214.pdf.

Jacobsohn, Ely, Subid Wagley, Eric Werling, and Stephen Bickel. "Is It Time To Move Beyond the Whole House Approach?" *Proceedings of the 2014 ACEEE Summer Study of Energy Efficiency in Buildings.* Washington, DC: ACEEE, 2014. http://aceee.org/files/proceedings/2014/data/papers/2-1260.pdf.

Kohler, Meera, and Ethan Schutt. *Energy for a Sustainable Alaska: A Rural Conundrum.* Anchorage: Commonwealth North, 2012. http://alaskarenewableenergy.org/wp-content/uploads/2012/03/CWN-Report-Energy-for-a-Sustainable-Alaska-The-Rural-Conundrum1.pdf

Kreiger, Rob, Karinne Wiebold, Nicole Dusenberry, and Sara Whitney. *Construction Cost Survey.* For the Alaska Housing Finance Corporation. Anchorage: Alaska Department of Labor and Workforce Development, 2015. https://www.ahfc.us/files/7714/2793/1526/constcosts_2015final.pdf

Lawrence Berkeley National Laboratory. *Buildings Energy Data Book: 3.1 Commercial Sector Energy Consumption;* Commercial Heating and Cooling Loads Component Analysis: Aggregate Commercial Building Component Loads as of 1998 (1). Table 24. Berkeley, Calif.: DOE / LBNL, 2012. http://buildingsdatabook.eren.doe.gov/docs/xls_pdf/3.1.12.pdf.

Lister, Cady, Brian Rogers, and Charles Ermer. *Alaska Energy Efficiency Program and Policy Recommendations.* Fairbanks: Information Insights for AEA and AHFC, 2008. http://www.cchrc.org/sites/default/files/docs/EE_Final.pdf.

McGuire, Lesil, and Bob Herron. *Preliminary Report to the Alaska State Legislature: Executive Summary.* Juneau: Alaska Arctic Policy Commission, 2014. http://www.akarctic.com/wp-content/uploads/2014/02/AAPCPreliminaryReportExecSummaryFinal.pdf

Michigan Saves. *Home Energy Loan Program.* Lansing, Mich.: Michigan Saves, 2016. http://michigansaves.org/program/help.

Northeast Energy Efficiency Partnerships. *Northeast Residential Lighting Strategy: 2014 – 2015 Update.* Lexington, Mass.: NEEP, 2014. https://www.energystar.gov/ia/products/lighting/cfls/downloads/EISA_Backgrounder_FINAL_4-11_EPA.pdf.

Nowak, Seth, Martin Kushler, Patti Witte, and Dan York. *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs.* Washington, DC: ACEEE, 2013. http://aceee.org/research-report/u132.

Pacific Gas & Electric. *Retrocomissioning Program Fact Sheet.* San Francisco: PG&E, 2014. https://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/analyzer/retrocommissioning/fs_retrocommissioning.pdf.

Powers, Danny, Vanessa Stevens, and Dustin Madden. *Fairbanks Nonprofit Retrofit Pilot Project Interim Report: Documentation and Recommendations*. Fairbanks: CCHRC, 2016.

Public Utilities Commission of the State of Colorado. Docket No. 07A-420E, Decision No. C08-0560 (In the matter of the application of Public Service Company of Colorado for authority to implement an enhanced demand side management program and to revise its demand-side management cost adjustment mechanism to include current cost recovery and incentives) *Order Granting Application in Part.* Denver: PUC of the State of Colorado, 2008. http://www.swenergy.org/Data/Sites/1/media/documents/news/news/file/2008-06-Xcel_DSM_Policy.pdf

Quantum Consulting, Inc. *National Energy Efficiency Best Practices Study: Volume NR5—Non-Residential Large Comprehensive Incentive Programs Best Practices Report.* For the

California Best Practices Project Advisory Committee. Berkeley, Calif.: Quantum Consulting, 2004. http://www.eebestpractices.com/pdf/bp_nr5.pdf.

Schweitzer, Martin, and Bruce Tonn. *Nonenergy benefits from the Weatherization Assistance Program: A Summary of Findings from the Recent Literature.* ORNL/CON-484. Oak Ridge, Tenn.: Oak Ridge National Laboratory, 2002. http://weatherization.ornl.gov/pdfs/ORNL_CON-484.pdf.

Sciortino, Michael. *States Stepping Forward: Best Practices for State-Led Energy Efficiency Programs.* Research Report E106. Washington, DC: ACEEE, 2010. http://aceee.org/states-stepping-forward-best-practices-state-led-energy-efficiency-programs.

Sheppy, Michael, Chad Lobato, Shanti Pless, Luigi Gentile Polese, and Paul Torcellini. *Assessing and Reducing Plug and Process Loads in Office Buildings.* Golden, Colo.: NREL, 2013. http://www.nrel.gov/docs/fy13osti/54175.pdf.

Spataro, Katie, Marin Bjork, and Mark Masteller. *Comparative Analysis of Prescriptive, Performance-Based, and Outcome-Based Energy Code Systems.* Seattle: Cascadia Green Building Council, 2011. https://www.ahfc.us/files/9013/5754/5384/cascadia_code_analysis_071911.pdf.

State of Alaska. *Capital Project Summary* to the Office of Management and Budget, Weatherization Program Appropriation, AMD 50683. Juneau: State of Alaska, 2016. https://www.omb.alaska.gov/ombfiles/16_budget/Rev/Enacted/2016proj50683.pdf.

Stratton, Susan, and Jim West. *Northwest Energy Efficiency Alliance Strategic Plan—2015-2019.* Portland, Ore.: NEEA, 2015. http://neea.org/docs/default-source/default-document-library/neea-2015-2019-strategic-plan-board-approved.pdf?sfvrsn=2.

Sustainable Southeast Partnership. *Energy Independence.* 2016. http://sustainablesoutheast.net/energy/.

Tidwell, Matt. "Case for Conservation: Helping Public Power Utilities Make the Business Case for Energy Efficiency." *Proceedings of the 2014 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: ACEEE, 2014. http://aceee.org/files/proceedings/2014/data/papers/5-655.pdf.

U.S. Department of Agriculture. *Community Facilities Direct Loan Grant Program.* Washington, DC: USDA, 2016. http://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program

U.S. Department of Agriculture. *Energy Efficiency and Conservation Loan Program.* Washington, DC: USDA, 2016. http://www.rd.usda.gov/programs-services/energy-efficiency-and-conservation-loan-program.

U.S. Department of Agriculture. *Rural Utilities Service.* Washington, DC: USDA, 2016. http://www.rd.usda.gov/about-rd/agencies/rural-utilities-service.

U.S. Department of Agriculture. *USDA 2015 Progress Report*. Washington, DC: USDA, 2015. http://www.rd.usda.gov/files/USDARDProgressReport2015.pdf.

U.S. Department of Agriculture Rural Development. *2014 Progress Report.* Washington, DC: USDA, 2014. http://www.rd.usda.gov/files/RD2014ProgressReport.pdf.

U.S. Department of Agriculture Rural Utilities Service. *An Outline of the Regulation for the Energy Efficiency and Conservation Loan Program.* Washington, DC: USDA / RUS Electric Program, 2016. http://www.rd.usda.gov/files/UEP_EE_Final_PowerPoint.pdf.

U.S. Department of Energy Better Buildings. *Winter 2016 Progress Update.* Washington, DC: DOE, 2016. http://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Winter_2016_Progress_Report_0.pdf.

U.S. Department of Energy Building Technologies Office. *Home Performance with ENERGY STAR Sponsor Guide and Reference Manual (v1.5).* Washington, DC: DOE / BTO, 2014. https://www.energystar.gov/ia/home_improvement/downloads/HPwES_Sponsor_Guide_v1-5.pdf?e182-bec4.

U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. *Appliance and Equipment Standards Fact Sheet – Updated February 2016.* Washington, DC: DOE / EERE, 2016. http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf.

U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. *Property-Assessed Clean Energy Programs.* Washington, DC: DOE / EERE, 2016. http://energy.gov/eere/slsc/property-assessed-clean-energy-programs.

U.S. Department of Energy Office of Indian Energy. *Strategic Technical Assistance Response Team (START) Program.* Washington, DC: DOE / OIE, 2016. http://www.energy.gov/indianenergy/resources/start-program.

U.S. Energy Information Administration. *Annual Energy Outlook 2014, with Projections to 2040.* Report No. DOE / EIA-0383(2014). Washington, DC: EIA, 2014. http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf.

U.S. Energy Information Administration. *Residential Energy Consumption Survey (RECS).* 2009 data. Washington, DC: EIA, 2016. http://www.eia.gov/consumption/residential/.

U.S. Environmental Protection Agency. *Energy Independence and Security Act of 2007 (EISA) Frequently Asked Questions.* Washington, DC: EPA, 2011. https://www.energystar.gov/ia/products/lighting/cfls/downloads/EISA_Backgrounder_FINAL_4-11_EPA.pdf

U.S. Environmental Protection Agency. *ENERGY STAR® Building Upgrade Manual, 2008 Edition.* Washington, DC: EPA, 2008. https://www.energystar.gov/ia/business/EPA_BUM_Full.pdf.

U.S. Environmental Protection Agency. *ENERGY STAR® Certification for Your Building.* Washington, DC: EPA, 2016. https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification.

U.S. Environmental Protection Agency. *ENERGY STAR® Retail Products Platform.* Washington, DC: EPA, 2015. https://www.energystar.gov/sites/default/files/asset/document/ESRPP_1pager_10-07-15.pdf.

U.S. Environmental Protection Agency. *Environmental Protection and Financial Value.* Washington, DC: EPA, 2016. https://www.energystar.gov/buildings?s=mega.

York, Dan. *Overview: Administrative Structures for Utility Customer Energy Efficiency Programs in the United States."* Washington, DC: ACEEE, 2012. https://www.iea.org/media/workshops/2012/pedee/Dan_York.pdf.

Zimring, Mark. *Energy Efficiency Financing Program Implementation Primer*. Berkeley, Calif.: Lawrence Berkeley National Laboratory, 2014. https://www4.eere.energy.gov/seeaction/system/files/documents/financing_primer_0.pdf

Zimring, Mark, Greg Leventis, Merrian Borgeson, Peter Thompson, Ian Hoffman, and Charles Goldman. *Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators.* Washington, DC: DOE / SEE Action, 2014. https://www4.eere.energy.gov/seeaction/system/files/documents/onbill_financing.pdf

Appendix C: Efficacy Spreadsheet

Residential Program	Budget	Percent of homes served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
	Cumulative since 2008	Cumulative since 2008	Qualitative	Cumulative since 2008	Start	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Technical Assistance and Training Grants	Low	Medium	Medium	Medium	2013	Medium	High	Medium	High	High	High
Association Loan Program	Low	Low	Low	Low		Medium	Medium	Medium	Low	Medium	High
Building Energy Code	Low	High	Medium	Medium	1993	Medium	High	High	High	High	High
Energy Efficiency Interest Rate Reduction Program	Low	Low	Low	Low	1996	Medium	Medium	Medium	Medium	Medium	Low
Home Energy Rebate Program	High	Low	Medium	Medium	2008	Low	High	High	High	Medium	Medium
New Home Rebate Program	Medium	Low	Medium	Medium	2008	Low	High	High	High	Medium	Medium
Second Mortgage for Energy Conservation	Low	Low	Medium	Low		Medium	Medium	Medium	High	Medium	Low
Small Building Material Loan	Low	Low	Low	Low		Medium	Medium	Medium	Medium	Medium	Medium
USHUD - Supplemental Housing Development Grant Program	High	High	High	High	1981	High	High	Medium	High	High	High
Weatherization Program (State + Federal)	High	Medium	High	High	1981	Low	Medium	High	High	High	High
Energy Star Rebate Program	Low	Low	Low	Low	2012-13	Medium	High	Medium	Medium	Medium	Low

Residential Program	Budget	Percent of homes served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
Fannie Mae Green Initiative- Loan Program	Low	Low	Low	Low		Medium	Medium	Medium	Medium	Medium	Medium
USDA - High Energy Cost Grant Program	Low	Low	Low	Low	2015	Medium	Medium	Medium	Medium	Medium	Medium
USDHSS - Low Income Home Energy Assistance Program (LIHEAP)	High	Medium	Low	Low	2010	High	Low	Low	Medium	High	Medium
USDVA - Energy-Efficient Mortgages	Low	Low	Low	Low		High	Medium	Medium	Low	Medium	Low
USHUD - FHA PowerSaver Loan Program	Low	Low	Low	Low	2015	High	Medium	Medium	Low	Medium	Low
USIRS - Residential Energy Conservation Subsidy Exclusion (Corporate)	Low	Low	Low	Low		High	Medium	Low	Low	Medium	Low
USIRS - Residential Energy Conservation Subsidy Exclusion (Personal)	Low	Low	Low	Low	1993	High	Medium	Low	Low	Medium	Low
USIRS - Residential Energy Efficiency Tax Credit	Low	Low	Low	Low	2006	Medium	Medium	Medium	Low	Medium	Low
Power Cost Equalization	High	Medium	Low	Low	1984	Medium	Low	Low	Medium	High	High
Services supporting Residential Sector Efficiency - Education, Outreach, Technical Support, Efficiency Partnership	Low	Medium	Medium	High		High	High	Medium	High	High	High

Residential Program	Budget	Percent of homes served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
Remote Alaskan Communities Energy Efficiency Competition (RACEE)	Low	Low	Medium	Medium		Low	High	Medium	High	High	High
USIRS - Energy-Efficient New Homes Tax Credit for Home Builders	High	Low	Low	Low	2014	High	High	High	Low	High	Low

Non-Residential Program	Budget	Percentage Buildings Served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
	Cumulative since 2008	Cumulative since 2008	Qualitative	Cumulative since 2008	Start	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Commercial Building Energy Audit Program	Medium	Medium	Low	Low	2011	Medium	Medium	Low	Medium	Medium	High
Village Energy Efficiency Program	Medium	Medium	Medium	Medium	2005	Medium	High	High	High	High	High
Energy Efficiency and Revolving Loan Fund	High	Medium	Low	Low	2010	High	Medium	Low	Medium	Medium	High
Building Energy Code	Low	Medium	Medium	Medium	1993	High	High	High	High	High	Medium
Loan Participation Program	High	Low	Low	Low	1980s	High	Low	Medium	Low	Low	Low
Power Project Loan Fund	High	Low	Low	Low	2008	High	Low	Medium	Low	Low	Medium
Sustainable Energy Transmission and Supply Development Fund	High	Low	Low	Low	2012	High	Medium	Medium	Low	Low	Medium
Alternative Energy Conservation Loan Fund	High	Low	Low	Low	2009	High	Medium	Medium	Medium	Medium	High
Energy Efficiency Improvement Program	Medium	Medium	Medium	Medium	2010	High	Medium	High	Medium	Medium	High
Rural Energy Initiative (Water/Wastewater)	High	Medium	Low	Low	2010	Medium	High	Medium	High	High	High
Fairbanks Non-Profit Retrofit Pilot	Low	Medium	Low	Low	2014	Low	Medium	Medium	High	High	Low
USDA - Community Facilities Direct Loan and Grant Program	High	Low	Low	Low	1980s	High	Low	Medium	Low	Medium	High

Non-Residential Program	Budget	Percentage Buildings Served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
	Cumulative since 2008	Cumulative since 2008	Qualitative	Cumulative since 2008	Start	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
USDA - Energy Efficiency and Conservation Loan Fund	High	Low	Low	Low	2013	Medium	Medium	Medium	Low	Medium	High
USDA - Rural Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance (EA/REDA) Program	High	Low	Low	Low	2003	High	Medium	Medium	Low	Medium	High
USDA - Rural Energy for America Program (REAP) Grants & Loan Guarantees	High	Low	Low	Low	2003	High	Medium	Medium	Low	Medium	High
USDA - High Energy Cost Grant Program	High	Low	Low	Low	2015	High	Low	Medium	Low	Medium	High
USDHSS - Low Income Home Energy Assistance Program (LIHEAP) / Multifamily	High	High	Low	Low	2010	High	Low	Low	High	High	High
USDOE - Energy Goals and Standards for Federal Government	Low	High	Medium	Medium	2005	High	High	High	High	High	High
USDOE - Federal Appliance Standards	Low	High	High	High	1975	High	High	High	High	High	High
USDOE - Loan Guarantee Program	High	Low	Low	Low	2005	High	Medium	Medium	Low	Medium	High
USDOE - Strategic Technical Assistance Response Team	Low	Medium	Low	Low	2012	High	High	Low	High	High	High

Non-Residential Program	Budget	Percentage Buildings Served	Job Creation	Energy Savings (Potential)	Years of Activity	Steady Funding	Market Transformation (Potential)	Benefit to Cost Ratio	Process Coordination & Reporting	Non-Energy Benefits	Regional Coverage
	Cumulative since 2008	Cumulative since 2008	Qualitative	Cumulative since 2008	Start	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
USDOE - Tribal Energy Program Grant	Medium	Low	Low	Low	2002	High	Low	Medium	High	High	High
USIRS - Qualified Energy Conservation Bonds (QECBs)	High	Low	Low	Low	2008	High	Medium	Medium	Low	Medium	High
USIRS - Energy-Efficient Commercial Buildings Tax Deduction	High	Low	Low	Low	2006	High	Medium	Medium	Low	Medium	High

Appendix D: Energy and Demographic Forecasts

Village Sector Energy Costs – Forecast Model

	Total heat (Mmbtu)	Total heat (cost 2017 $)	Cost of heat ($ / Mmbtu)	Electricity (Mmbtu)	Electricity	Total electricity (cost 2017 $)	Cost of electricity ($/Mmbtu)	Cost of heating ($/gallon)	Cost of electricity ($/kWh)
Residential	9,049,144	$271,624,068	$30.02	1,806,789	529,539,444	$125,561,322	$69.49	$4.16	$0.24
Non-Residential	7,387,791	$265,126,038	$35.89	2,102,828	616,303,684	$181,174,574	$86.16	$4.97	$0.29
Total	16,436,935	$536,750,106	$32.66	3,909,617	1,145,843,127	$306,735,897	$78.46	$4.52	$0.27

Residential Forecast Model Data

Region	NPV benefit	NPV cost	NPV net benefit	Benefit-cost ratio	Average heating oil price (per gallon)	Occupied houses	Houses to retrofit	Percent region remaining	Percent of total remaining
Aleutians	$21,879,130	$19,001,089	$2,878,041	1.38 : 1	$4.81	1,784	1,462	82%	4%
Bering Straits	$56,167,870	$41,110,927	$15,056,945	1.81 : 1	$6.06	2,950	2,487	84%	6%
Bristol Bay	$25,085,433	$16,250,931	$8,834,502	1.55 : 1	$6.20	2,540	1,572	62%	4%
Copper River / Chugach	$69,820,875	$29,293,108	$40,527,766	2.61 : 1	$4.91	3,593	2,796	78%	7%
Kodiak	$38,141,675	$24,343,109	$13,798,566	1.4 : 1	$5.15	3,012	2,166	72%	5%
Lower Yukon-Kuskokwim	$104,897,233	$71,516,480	$33,380,756	1.72 : 1	$6.42	7,092	5,238	74%	13%
North Slope	$31,630,796	$22,338,423	$9,292,373	1.42 : 1	$0.22	2,155	1,867	87%	5%
Northwest Arctic	$36,072,225	$21,032,632	$15,039,592	2.2 : 1	$7.74	2,046	1,299	63%	3%
Southeast	$254,357,484	$184,109,119	$70,248,365	1.32 : 1	$4.20	27,122	20,444	75%	50%

Region	NPV benefit	NPV cost	NPV net benefit	Benefit-cost ratio	Average heating oil price (per gallon)	Occupied houses	Houses to retrofit	Percent region remaining	Percent of total remaining
Yukon-Koyukuk / Upper Tanana	$42,749,206	$20,734,520	$22,014,689	1.99	$5.76	2,698	1,555	58%	4%
AkAES	**$680,801,927**	**$449,730,338**	**$231,071,595**	**1.74**	**$5.15**	**54,992**	**40,886**	**74%**	**100%**

Appendix E: List of Interviewees

The list of identified interviewees, both in-person and phone, reflect a breadth of stakeholders affiliated with energy efficiency programs in Alaska and provided a diversity of perspectives on the barriers and opportunities for energy efficiency in rural Alaska.

Last name	First name	Title	Organization
Galton	William	Microgrid Project Manager	ABB Inc.
Astorga	Pablo	Global Sales Manager Microgrids	ABB Inc.
Davis	Mark	Chief Infrastructure Development Officer	AIDEA
Keen	James	CDP	AKT, CPAs and Business Consultants
Dushkin	Colleen	Administrator	Alaska Association of Housing Authorities
Roe	George	Research Professor	Alaska Center for Energy and Power
Andersen	Jim	Loan/Collection Manager	Alaska Department of Commerce, Community, and Economic Development
Hodgin	Christopher	Program Manager, Energy Office	Alaska Department of Transportation & Public Facilities
Smith	Rebecca	Lead Project Manager, Energy Office	Alaska Department of Transportation & Public Facilities
Hodgin	Chris	Program Manager	Alaska Department of Transportation and Public Facilities
McMahon	Neil	Program Manager for Energy Planning	Alaska Energy Authority
Conway	Katie	Assistant Program Manager, Energy Efficiency and Conservation Program	Alaska Energy Authority
Lister	Cady	Assistant Program Manager, Energy Efficiency and Conservation Program	Alaska Energy Authority
Garrett	Rebecca	Project Development Specialist, Energy Efficiency and Conservation Program	Alaska Energy Authority
Lockard	David	Solar Program Manager / Bulk Fuel	Alaska Energy Authority
Drolet	Jedediah	Energy Information Analyst, Regional Energy Planning	Alaska Energy Authority
Skaling	Sean	Policy and Programs Director	Alaska Energy Authority
Leach	Timothy	Energy Specialist I	Alaska Housing Finance Corp

Last name	First name	Title	Organization
Waterman	Scott	State Energy Program Manager	Alaska Housing Finance Corp
Ord	Jimmy	Energy Program Information Manager	Alaska Housing Finance Corporation
Burbage	Mimi	Weatherization Program Manager	Alaska Housing Finance Corporation
Waterman	Scott	State Energy Program Manager	Alaska Housing Finance Corporation
Bowers	Kari	Home Energy Rebate Program Manager	Alaska Housing Finance Corporation
Combs	Esther	Supplemental Housing Coordinator	Alaska Housing Finance Corporation
Anderson	John	Director, Research & Rural Development	Alaska Housing Finance Corporation
San Juan	Jeff	Infrastructure Development Finance Officer	Alaska Industrial Development and Export Authority
Dixon	Gavin	Senior Project Manager, Rural Energy Initiative	Alaska Native Tribal Health Consortium
Duame	Dan	Executive Director	Aleutians Housing Authority
Dushkin	Colleen	Administrator	Association of Alaska Housing Authorities
Strait	Dena	Energy Programs Manager	Bettisworth North
Larson	Emil	Deputy Director	Bristol Bay Housing Authority
Tennyson	Kevin	Planner / Weatherization Director	Bristol Bay Housing Authority
Ayers	Kate	Energy Efficiency and Conservation Specialist	Chugach Electric Association
Bolling	Lee	Mechanical Engineer	Coffman Engineers
Hebert	Jack	Chief Executive Officer/Founder	Cold Climate Housing Research Center
Wiltse	Nathan	Policy Program Manager	Cold Climate Housing Research Center
Madden	Dustin	Policy Researcher	Cold Climate Housing Research Center
Kochanowski	Givey	Alaska Program Manager	DOE Office of Indian Energy
Pierce	Lizana	Program Manager	DOE Office of Indian Energy Policy and Programs
Kassel	Karl	Mayor	Fairbanks North Star Borough
Van Cleve	Ramona	Tribal Liaison	FEMA Alaska Area Office
Bradish	Corinne	Director of Member Services	Golden Valley Electric Association
Hackenmueller	Paul	Economic Development Coordinator	Haa Aaní, LLC / Sealaska
Lautaret	Tonya	Member Services Supervisor	Homer Electric Association
George	Jana	Chief Executive Officer	Interior Regional Housing Authority
Mikulski	Pearl	Planner	KAWERAK, Inc.
Banister	Charles	Principal	Kumin Associates
Estey	Julie	Director of Public Relations	Matanuska Electric Association, Inc.
Isaacson	Doug	General Manager	Minto Development Corporation
Garoutte	Ed	Housing Director	Native Village of Kotzebue
Beardsley	Peter	Principal	Nortech

Last name	First name	Title	Organization
Adams	Guy	Executive Director	Northwest Inupiat Housing Authority
Collins	Chris	Deputy Director	Northwest Inupiat Housing Authority
Hanson	Natalie	Program Coordinator	Nuvista Light and Electric Cooperative, Inc.
Ferland	John	VP of Project Development	Ocean Renewable Power Corporation
Fredeen	Craig	Senior Associate, Mechanical Engineer	PDC Inc. Engineers
Rose	Chris	Executive Director/Founder	Renewable Energy Alaska Project
Foster Wilder	Piper	Deputy Director	Renewable Energy Alaska Project
Kilcoyne	Shaina	Energy Efficiency Director	Renewable Energy Alaska Project
Wilson	Adam	Mechanical Project Engineer	RSA Engineering, Inc.
McDonough	Amber	Account Executive	Siemens
Pelunis-Messier	Dave	Rural Energy Coordinator	Tanana Chiefs Conference
Klouda	Nolan	Executive Director	University of Alaska Business Enterprise Institute
Johnson	Renee	Director Business Programs	US Department of Agriculture, Alaska State Office
Jensen	Les	Housing Program Officer	US Department of Interior, Bureau of Indian Affairs
Johnson	Renee	Director of Business Programs	USDA
Qatalina Shaeffer	Jackie	Project Specialist	WHPacific
Zulkosky	Tiffany	Vice President of Communications	Yukon-Kuskokwim Health Corporation (Formerly Nuvista)