Snapshot: The Home Energy Rebate Program

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Alaska's state government has spent an estimated $110 million since 2008 for better insulation, new furnaces, and other retrofits for roughly 16,500 homeowners—10% of all homeowners statewide.[1] That spending was under the Home Energy Rebate Program, which rebates homeowners part of what they spend to make their houses more energy-efficient and less expensive to heat.[2]

The state legislature established the current program in 2008, as energy prices were spiking. The Alaska Housing Finance Corporation (AHFC) administers it, and the Institute of Social and Economic Research and the Cold Climate Housing Research Center did this analysis for AHFC, assessing the broad program effects from April 2008 through September 2011.

Changes in fuel use and heating costs reported here are estimates from AHFC's energy-rating software; figures based on actual household heating bills aren't currently available. The software uses house characteristics and location-specific information on weather and other factors to produce the estimates—but remember they are estimates.[3]

Jobs Generated and Returns on Investment

• ***Total spending for energy-efficiency improvements under the rebate program from 2008 to 2011 was about $185 million, with state rebates covering an estimated $110 million (60%) and homeowners $75 million (40%).*** It's uncertain how much Alaskans would have spent without the program, but it's reasonable to assume many wouldn't have invested as much in energy-efficiency without state aid.

• ***State spending for rebates accounted for an estimated 1,332 jobs*** from April 2008 to September 2011. That total is based on a multiplier that estimates $1 million in new state spending for retrofits generates 12 jobs—7 direct retrofitting jobs and 5 indirect jobs (Figure 1).

• ***Spending by homeowners for retrofits didn't generate additional jobs the way state spending did,*** since homeowners likely cut back on other kinds of spending to pay for the retrofits.

• ***Alaskans are saving an estimated $22 million annually on heating bills due to the rebate program***—an average decline of 26% for homeowners who went through the program.

• ***If homeowners spend the $22 million in savings locally, that spending generates about 240 jobs a year.*** The job figure is based on a multiplier that estimates $1 million of new household spending generates 11 jobs throughout the economy.[4] These are permanent jobs—and there will be more, as more houses are retrofitted.

• ***Savings on heating bills also represent a return on investment***—a tangible measure of how long it takes to recoup that investment. Homeowners in the rebate program can on average recoup their expenses to date in about 3.5 years, and savings would cover combined public and private spending in about 8.5 years (Figure 15).

Savings on Fuel

• ***Annual fuel use has dropped an estimated 33% among homes retrofitted under the rebate program***—for an annual energy savings of 1.6 trillion Btus. That's the energy equivalent of about 275,000 barrels of oil—and roughly 5% of the estimated energy used for all residential space heating statewide in 2008 (Figure 8).

• ***Nearly 70% of the energy saved is natural gas in Southcentral Alaska*** (Figure 7). That reduces demand on the region's gas supply; in recent years analysts have worried about potential shortages.

• ***But part of the drop in energy use may be a reaction to higher energy prices,*** according to a recent analysis by ENSTAR Natural Gas Company, which pipes Cook Inlet gas to Anchorage and other areas of Southcentral Alaska. The company analyzed bills of customers who had gone through the rebate program, and found their gas use dropped in the range of 30%—very similar to estimates from AHFC's energy-rating software. But the analysis also found that use declined an average of 10% among *all* residential customers after prices spiked in 2007 (Figures 11 and 12).

Figure 1. How Many Jobs has the Home Energy Rebate Program Generated?
Estimated 16,500 Houses Completed, April 2008 - September 2011

Jobs from public spending ($110 million) → **1,332 jobs**

Multiplier:
$1 million of public spending for retrofits generate 12 jobs
(7 direct retrofit jobs + 5 indirect jobs)[a]

Jobs from estimated annual savings on heating bills ($22 million) → **242 jobs**

Multiplier:
$1 million household spending generates 11 jobs
(Jobs in sectors throughout economy)[b]

[a] ISER Input-Output model
[b] Assumes households spend additional disposable income locally. Based on ISER estimate of jobs created by Permanent Fund dividend spending.

Background: Higher Fuel Prices

The Home Energy Rebate Program is part of the state's energy plan, which calls for using better technology and conservation to increase Alaska's energy efficiency 15%—per person—by 2020.[5] From 2008 to 2011, the state legislature appropriated close to $200 million for the rebate program.[6]

This publication reports *only* on the rebate program, but there is a second home-retrofit program, the Weatherization Program, which is structured much differently (as we describe briefly on the next page). That program has also received substantial state money in recent years—$264 million in appropriations from 2008 to 2011.[7]

The legislature put this money into the home-retrofit programs as prices for both natural gas and fuel oil were rising fast. Figure 2 shows that the price of natural gas for customers in Anchorage and other areas of Southcentral increased 80% between 2004 and 2007 and another 20% between 2007 and 2009. Since 2009 the price has declined, but it remains nearly double what it was in 2002.

Figure 3 tells an even more dramatic story for prices of fuel oil, using prices in the southwest hub of Bethel as an example. Unlike the price of natural gas—which is piped from Cook Inlet and is the same for all customers of ENSTAR Natural Gas Company—prices of fuel oil vary widely across Alaska. Those prices depend on how difficult it is to deliver fuel to a given community, whether deliveries are year-round or just seasonal, the amount of local storage capacity, and other factors.[8]

The price of a gallon of fuel oil in Bethel jumped more than 40% between 2004 and 2006, and another 50% from 2006 to 2008, before declining somewhat. Still, the price of home-heating fuel in Bethel in mid-2011 was more than twice what it had been in 2002.

So prices of both natural gas and fuel oil increased sharply over the past decade—but as Figure 4 shows, if we consider the cost of equivalent amounts of energy, fuel oil is far more expensive. In 2011, buying 100 gallons of fuel oil in Bethel would have cost about $476—but the same amount of energy in natural gas in Southcentral would have cost about $121.

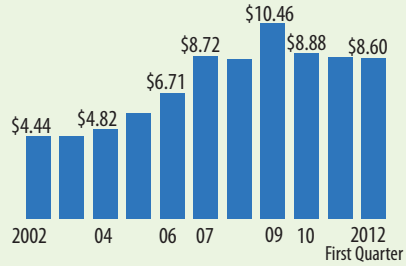
Also, many places that depend on fuel oil stay colder longer, so residents spend even more of the household budget on heating fuel.

Figure 5 shows the two most commonly used sources of home-heating fuel in each region. (Map 1 shows the regions). Only in Anchorage and some other areas of Southcentral do most households have access to gas—but outside Anchorage, a third of Southcentral households rely on fuel oil.

In the remote Western and Southwestern regions, close to 90% of households use fuel oil.

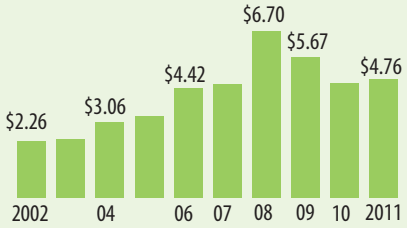
In Fairbanks, the second largest city in Alaska, nearly 80% of households use fuel oil; only a few have access to natural gas trucked from the Southcentral region. In Juneau, the capital city, about 70% of households use fuel oil. Electricity is the second largest source, at 20%.

Figure 2. Price of Natural Gas for Residential Customers in Southcentral Alaska*
(Per Thousand Cubic Feet)



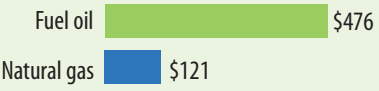
*Includes both payment to gas producers and ENSTAR transportation charge
Source: ENSTAR Natural Gas Company

Figure 3. Price per Gallon of Fuel Oil, Bethel
(As of June of Each Year)



Source: University of Alaska Fairbanks, Cooperative Extension Service

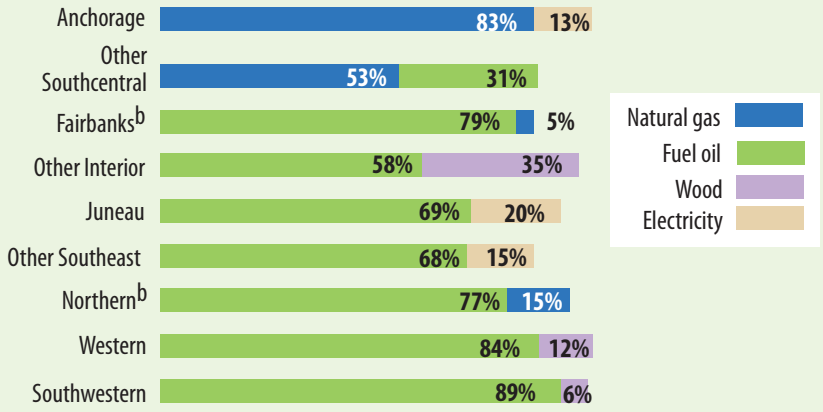
Figure 4. Price of 100 Gallons Fuel Oil in Bethel and Equivalent Energy from Natural Gas, Anchorage, 2011*



*100 gallons fuel oil has 14 MMBtus energy, which equals the energy content of 14 Mcf of natural gas, priced in 2011 at $8.63/Mcf

Sources: ISER calculations, with data from UAF Cooperative Extension Service and ENSTAR Natural Gas

Figure 5. Which Heating Fuels are Most Common Around Alaska?
(Percentages of Households Using Two Most Common Fuel Types in Each Region[a])



[a]Based on samples of the population. Small samples in rural areas make those estimates subject to more error. Figures do not total 100% because less common energy sources are not shown.
[b]Some Fairbanks households use natural gas trucked from Southcentral; the communities of Barrow and Nuiqsut have access to North Slope gas fields.

Source: American Community Survey, 5-Year Estimates, 2006-2010

Structure of Programs

The Home Energy Rebate Program and the Weatherization Program are both intended to make homes more energy-efficient, and in both programs auditors assess energy-efficiency before and after retrofits. But the programs also have significant differences.

• *The rebate program is open only to homeowners, has no income limits, and requires homeowners to spend their own money first.* Homeowners can hire private contractors or do the work themselves, and then apply for state rebates up to a maximum of $10,000, depending on how much they improve the energy-efficiency of their houses.[9]

Since 2008, the average spending per household for retrofits under the rebate program has been $10,963, with rebates covering 60% (Figure 15, page 7). That's based on receipts homeowners submitted to AHFC to qualify for rebates (as well as reimbursements to homeowners for energy audits before and after the retrofits). But some homeowners likely didn't submit receipts for everything they spent, beyond what could qualify for a rebate.

• *The weatherization program is open to both renters and homeowners with incomes at or below the median household income* in their region.[10] In most areas, renters make up 75% or more of households that go through the program, and many live in multifamily units. Households don't pay for the improvements—the federal and state governments share the costs, but since 2008 the state has paid more than 90% of the total.[11]

Unlike the rebate program, which uses private contractors to do the retrofits, the weatherization program is managed by regional non-profit organizations that employ teams of workers to assess the houses and make the improvements.[12]

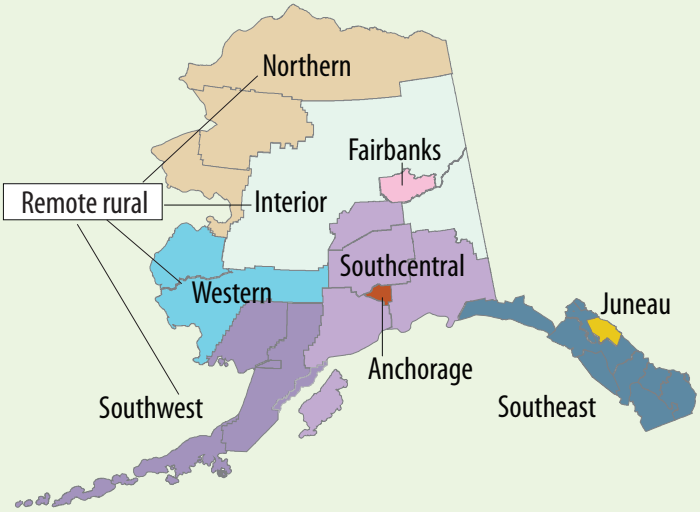
The different regional distribution of houses that have been through the rebate and weatherization programs in recent years largely reflect the differences in the way the two progams work (Figure 6).

Houses in the rebate program have been mostly in Anchorage and other areas of the railbelt, while nearly one-quarter of those in the weatherization program have been in remote rural areas.

Only larger communities can support private contractors who install furnaces, replace windows, and improve insulation in houses. Alaska's population is concentrated in Southcentral, with two-thirds of households in Anchorage and surrounding areas. Another 15% are in or near Fairbanks.

Small communities—especially remote places off the road system—have few private businesses of any type, and private contractors from urban areas are very unlikely to travel to remote places to do energy audits for individual homeowners.

Map 1. Regions in Rebate Program

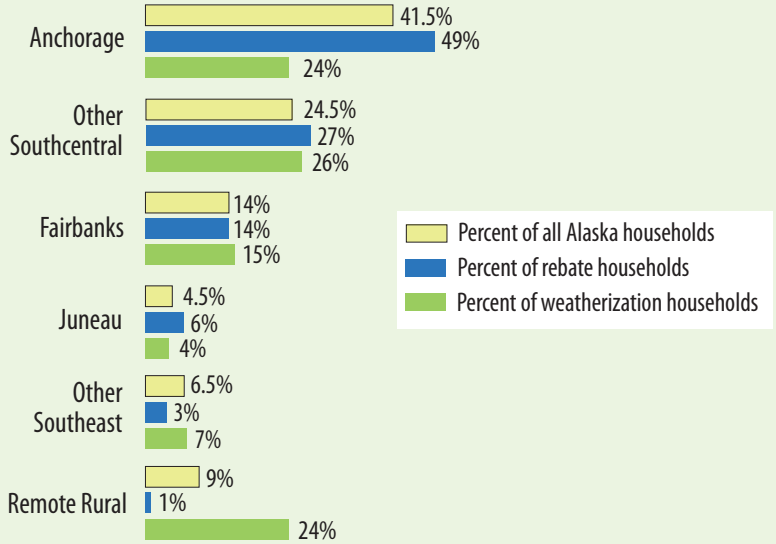


Managers of the weatherization program typically plan to retrofit a number of houses when they go into a rural community—but they have a limited number of people to do the work, which limits the number of communities they can reach in a given period. Getting necessary materials to remote places also takes time and money.

Income also shapes participation in the two programs. Average incomes in the larger urban areas are higher, so a smaller percentage of households qualify for the weatherization program. More can afford to spend money upfront for retrofits, and to cover the out-of-pocket costs after rebates.

By contrast, not many households in small remote places have high enough incomes to pay for retrofits. A big percentage have lower incomes and qualify for the weatherization program.[13]

Figure 6. Regional Breakdown: All Alaska Houses, Houses In Rebate Program, and Houses in Weatherization Program*



*All housing, 2010 U.S. census; homes in rebate program and weatherization program, April 2008-September 2011. Regional percentages in rebate and weatherization programs approximated with data by legislative house district.

Sources: U.S. Census Bureau; CCHRC and ISER calculations, with data from AHFC's Alaska Retrofit Information System and WX Manager

Fuel Savings and Reduced CO2 Emissions

Since 2008, one in ten Alaska homeowners—about 16,500 of the state's roughly 162,800 homeowners—have been through the rebate program, adding more insulation, buying new furnaces, and making other changes that save energy.[14] Fuel use overall among retrofitted houses is down an estimated 33%. Figure 7 shows estimates of savings, by type of fuel. Figure 8 looks at the savings as a share of statewide residential energy use—and also estimates how reduced fuel use is lowering CO2 emissions.

• *About two-thirds of the estimated fuel being saved is natural gas—more than a billion cubic feet annually.* That's not surprising, given that so many of the houses retrofitted in the past few years are in Anchorage and other areas of Southcentral Alaska, where the majority of households use natural gas. To put the savings in context, that's enough gas to meet the needs of about 6,400 homes in Southcentral Alaska for a year at current *average* use—mostly for home-heating but also for water heaters, dryers, or other appliances that run on gas.[15]

• *Houses retrofitted under the rebate program are saving an estimated 2.5 million gallons of fuel oil annually.* To help put that in context, the Russian tanker that made the much-publicized winter delivery of fuel to Nome earlier this year carried 1.3 million gallons of fuel.[16] (Keep in mind, however, that the 2.5 million gallons saved is only for the rebate program, where most of the retrofitted houses use natural gas rather than fuel oil. Houses retrofitted under the Weatherization Program are much more likely to use fuel oil; savings under that program are not included here.)

• *Retrofitted houses using the less common heating fuels are saving an estimated 5,000 cords of wood*, 100,000 gallons of propane, and 6 tons of coal. (Most of the coal produced in Alaska is either exported or used to generate electricity in the Interior; very few households use coal for space heating.)

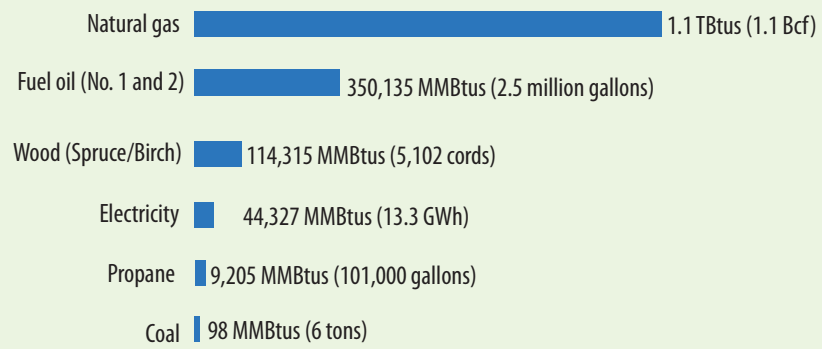
• *Use of electricity in retrofitted houses is down an estimated 13.3 million kilowatt-hours per year.* (For comparison, the total electricity generated in Alaska for all purposes in 2010 was 6.5 *billion* kilowatt-hours.[17]) The majority of the savings are from houses that use electricity as a primary heat source, but some also comes from those that installed new, more efficient furnaces or boilers that turn on less frequently—and therefore need less electricity to fire them. It's also likely many households in the rebate program—regardless of the type of primary heating fuel they use—rely less on auxiliary electric space heaters since they became more energy-efficient.

• *Overall, houses retrofitted under the rebate program are saving an estimated 1.6 trillion Btus of energy annually—or 5% of the estimated 30 trillion Btus* of energy Alaskans used for residential space heating in 2008.[18]

• *A related effect of reduced energy use is an estimated reduction of 92 thousand metric tons (about 204 million pounds) a year in CO2 emissions in Alaska.* In recent years analysts have been assigning a dollar value to the damage carbon emissions cause to human health and to the environment—the "social cost" of such emissions.

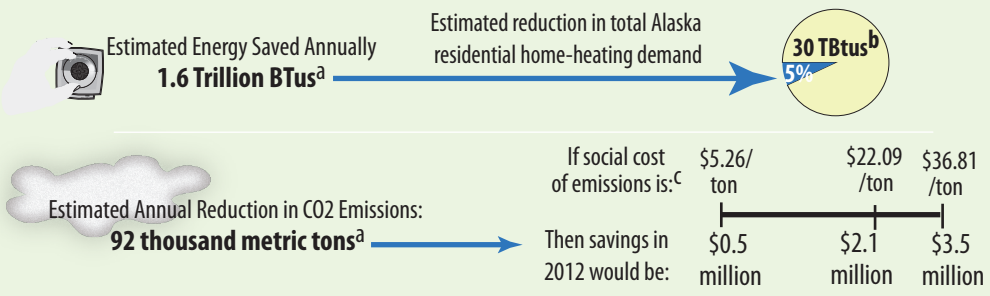
There are wide differences of opinion about how to measure that social cost. But one recent analysis by the National Bureau of Economic Research included a range of estimates of costs per ton of CO2 emissions.[19] Figure 8 shows that based on the mid-range estimate, reducing CO2 emissions by 204 million pounds could avoid about $2.1 million in social costs in 2012. That amount would increase in later years, taking inflation into account.

Figure 7. Estimated Total Fuel Saved Annually, by Type, Houses in Rebate Program
(Estimated 16,500 Houses, April 2008 - September 2011)



Source: CCHRC, with data from AHFC's Alaska Retrofit Information System

Figure 8. Reduced Energy Use and CO2 Emissions Among Houses in Rebate Program
Estimated 16,500 Houses, April 2008 - September 2011



[a]CCHRC estimates, based on data from AHFC's Alaska Retrofit Information System. A Btu (British thermal unit) is a measure of energy content, roughly the amount needed to heat one pound of water one degree Fahrenheit. A trillion Btus is the energy content of about a billion cubic feet of natural gas.
[b]ISER estimate for 2008 home-heating use, adjusted to exclude electricity and non-heating uses of fuel.
[c]Estimates of low, medium, and high social costs of carbon, in 2010 dollars, from National Bureau of Economic Research, *Estimating the Social Cost of Carbon for Use in U.S. Federal Rulemaking: A Summary and Interpretation,* by Michael Greenstone, Elizabeth Kopits, and Ann Wolverton. Working Paper 16913, March 2011.

Savings per Household on Heating Costs

How does reduced energy use translate into savings on heating bills? On page 1 we reported that overall, households that went through the rebate program since 2008 are saving an estimated $22 million a year. Figures 9 and 10 estimate how much the average household is saving on heating bills, and how different kinds of improvements contribute to those savings.

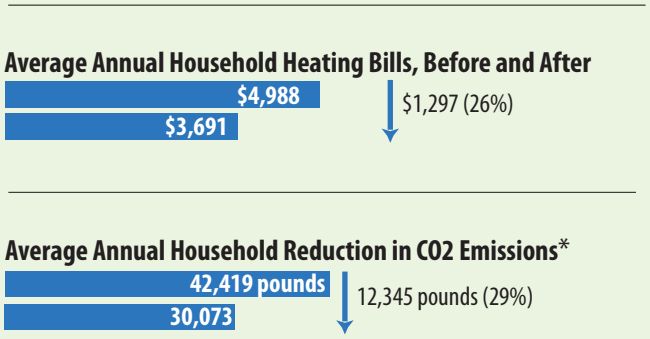
• *Households that went through the rebate program are saving an estimated $1,297 a year on their heating bills.* That's on average a 26% decline, taking savings on various kinds of fuel into account.

• *Estimated reductions in CO2 emissions among houses in the rebate program are about 12,300 pounds a year—an estimated 29% decline.* Keep in mind that the estimated change in CO2 emissions is based on the mix of fuels households use—and various fuels have different levels of emissions.

What kinds of improvements saved households money on heating bills? We don't have information about how much households spent for specific kinds of improvements, but AHFC's database on the rebate program does allow us to estimate how various kinds of improvements contributed to the average household savings on heating bills.

Figure 10 shows that for houses in the rebate program, the biggest money savers were more efficient furnaces or boilers, accounting for half the estimated savings on heating bills. Better insulation—in walls and doors, above the ceiling, and around the foundation or crawl space—contributed about a quarter of the savings, and sealing air leaks around the house accounted for nearly 15% of savings. Replacing windows and water heaters generated about 10% of savings.

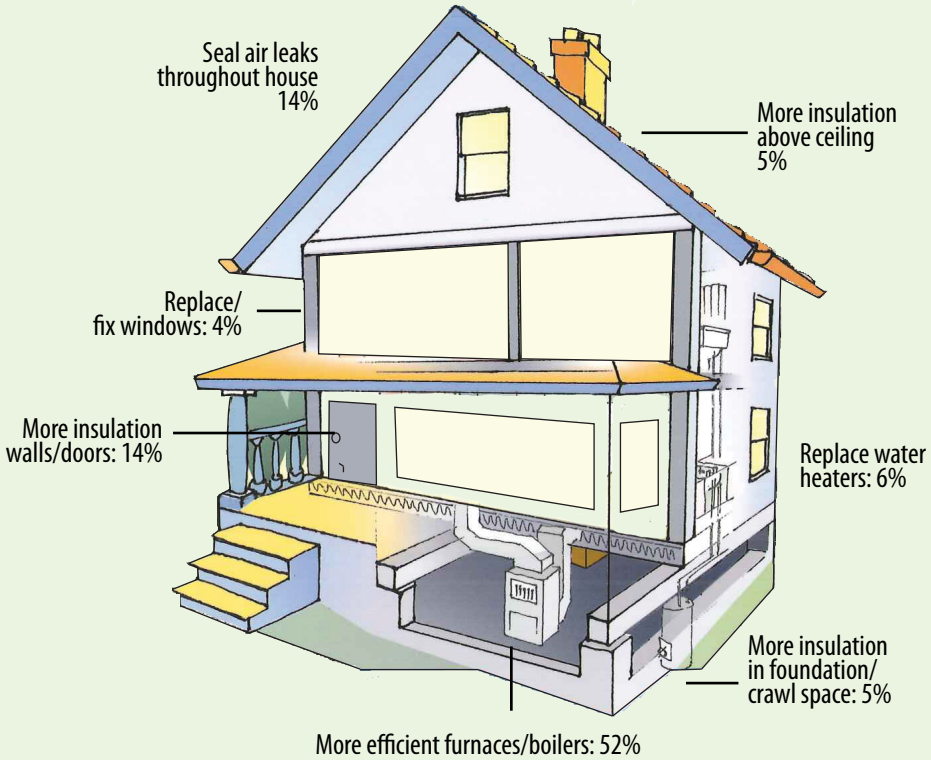
Figure 9. Savings per Household in Energy Rebate Program
(Estimated 16,500 Houses, April 2008 - September 2011)



*The percentage change in CO2 emissions reflects the fact that different types of fuel emit different levels of CO2.

Source: CCHRC, with data from AHFC's Alaska Retrofit Information System

Figure 10. How Did Retrofits Save Households Money ?
(Percentages of Estimated Average Annual Savings, Houses in Rebate Program)



Source: ISER, with data from AHFC's Alaska Retrofiit Information System, houses completed in rebate program 2009 -2010

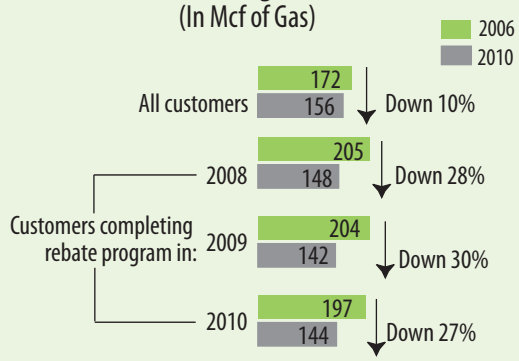
ENSTAR Analysis of Changes in Use of Natural Gas

As we said earlier, there are currently no comprehensive assessments of changes in fuel use that are based on the actual heating bills of households that have been through the rebate program. So far we've reported effects of the program based on estimates generated by AHFC's energy-rating software.

But ENSTAR Natural Gas Company, which pipes gas from Cook Inlet to nearly 20,000 residential customers in Southcentral Alaska, has analyzed how use of natural gas changed from 2006 through mid-2011—among all residential customers and a sample of customers who went through the rebate program from 2008 to early 2010.

ENSTAR made that analysis available to us. Figure 11 summarizes overall changes from 2006 to 2010. Figure 12 is complex, but it presents additional information—the pattern of decline in use among alll customers and those who completed the rebate program in different years. The black line line represents changes in use among all residential customers. The other lines represent changing use among customers who completed the rebate program in 2008, 2009, or 2010.

Figure 11. Annual Use of Natural Gas, All ENSTAR Residential Customers and Customers in Rebate Program, 2006 and 2010*
(In Mcf of Gas)



*All residential customers 118,726. Samples of rebate program participants: 2008, 71; fourth quarter 2009, 372; first quarter 2010, 360.

Source: ENSTAR Natural Gas Company

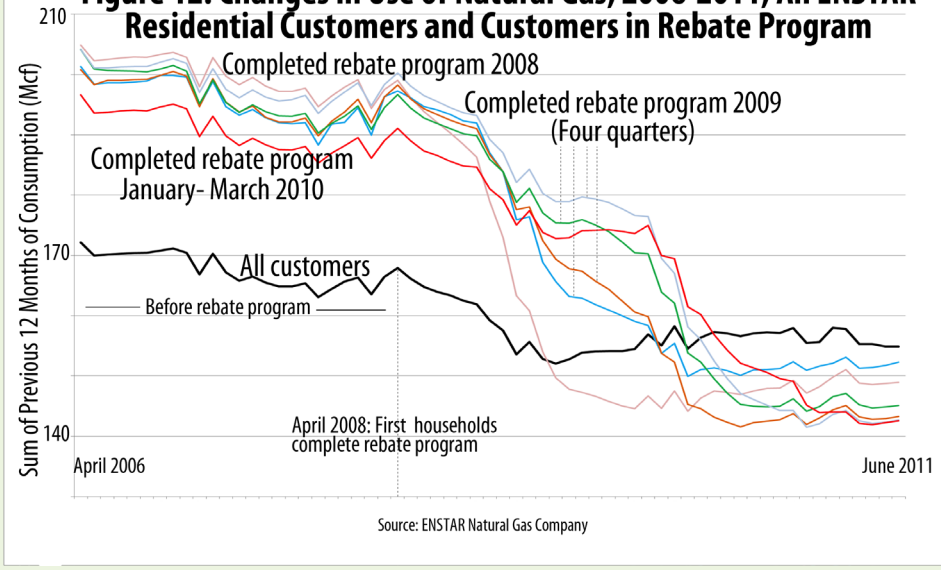
- *Average annual use among customers who went through the rebate program was 25% to 30%* lower after their houses were retrofitted. That drop is in the same range estimated by AHFC's software.
- *Annual use among all ENSTAR's residential customers has dropped 10% since 2006*, and reached its lowest level in 2009, when prices of natural gas peaked (see Figure 2, page 2). So it's possible that the drop in use among those who went through the rebate program can be traced to a combination of efficiency improvements and higher prices.
- *Customers who went through the rebate program started with higher use—on average using 15% to 20% more* gas annually than other customers. But by 2011, their use had dropped to about 8% below that of other customers (Figures 11 and 12).

Age and Size of Houses in Rebate Program

We don't have data specifically on the characteristics of houses of the ENSTAR customers who went through the rebate program, but it's reasonable to think that many knew they had less efficient houses, and the rebate program gave them an incentive to make improvements. Older houses—built before current design standards—are typically less efficient. Figure 13 compares the age of all Alaska houses with those that went through the rebate program. Figure 14 shows average age and size of houses that went through the rebate program, by region.

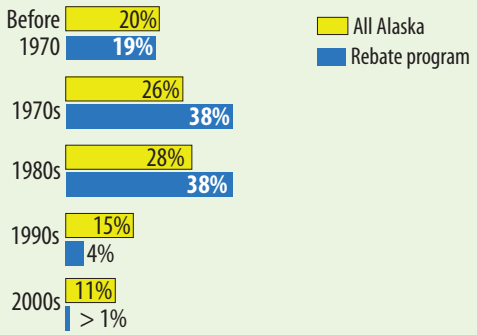
- *Three quarters of the houses retrofitted in recent years had been built in the 1970s and 1980s*, while only about half of all Alaska's housing stock dates from that period. By contrast, only about 5% of the retrofitted houses had been built after 1990, while a quarter of all the state's houses were built in the last 20 years (Figure 13).
- *Houses in Southeast Alaska were the oldest to be retrofitted*—on average 46 years old. The newest were in Southcentral (excluding Anchorage), but they still averaged over 30 years old. (Figure 14).
- *Houses in Juneau and other areas of Southeast were on average also the smallest* to be retrofitted—which isn't surprising, given that older houses tend to be smaller.

Figure 12. Changes in Use of Natural Gas, 2006-2011, All ENSTAR Residential Customers and Customers in Rebate Program



Source: ENSTAR Natural Gas Company

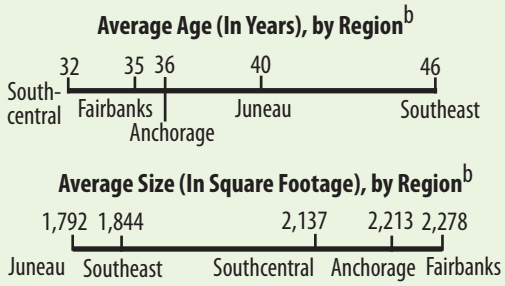
Figure 13. Age of Houses Statewide and In Rebate Program*



*2010 U.S. census; houses completed under rebate program 2009-2010

Sources: U.S. Census Bureau; ISER calculations with data from AHFC's Alaska Retrofit Information System

Figure 14. Average Age and Size of Homes in Rebate Program[a]



[a]Based on 7,075 houses that completed the rebate program in 2009-2010

[b]The number of houses that went through the rebate program in remote rural areas is too small to allow a useful breakdown.

Source: ISER estimates with data from AHFC's Alaska Retrofit Information System

Returns on Public and Private Investment

Public and private spending for home retrofits is an investment, intended to reduce residential energy use and home-heating bills—and in the bigger picture, to advance the state's goal of reducing per capita energy use among Alaskans 15% by 2020.

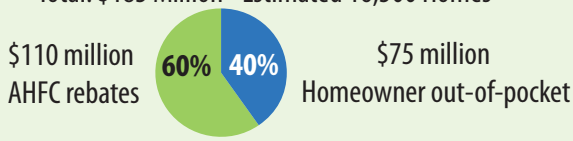
But how can we measure the return on that investment—to households and the state? The answer is: in the savings on heating bills. Those savings indicate how quickly Alaskans and the state government will recoup the money they spent for retrofits—and that's a more tangible measure of returns than exists for many other kinds of public investments.

Figure 15 shows estimated returns on investment for rebate program spending from April 2008 through September 2011.

- *On average, homeowners in the rebate program so far can expect to recoup their out-of-pocket costs in roughly 3.5 years.* That's $75 million in spending not covered by rebates, divided by an estimated savings of $22 million a year in lower heating bills. That estimate assumes fuel prices stay the same—but if they increase, the savings would also increase and shorten the time needed to recoup the spending.
- *Combined state and private spending for the rebate program since 2008 will be returned in homeowner savings in less than 9 years*—$185 million in spending, divided by $22 million annual savings. Those savings benefit Alaska broadly—because they reflect reduced energy use and lower CO2 emissions, and help move the state toward its goal of reducing per capita energy use.

Figure 15. Investment in Energy Rebate Program
April 2008 - September 2011

Total: $185 Million • Estimated 16,500 Homes



Average per Household

How Long Will It Take Homeowners to Recoup Their Expenses?[b]

$75 million (Out-of-pocket expenses) ÷ $22 million (Annual savings) = **3.4 years**

How Long Will It Take to Recoup Combined Public and Private Spending?[b]

$185 million ÷ $22 million (Annual savings) = **8.5 years**

[a]Includes payments for energy audits before and after retrofits and final rebate to homeowner.

[b]Assumes prices at current level.

Sources: CCHRC and ISER, based on AHFC's Alaska Retrofit Information System

Conclusions

From spring 2008 through fall 2011, about 16,500 homeowners completed the rebate program. Another 3,000 homeowners were completing work in late 2011, and as of March 2012 about 1,332 were on a waiting list to have their initial energy audits done.

The Alaska Legislature will decide how much more money to put into the rebate program in the coming years, but this publication has summarized a number of benefits from state spending so far.

We've put estimated values on some of those benefits—reduced heating bills, returns on investment, jobs created—but the increased state money going into home retrofits in the past several years has produced other benefits that we can't quantify.

• *Improving the value and quality of Alaska housing.* Houses in the rebate program are ranked under a five-star system, with five the most energy-efficient. As homeowners make improvements of various kinds, they gain points that move them up in the star rating system—and qualify them for bigger rebates.

Builders and realtors generally believe that the potential savings on heating bills from increased efficiency make these houses more valuable—and more marketable. But efficiency ratings are relatively new, in Alaska and across the country, and as of now there is no standard dollar value attached to different levels of improvement.[20]

• *Giving Alaskans incentive to make their houses more energy-efficient.* We don't have figures specifically for Alaska, but recent estimates put the time homeowners nationwide typically spend in the same houses at 6 to 9 years.[21] If the state hadn't covered a big share of the costs, many homeowners might have decided that the gains from retrofitting weren't worth the costs, if they didn't plan to spend many more years in the same house.

• *Boosting activity in the residential sector at a time of economic slowdown.* The rebate program and the weatherization program both got infusions of state money in 2008, just about the same time the national recession was starting. Alaska didn't see the the housing market crash that was common in other states—but it did see a slowdown in residential construction,[22] and the increased activity in retrofitting likely helped offset that slowdown.

• *Reducing the need to store natural gas in Southcentral, which helps hold down delivery costs.* In the summer ENSTAR pipes gas directly from Cook Inlet wells to consumers, but in the winter it has to ship stored gas to meet peak demand—which adds to costs. By reducing gas use, the rebate program can help reduce the need to store gas.

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Endnotes

1. Based on 2010 U.S. census, Summary File 2, 162,765 owner-occupied units.

2. This summary reports only on the part of the rebate program that helps pay costs of retrofitting existing houses. There is another, smaller part of the program, 5 Star Plus, that pays rebates to Alaskans who build new very energy-efficient homes. From April 2008 to September 2011, an estimated 1,154 new homes built in Alaska qualified as 5 Star Plus; most of those qualified for the $7,500 rebate.

3. The AkWarm program is similar to energy-rating software used nationwide but has been adapted for Alaska; see http://www.ahfc.us/reference/akwarm.cfm. Also, as of March 2012, CCHRC was investigating the feasibility of surveying a sample of homeowners in Anchorage and Fairbanks who had completed the rebate program, to get data about changes in actual heating-fuel bills.

4. This estimate is conservative, based on the estimated effect of the Permanent Fund dividend, as reported in Alaska Citizen's Guide to the Budget: http://citizensguide.uaa.alaska.edu/. Because these are monthly savings (rather than annual payments), households are more likely to spend the extra money. We also recognize that household savings from reduced fuel use are not entirely a bonus to the economy, because when households use less fuel, businesses that sell fuel lose income. But the estimates presented here are rough and intended just to provide a broad picture of economic effects.

5. 26th Alaska Legislature (2009-2010), House Bill 306.

6. Total appropriations, FY 2008-FY 2012. The FY 2013 capital budget approved by the legislature includes an additional $20 million for the rebate program.

7. Total state appropriations FY 2008-FY 2012. The FY 2013 capital budget approved by the legislature includes an additional $31.5 million for the weatherization program.

8. See *Components of Delivered Fuel Prices in Alaska*, by Meghan Wilson, Ben Saylor, Nick Szymoniak, Steve Colt, and Ginny Fay, Institute of Social and Economc Research, University of Alaska Anchorage, June 2008.

9. More detailed information about the home rebate program is available on AHFC's website at http://www.ahfc.us/energy/home_rebate.cfm.

10. An exception to the income limit is that households of any income can qualify, if a member of the household receives federal Supplemental Security Income (SSI).

11. Based on CCHRC analysis of the Weatherization Manager, AHFC's database of information on the weatherization program.

12. More details about the weatherization program are available on AHFC's website at http://www.ahfc.us/grants/weatherization.cfm.

13. For example, the Bureau of Economic Analysis reports that per capita personal income in Anchorage in 2009 was $48,598, compared with $29,173 in the Bethel census area in Southwest Alaska.

14. See note 1.

15. At 156 Mcf annually, the average residential use reported by ENSTAR for 2010.

16. Associated Press, "Crews prepare to transfer fuel across sea ice to Nome," by Mary Pemberton, January 15, 2012.

17. *Alaska Energy Statistics 1960-2008*, by Ginny Fay, Alejandra Villalobos Meléndez, Ben Saylor and Sarah Christine Gerd, Institute of Social and Economic Research, University of Alaska Anchorage, May 2011.

18. See note 17. Figure adjusted to exclude electricity and non-heating fuel uses.

19. National Bureau of Economic Research, *Estimating the Social Cost of Carbon for Use in U.S. Federal Rulemaking: A Summary and Interpretation*, by Michael Greenstone, Elizabeth Kopits, and Ann Wolverton. Working Paper 16913, March 2011.

20. As of March 2012, CCHRC was working with AHFC and the Alaska Craftsman Home Program to develop potential methods for estimating the value energy-efficiency adds to the overall value of homes.

21. See, for example, National Association of Realtors, "Tenure in the Home and Motivation for Selling," by Jessica Lautz, January 25, 2012 (http://economistsoutlook.blogs.realtor.org); and National Association of Home Builders, "How Long Buyers Remain in Their Homes," by Paul Emrath, February 11, 2009 (www.nahb.org).

22. *Alaska's Construction Spending: 2011 Forecast*, by Scott Goldsmith and Mary Killorin, Institute of Social and Economic Research, University of Alaska Anchorage, January 2011 (www.iser.uaa.alaska.edu/Publications/2011constructionforecast.pdf)