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# Alaska Housing Finance Corporation

## Alaska Craftsman Home Program

### Profile #47, 1993

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# Executive Summary

The Alaska Craftsman Home Program (ACHP) is a non-profit corporation that was formed through a cooperative arrangement between the University of Alaska Cooperative Extension Service, the State government, and the Alaska Homebuilders' Association. The program's goal is to improve the energy efficiency of new residential construction in Alaska by educating Alaskan builders and purchasers about the benefits of energy efficiency.

ACHP has both an educational component and a home certification element. ACHP conducts intensive workshops for builders, contractors, and engineers. The workshops provide comprehensive training on the design and construction of energy-efficient homes, retrofitting techniques, and the design and installation of mechanical ventilation systems.

A building manual forms the centerpiece of the educational program, providing information to builders about adaptations necessary to optimize energy efficiency in different regions of Alaska where climates may vary tremendously. For example, Ketchikan has about 7,065 heating degree days each year, while Barrow has 20,265! Thus, insulation standards for the relatively warm and very rainy Southeast are inadequate in the North. The Building Manual and ACHP curricula address these regional differences.

The home certification element is implemented with the use of the HOT-2000 computer program. New homes or retrofit projects that meet the HOT-2000 energy usage goal for the home type and location are certified as Alaska Craftsman Homes save up to 80% of the energy usage over conventional homes. Additionally, Alaska Craftsman Homes receive "five star plus" ratings, the highest available from Energy Rated Homes of America, and thus are eligible to receive rebates of up to \$2,500, which can be applied to buy-down the home's mortgage.

Since 1986, ACHP has operated on a budget of approximately \$2.4 million and has certified more than 2,500 builders and over 100 homes. Currently ACHP has 45 active builder members and approximately 1,600 subscribers to its bi-monthly newsletter, "Northern Building Science." Participation in the ACHP increased dramatically in 1992 when 48 Alaska Craftsman Homes were certified.

To date most of the program activity has been focused on rather large and expensive custom-built homes. Now ACHP is trying to focus its attention on lower and middle income homes, and on retrofit projects as well, and in 1992 made several steps toward reaching these markets. First, five homes in Barrow, located on the Arctic Ocean coast, have been certified as Alaska Craftsman Homes. The homes are 1,200-1,500 square feet and are fabricated in Washington by certified ACHP builders, then shipped to Barrow where the homes are assembled. Since there is no road access to the bush community of Barrow, the northernmost community in the United States.

## Alaska Craftsman Home Program

- Agency:** Alaska Housing Finance Corp.  
**Sector:** Residential  
**Measures:** Building envelope, ventilation systems and equipment, combustion equipment, appliances and other energy efficiency improvements for new homes and home retrofits  
**Mechanism:** A certification process for energy-efficient home construction. Builders and homes are certified through ACHP.  
**History:** Started in 1985 as a program of the Alaska Cooperative Extension Service; incorporated in 1987 as a non-profit corporation overseen by the Department of Community and Regional Affairs; later brought under the jurisdiction of the Alaska Housing Finance Corp.

### Program Data

- # of homes certified:** > 100  
**# of builders certified:** ~ 2,500  
**Total expenditures:** \$2,367,200

### Conventions

For the entire 1993 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the International Monetary Fund's International Financial Statistics Yearbook: 1991.

The Results Center uses three conventions for presenting program savings. **Annual savings** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **Cumulative savings** represent the savings in a given year for all measures installed to date. **Lifecycle savings** are calculated by multiplying the annual savings by the assumed average measure lifetime. **Caution:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

# Cooperating Agencies Overview

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The Alaska Craftsman Home Program was formed through the cooperation of several public agencies in Alaska. The program originated at the University of Alaska Cooperative Extension Service, and was later enhanced through the participation of the State of Alaska Office of Energy Programs and the Alaska Homebuilders' Association. The program was later transferred from the Office of Energy Programs to the state-owned Alaska Housing Finance Corporation. The following overview section briefly describes each of these participants in the ACHP.

## **UNIVERSITY OF ALASKA COOPERATIVE EXTENSION PROGRAM**

The University of Alaska Cooperative Extension Service is a land-grant funded organization directly affiliated with the University of Alaska Fairbanks, the State of Alaska, and the United States Department of Agriculture. Each state in the United States has a land-grant university associated with it, and cooperative extension was designed to make the resources of these universities accessible to the public. Many people associate the Cooperative Extension Service with agricultural programs, but agriculture is just one of many topics that Cooperative Extension agents are equipped to provide information on to the public. The University of Alaska Cooperative Extension Service has four major programs covering topics including gardening, food preservation, nutrition, alternative crops, forestry, natural resource management, water quality, pesticide training, 4-H and other programs for youth, and finally, energy, housing, and building and construction. The University of Alaska Cooperative Extension's involvement with the Alaska Craftsman program is linked to this latter category.[R#10]

## **ALASKA STATE HOMEBUILDERS' ASSOCIATION**

The Alaska State Homebuilders' Association is a non-profit trade association made up of five local chapters

of the National Homebuilders' Association. The group, which is involved in advocacy and educational work, was asked to be involved in ACHP when the program was incorporated in 1987. The Homebuilders' Association took on an advisory role, and was given seats on the ACHP board of directors when the program was incorporated.[R#2]

## **ALASKA HOUSING FINANCE CORPORATION**

The Alaska Housing Finance Corporation is a privately held corporation owned by the State of Alaska. Energy Rated Homes of Alaska, the Home Energy Loan Program, and the Home Energy Rebate Program, along with the Alaska Craftsman Home Program, are all under the auspices of the Alaska Housing Finance Corporation.

**Energy Rated Homes of Alaska:** Energy Rated Homes of Alaska is part of the non-profit membership organization Energy Rated Homes of America, based in Little Rock, Arkansas. The program is a public-private partnership administered by the Alaska Housing Finance Corporation in cooperation with the state housing and finance industries. In 1987, the Energy Rated Homes began developing a statewide rating system at the request of the State of Alaska. In 1989, training of energy raters throughout the state was initiated. Qualified energy professionals attended a week-long workshop in which they received intensive training in performing blower door tests and home rating generation.[R#3]

By the spring of 1990, the Energy Rated Homes of Alaska had established an advisory board to provide guidance on policy issues and to develop a three-year plan by which the program could become financially self-sustaining. Energy raters are free to charge reasonable fees for performing blower door tests and generating home ratings, the average cost in 1992 for a rating and blower door test was \$75. Homes are rated on a scale of one star to five stars plus. Homes that achieve a four-star rating automatically show compliance with the Alaska

## Cooperating Agencies Overview (continued)

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Building Energy Efficiency Standards. Only Alaska Craftsman Homes are eligible to receive the five star plus rating. [R#3,9]

Home ratings may be used to obtain energy efficiency mortgages through participating lenders. Typically, lenders base loan amounts on a buyer's monthly income. With a rating from ERHA that indicates that the home is energy-efficient, lenders may credit the estimated monthly utility bill savings toward the qualifying monthly income. In this way, buyers may become eligible for larger loans than they would be able to qualify for with a conventional home. Homebuyers may also qualify for additional loans to cover the cost of upgrading the efficiency of a newly purchased older home. [R#12]

**Home Energy Loan Program:** In conjunction with Energy Rated Homes of Alaska, home buyers may qualify for contributions toward the principal on their home loans through the Home Energy Loan Program. Homes that receive ratings of four stars plus, five stars, or five stars plus are eligible for loan contributions of \$1,900, \$2,200, and \$2,500, respectively, toward the principal on their mortgage. [R#9,12]

**Home Energy Rebate Program:** Homeowners who want to make improvements in their home energy-efficiency can qualify for rebates offered through the Home Energy Rebate Program in the Alaska Housing Finance Corporation. First, the homeowner arranges for a rating by an Energy Rated Homes of Alaska certified rater who identifies appropriate energy conservation measures. Then the homeowner may implement as many measures as desired, and arrange for a second rating. (The fee for the second rating in conjunction with the Home Energy Rebate Program is \$20.) Homeowners then receive rebates up to \$2,000, depending upon the amount of improvement in the home's rating. [R#9,12]

Additionally, through the Home Energy Rebate Program, homeowners who finance their home energy-efficiency projects with home improvement loans may be eligible for principal or interest rate reductions. [R#9]

# Program Overview

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The Alaska Craftsman Home Program (ACHP), Inc. is a non-profit corporation formed through the cooperation of the State government, the University of Alaska, and the housing industry association. The program's goal is to improve the energy efficiency of new residential construction in Alaska by educating Alaskan builders, owners, and purchasers about the benefits of energy efficiency. While many public utilities in the U.S. have implemented new home energy efficiency programs, (see Results Center Profiles #7, #11, #26, and #30) ACHP is the first such program in the U.S. implemented through a non-utility entity.

In 1985, the University of Alaska Cooperative Extension Service began offering educational opportunities to builders and prospective home buyers who were interested in learning about new home energy efficiency. As interest in the Cooperative Extension program grew, it became clear that there was both interest and demand for further educational efforts aimed at informing the building industry of advances in energy-efficient construction. As a result, a Building Manual was developed and a formal training procedure was introduced in 1986 with funds from the State of Alaska Department of Community and Regional Affairs. In 1987, the State of Alaska Office of Energy Programs coordinated with the University of Alaska Cooperative Extension Service and the State Homebuilders Association to incorporate the Alaska Craftsman Home Program to continue the work already accomplished by the Cooperative Extension program.

Since its inception ACHP has operated on funds totaling approximately \$2.4 million. For five years (1986 - 1990) the program was funded through Exxon overcharge funds. In 1990, additional funding was received from the Railbelt Energy Fund. From 1991 to 1993, the program has been about one-third funded through workshop fees, with the remaining two-thirds from \$300,000 annual state grants.

The ACHP has both an educational component and a home certification element. ACHP conducts intensive workshops for builders, contractors, and engineers. The workshops teach the design and construction of energy-

efficient homes, retrofitting techniques, and the design and installation of mechanical ventilation systems. In addition, ACHP has a bimonthly newsletter and participates in ongoing research projects relevant to residential energy efficiency.

A Building Manual forms the centerpiece of the educational program, providing information to builders about adaptations necessary to optimize energy efficiency in different regions of Alaska where climates may vary tremendously. For example, Ketchikan has about 7,065 heating degree days each year, while Barrow has 20,265! Thus, insulation standards for the relatively warm (and very rainy) Southeast are inadequate in the North. The Building Manual and curriculum requirements address these regional differences.[R#1]

The home certification element is implemented with the use of the HOT-2000 computer program. New homes or retrofit projects that meet the HOT-2000 energy usage goal for the home type and location are certified as Alaska Craftsman Homes. (An Alaska Craftsman Home is estimated to save up to 80% of the energy usage over a home built to conventional standards.) Additionally, in conjunction with Energy Rated Homes of Alaska (ERHA), a member of Energy Rated Homes of America, a non profit membership corporation, any Alaska Craftsman Home receives a "five star plus" rating, the highest available from ERHA. ERHA is a member of the Alaska Housing Finance Corporation, and any home financed through the Alaska Housing Finance Corporation that receives a "five star plus" rating from ERHA is also eligible to receive a rebate of up to \$2,500, which may be applied toward the mortgage.

**"This (ACHP) is a premier program provided for a fraction of what has been spent in other parts of the country and the world... I am astounded about how much ACHP has accomplished in so short a time."** — Oliver Drerup, technical coordinator, R-2000 program, Canada Energy Mines and Resources.[R#1]

In the course of its existence, ACHP has certified more than 2,500 builders and over 100 homes. The ACHP has 45 active builder members and approximately 1,600 subscribers to its bimonthly newsletter.

# Implementation

## MARKETING AND DELIVERY

Since its incorporation in 1987, the ACHP has become widely recognized among all people involved in the homebuilding industry in Alaska. In 1992, the program was highlighted by the U.S. Department of Energy as an "Outstanding State Energy Grant Project." In addition, the ACHP received an environmental achievement award from the National Environmental Awards Council. In 1992, the Governor's Award for Excellence in Energy-Efficient Design was awarded to an ACHP home, one of 24 entered in a contest designed to recognize builders who construct high quality energy-efficient homes, while educating home buyers about the benefits of such homes. The Alaska State Legislature also requires that any builder seeking a residential construction certificate either be certified through ACHP or receive equivalent training. [R#4]

These achievements are indicative of the success of the program and they have also helped the program gain further acceptance in Alaska as well as the national and international building industry. The program also actively promotes its activities through its newsletter "Northern Building Science" (NO.B.S.) published every other month.

The newsletter contains information regarding new techniques and research, home energy-efficiency activities in other regions (both in and outside the United States), a letters column through which subscribers share their ideas and knowledge, and a calendar of workshops and seminars sponsored by ACHP. The newsletter is available by subscription for \$10 - \$15, and, in 1993, has approximately 1,600 subscribers. The ACHP sells builder and associate memberships for \$100 and \$200, respectively. Members and workshop participants automatically receive a newsletter subscription; members are allowed to use the ACHP logo in their marketing programs. Builder print advertisements are valuable to ACHP in promoting the program. [R#4,6]

The ACHP has one primary demonstration home – the State Fair Demonstration Home at the State Fairgrounds in Palmer – which is open to the public. In addition, the Wasilla High School construction trades program spent several months retrofitting a partially constructed home to ACHP standards. The students began construction of the Vica House in 1986, and the house had been framed and dried in and the heating system was installed when the decision to upgrade the home to ACHP standards was made in early 1989. The

### ACHP WORKSHOPS

Workshop Name	Duration	Fee	Description
Realtors Workshop	3 hours	\$75	The Realtors Workshop provides an introduction to energy conservation techniques in designing and building, and is worth 3 credits for the realtor continuing education requirement.
Homebuilding Workshop	2 days	\$350	This course provides intensive coverage of energy-efficient building practices; the course is required for ACHP certified builders.
Ventilation Workshop	2 days	\$350	This workshop focuses on Heat Recovery Ventilation Systems, including air quality, system design, technical requirements, maintenance and certifies participants to install HRV systems.
Airtightness Workshop	3 days	\$400	This workshop teaches participants how to perform blower door tests, evaluate homes for air tightness, recognize and correct problems, and mitigate pressure imbalances and certifies participants to perform air tightness tests.
Heating Workshop	1 day	\$150	Heating workshops focus on combustion heating theory of gas/oil heaters, and related energy-efficiency topics.
HOT-2000 Workshop	1 day	\$150	The HOT-2000 workshop teaches builders and designers how to use the program in designing energy-efficient homes.
Retrofit Workshop	2 days	\$300	This workshop includes case studies, heating system evaluation, problem diagnosis, performance prediction, and preparation of job specifications for retrofitting older homes.

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students worked on upgrading the home to ACHP standards for several months, and ACHP certification was received at the end of May, 1989. The home was sold in 1990, and the high school students, in conjunction with ACHP, then addressed problems that were found in the house after the first year of occupancy. Since the completion of the Vica house, the Wasilla High School has constructed two other Alaska Craftsman Homes.[R#6]

As its primary educational endeavor, the ACHP offers one and two day workshops for building professionals, contractors, engineers, and architects, as well as developers, homebuyers, owner/builders, and other interested parties. The workshops are advertised in local news media and trade magazines, in addition to the announcements in the ACHP newsletter NO.B.S.. Most workshops are held in Anchorage, Fairbanks, Juneau, or Barrow. The program offers five different core workshops: Homebuilding, Retrofit, Ventilation, Heating, and Airtightness. In addition, there is a Realtors course and a HOT-2000 workshop. Brief descriptions of the ACHP workshops may be found in the accompanying table on page 6.

ACHP has developed several technical manuals which form the core for the ACHP workshops. The "ACHP Builders Manual" contains 14 sections and substantial appendices. The Manual covers specific technical considerations that builders and designers must be familiar with if they are constructing an energy-efficient home. The Ventilation Design and Installation manual describes ventilation techniques for optimal energy efficiency. The applicable manual is provided to workshop participants as part of the workshop fee. (Additionally, lunch is included in the fee for workshops of one day or longer).

Builders are certified as ACHP builders after completing the homebuilding course and passing a qualifying exam. Only licensed residential contractors are eligible for certification through ACHP and only homes built by ACHP certified builders may qualify as Alaska Craftsman Homes.

In order to receive the Alaska Craftsman Home certification, qualified builders pay a \$100 certification fee, and submit specifications for the home to ACHP. The specifications are entered into the HOT-2000 computer program along with weather data from one of 19 weather stations located throughout the state. HOT-2000 determines an energy usage goal for the particular home, based

## **ALASKA CRAFTSMAN HOME PROGRAM BUILDING MANUAL CONTENTS**

- Introduction
- Building Science Basics
- Design Decisions
- Materials
- Foundations
- Floors
- Walls
- Attics and Roofs
- Windows and Doors
- Heating
- Domestic Hot Water
- Ventilation
- Lighting
- Appliances
- Appendices: Insulation Values, Permeance, Electricians' Manual, Plumbers' Manual, Drywallers' Manual.

on the location, size, and type of construction. The potential energy usage is calculated, using the specifications provided by the builder, including building envelope insulation, type and area of glazing, solar orientation, heating and ventilation equipment, estimated lighting usage, and other appliance installations and projected uses.

Alaska Craftsman Homes may also be rated by Energy Rated Homes of Alaska (ERHA) at "five stars plus" and become eligible for a \$2,500 rebate applicable toward the mortgage payment. ERHA is a member of the Alaska Housing Finance Corporation which finances approximately 70% of all new homes in Alaska. Any home that is financed through this organization and which receives the five star plus rating would be eligible for the rebate. (Note that one of the requirements for a home to receive the "five stars plus" rating is that the home must be certified as an Alaska Craftsman Home.)

The ACHP also sells the HOT-2000 Computer program, which builders and home designers can use to predict the energy usage of a home. Additionally, the ACHP sells the Bonneville Power Administration's "Builders Field Guide," the "Consumer Guide to Home Energy Savings," National Association of Homebuilders' "Frost Protected Shallow Foundations," and several relevant videos.

# Implementation(continued)

## MEASURES INSTALLED

One of the most outstanding “measures installed” by the ACHP has been the information regarding home energy-efficiency disseminated to the building industry and homebuyers throughout Alaska. On a more concrete level, the ACHP can be credited with reducing the energy use of certified homes by 80% over conventional homes.

Home certification is accomplished through the HOT-2000 computer program, which allows builders total flexibility in meeting the energy usage goal specified by the program. The most significant specifications are that air change must be 1.5 air changes per hour or less, the home must be equipped with continuous mechanical ventilation, and the home may not have any naturally aspirated combustion appliances. A complete list of requirements for ACHP certified homes may be found in the ACHP Technical Requirements Table.

A typical Alaska Craftsman Home may have the same features as the ACHP home that won the 1992 Governor’s Award for Excellence in Energy Efficient

Design. The home was certified as an Alaska Craftsman Home with the features shown in the accompanying table.[R#4]

## STAFFING REQUIREMENTS

The ACHP is administered through the Alaska Housing Finance Corporation. The ACHP Executive Director, Tim Sullivan, is assisted by Technical Director Sam Halterman; other staff are a workshop coordinator, a full time receptionist, and a part-time accountant, for a total of 4.5 full time equivalents (FTEs). Seminars and workshops are instructed and coordinated by ACHP staff, and 16 certified instructors. The ACHP board is comprised of 13 members who meet monthly to discuss implementation and policy issues and to advise the ACHP staff on issues of concern.

At the University of Alaska Cooperative Extension service and the Alaska Homebuilders’ Association several people are involved with the ACHP, primarily in a technical advisory role.

### 1992 GOVERNOR'S AWARD FOR EXCELLENCE IN ENERGY EFFICIENT DESIGN WINNING HOME SPECIFICATIONS

Wall Insulation	R-37	one layer of R-19 fiberglass insulation installed vertically within framed wall + one layer of R-11 fiberglass insulation installed horizontally on interior side of framed walls + one inch layer of R-7.2 foam insulation board on exterior wall
Ceiling Insulation	R-50	Fiberglass insulation using Insulsafe III
Floor and Foundation Insulation	R-26	Foundation walls
	R-10	Foundation slab -- foam under the home
	R-20	Foundation slab -- foam around the perimeter
Windows	R-4.6	Hurd InSol-8 with R-8 center glass and overall window rating of R-4.6
Air Leakage Area	20 in <sup>2</sup>	Continuous 6 mil sheet of high density polyethylene with sealed seams installed between insulation and drywall layers
Heating System		Combined space and domestic hot water heating by sealed combustion gas boiler; In-floor radiant heat system; hot water heated two - three times per day and then transferred to insulated storage tank

[R#4]

### ACHP NEW HOME TECHNICAL REQUIREMENTS SUMMARY

Air leakage	< 1.5 air changes per hour at 50 pascals
Ventilation	continuous mechanical
continuous outdoor air supply rate requirements:	0.30 ach or 10 cfm per habitable room and 20 cfm for master bedroom & basement
intermittent exhaust air requirements:	100 cfm kitchens 50 cfm bathrooms
continuous exhaust air requirements:	60 cfm kitchens 30 cfm bathrooms
Combustion Equipment	must meet state energy conservation standards for new residential buildings
Woodstoves and fireplaces	must have tight-fitting doors and separate outdoor air supply; must be constructed to maintain continuity of the house air barrier and insulated with non-combustible material
Air-supply ducts	must be insulated to R-4 and have a vapor barrier if ducts to combustion appliances pass through unconditioned space
Combustion appliances	must be adequately vented and installed in accordance with ACHP guidelines
Envelope R-values	must be sufficient to meet HOT-2000 energy usage goals and/or achieve 5 star rating from Energy Rated Homes of Alaska Program
Windows	minimum R-3.1 minimum air space between panes 0.5 inches
Water Heaters	R-4 insulation on first 3 feet of pipe
Electric	R-16
Other types (except on-demand)	R-10
Appliances	in upper 30% of energy-efficient range as rated by the American Council for an Energy Efficient Economy
Underfloor protection	piling or post and pad foundation must be protected by an appropriate covering on the bottom of the floor system
Radon	radon mitigation strategy must be employed radon levels must be <4 pCi/L

# Monitoring and Evaluation

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## MONITORING

The ACHP does some follow-up monitoring of Alaska Craftsman Homes. The HOT-2000 computer program is really the primary “monitoring” tool, providing energy usage estimates for each home certified under the program. Through HOT-2000, ACHP has a record of the types of measures installed in ACHP-certified homes.

## EVALUATION

The Vica house was extensively evaluated to determine its performance in comparison to HOT-2000 predictions, as well as to identify any problems experienced with regard to construction and comfort. The evaluation identified principal areas of concern and steps were taken to mitigate the problems.

First, humidity was found to be excessive, as evidenced by persistent condensation on a window in a back bedroom, frosting problems on the front door, and failure of the heat recovery ventilator due to freezing. The high humidity was attributed to uncoordinated settings on the humidistat and the heat recovery ventilator. The former was set to call for 45% relative humidity, while the latter was set to vent excess moisture down to 40% relative humidity. Thus, the humidifier was running consistently and in opposition to the heat recovery ventilator. After disengaging the humidifier, relative humidity was maintained between 40% and 50% throughout most of the winter season. An important consideration was that the occupants of the home maintained approximately 12 to 20 houseplants which contribute significant moisture.

The second problem was with the heat recovery ventilator, which froze during each cold spell, and was thought to be inadequately responsive to air quality problems. While the failure of the heat recovery ventilator was attributed in part to the excess humidity several other problems were found that were corrected. Saturation of the fresh air supply lines due to high moisture levels was one issue. Another contributing factor was that the core had been installed backwards. Finally, the recirculating natural gas range hood was changed to vent directly to the outside. In the winter subsequent to implementation of these changes, no problems with the system were noticed, and the occupants indicated that air quality was satisfactory.

An evaluation of the performance of the heating system was initiated when natural gas bills were found to be more than twice the HOT-2000 prediction. Two factors were identified as contributing to the high natural gas bill. First, natural gas rates had increased 44.6% since the HOT-2000 analysis had been performed. Second, the garage was being used as an auto body repair facility, with the average temperature inside the garage at 70°F. This scenario had not been considered in the HOT-2000 analysis. Upon examination of actual energy usage patterns of the natural gas-supplied equipment and appliances, it was found that HOT-2000 predicted energy usage within 10% of the actual usage.

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The investigation into the natural gas usage revealed several minor problems. Negative pressures within the furnace room (which is in the garage) and the crawl space were corrected by adjusting the run time of the furnace fan. Additional sealing of the ducts and management of the air in the furnace room were recommended to further address the pressure imbalance. The vent duct for the natural gas clothes dryer was replaced after several breaks were found (apparently the occupants' dog was responsible for the problem).

In addition, the electric bills were found to be averaging more than two times the HOT-2000 prediction. An investigation into actual electrical appliance usage revealed that the occupants were using significantly more high-energy consumption appliances than was assumed during the HOT-2000 analysis. Primary among these were the many body shop tools whose use had not been anticipated. In addition, a 5 amp fan motor on the furnace consumed energy that had not been included in the HOT-2000 prediction. [R#4]

In 1992, Richard Seifert of the University of Alaska Cooperative Extension Service completed an evaluation of 13 Alaska Craftsman Homes. The evaluation sought to determine whether the homes were consuming energy as predicted by the HOT-2000 program. Additionally, comments regarding owner satisfaction with their homes were

solicited. The evaluation was based on HOT-2000 data and responses to a survey which requested actual utility bills and included a questionnaire regarding the participants homes and energy-usage behavior. Actual annual energy use in eight of the 13 homes exceeded predictions by 7.2% to 219%, with the mean at 75%. (The Vica House, described previously, was the 219% exceedance.) Annual energy use in the remaining five was 6% to 50% of the prediction. Annual energy use predictions for the homes in the sample ranged from 14,114 kWh to 35,545 kWh, and actual annual usage ranged from 8,668 kWh to 51,199 kWh. (The home that reported 8,668 kWh annual use only included heating costs.)

The evaluation found that the most likely reason for the discrepancy between HOT-2000 predictions and actual energy consumption was the underestimation of the use of electrical appliances. Many homes had such amenities as engine block heaters and hot tubs, and one home had a central vacuum cleaning system, which contributed significant energy demands not included in the HOT-2000 analysis.

Nonetheless, the evaluation found that the ACHP homeowners were extremely satisfied with the energy performance and comfort of their homes. All the homeowners surveyed said that they would consider purchasing an ACHP again. [R#11]

# Program Savings

Alaska Craftsman Homes are estimated to use approximately 80% less energy than a home built to conventional specifications. Most of the Alaska Craftsman Homes certified to date have been custom homes with floor areas greater than 2,000 square feet. Such homes, if built to conventional standards, are typically very high energy consumers. Because of huge variations among homes, it is difficult to identify a baseline home with which to compare Alaska Craftsman Homes and thus determine some average energy savings figures.

The Pease Home retrofit case study depicts energy and energy-cost savings for space heating in a home retrofitted and certified through the ACHP. In the pre-retrofit years, the home required 114 to 118 million Btus for space heating. While the retrofit was in progress, in 1989, space heating requirements dropped to 70 million Btus, and after the retrofit was completed annual space heating was 47 million Btus, a 60% difference over the pre-retrofit requirement. [R#8]

## CASE STUDY: PEASE RESIDENCE ACHP RETROFIT

### HOUSE SPECIFICATIONS:

1,500 square foot ranch house with all-weather wood crawlspace foundation on concrete footing and T-111 plywood siding.

### RETROFIT WORK COMPLETED:

- Foundation exposed and electrical protrusions sealed, and insulation upgraded around top plate.
- Vapor diffusion retarder installed over the siding
- Exterior foundation insulation fastened with ledger plate nailer and weatherproofed
- Ledger and curtain wall installed, with ledger cavity insulated to R-19 and curtain wall cavity to R-11
- House wrapped with spun olefin air barrier and T-111 siding hung
- Window openings reframed and sealed to vapor retarder
- Existing ceiling vapor retarder was repaired
- Attic reinsulated to R-53
- Crawl space dried out and vapor retarder installed on walls and floor
- Heat recovery ventilator installed.

Space Heating Costs	Primary Heating Fuel	Energy Usage		Cost
1987	Electrical	33,397 kWh	114 million Btu	\$2,825
1988	Wood	10 cords	118 million Btu	\$1,350
1989	Wood	6 cords	70 million Btu	\$810
1990	Wood	4 cords	47 million Btu	\$540
1991	Wood	4 cords	47 million Btu	\$540

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## **PARTICIPATION RATES**

Participation in the ACHP increased dramatically in 1992. Approximately 48 Alaska Craftsman Homes were certified, representing nearly half of the more than 100 homes that have been certified since the program's inception. Most certifications have been for new, custom-designed homes.[R#1,6]

ACHP is trying to focus attention on lower and middle income homes, and on retrofit projects. In 1992, the ACHP made several steps toward reaching these markets. First, five smaller homes in Barrow, located on the Arctic Ocean coast, have been certified as Alaska Craftsman Homes. The homes vary from 1,200 to 1,500 square feet, and are mostly built in Washington by certified ACHP builders. The materials are then shipped to Barrow, where the homes are assembled. (There is no road access to the bush community of Barrow, which is the northernmost community in the United States.) Additionally, the ACHP has provided consultation services for a new home construction project in Golovin, located on Norton Sound about 100 miles east of Nome. Thirteen new homes will be built, with estimated heating bill savings of up to 70% over similar-sized homes in the region. (Golovin is also a bush community – that is, there is no road access to the area.)[R#1] One of ACHP's certified builders was awarded a contract to build 50 homes, primarily in Siberia, (Russia) beginning in March, 1993. These homes will average less than 1,100 square feet.[R#6]

More than 2,500 builders have been certified through the ACHP. Some of these were owner/builders who constructed only one home to ACHP standards. Some certified builders are no longer active. However, like Canada's R-2000 program (see Profile #26), it is likely that a significant number of homes have been built to ACHP standards but have not been certified as Alaska Craftsman Homes. An additional number of homes likely incorporate energy-saving features as a result of the builder training through ACHP.

The ACHP currently has 45 active builder members, and 1,600 subscribers to the bimonthly newsletter, Northern Building Science. It is estimated that in all, the program has reached 2,000 to 3,000 people.

## **FREE RIDERSHIP**

As a primarily educational program, free-ridership is not really an issue for the ACHP. The program is aimed at reaching as many people as it can, in order to influence the market for new energy-efficient residential homes.

If the state energy code changes and becomes more stringent for energy-efficiency, it is likely that ACHP will adjust its criteria for certifying Alaska Craftsman Homes.

## **MEASURE LIFETIME**

Because no lifecycle savings or cost of saved energy was calculated for this program, The Results Center did not identify a measure lifetime. Typically new home construction programs have assigned lifetimes of from 40 to 70 years. As the majority of homes certified through the ACHP are high-quality, custom-designed homes, they are likely to have lifetimes on the upper end of the range. Additionally, because many of the home owners had actively sought out energy-efficient homes, the owners are likely to maintain special equipment properly, thus extending the expected lifetime of many of the measures installed in Alaska Craftsman Homes.

## **PROJECTED SAVINGS**

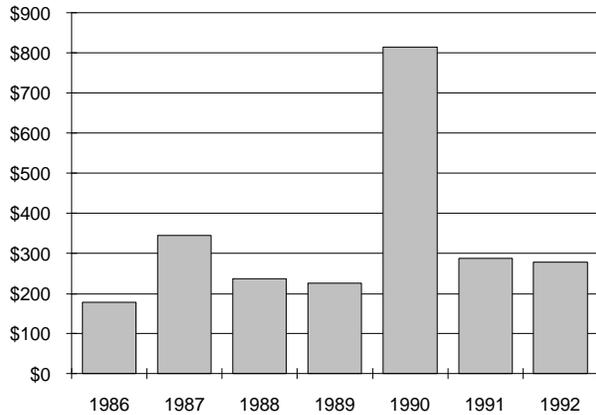
The ACHP is anticipated to continue functioning in its present form at least through 1997. Funding has been guaranteed for this period. The program is expected to grow and further penetrate the markets not yet reached.

# Cost of the Program

In the first five years of the program, the ACHP was primarily funded with \$1.201 million from the Exxon overcharge funds. This money was appropriated in five

annual installments from 1986 to 1990. In 1990, additional funding in the amount of \$600,000 became available from the Railbelt Energy Fund. In 1991 and 1992, the state granted \$300,000 (not levelized) each year to fund the program. The 1991 and 1992 funding was obtained through funds appropriated to Energy Rated Homes of Alaska. Finally, in 1992, funding for 1993 through 1997 was committed to by the state, thus guaranteeing continuation of the program. Thus, a total of \$2.4 million has been spent between 1986 and 1992.

**TOTAL PROGRAM COST (x1,000)**



Additional income is generated by program activities. The \$100 certification fee offsets some of the costs of certifying a home. Workshop and training fees, which range from \$75 to \$400, offset the costs of advertising and conducting the classes, preparing and updating the course materials, and paying instructor fees. The newsletter subscription fee covers some of the cost of its production.

<b>Costs Overview Table</b>	<b>Exxon Overcharge Fund (x1000)</b>	<b>Railbelt Fund (x1000)</b>	<b>State of Alaska Funding (x1000)</b>	<b>Total Program Cost (x1000)</b>
1986	\$178.9	\$0	\$0	\$178.9
1987	\$345.2	\$0	\$0	\$345.2
1988	\$236.8	\$0	\$0	\$236.8
1989	\$225.9	\$0	\$0	\$225.9
1990	\$214.3	\$600.0	\$0	\$814.3
1991	\$0	\$0	\$287.4	\$287.4
1992	\$0	\$0	\$278.7	\$278.7
<b>Total</b>	<b>\$1,201.1</b>	<b>\$600.0</b>	<b>\$566.1</b>	<b>\$2,367.2</b>

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## **COST EFFECTIVENESS**

Because energy savings estimates were not possible for this program, The Results Center did not calculate the cost of saved energy. The ACHP has addressed cost-effectiveness from the homebuyer's perspective. Typically, the additional features necessary to construct a home to Alaska Craftsman standards require an additional 8% of the home's overall cost. Then, depending on the location of the home, and the local energy costs, the energy-efficient measures can pay for themselves over time. In Alaska, natural gas or oil may be somewhat cheaper than in other parts of the United States, but transportation charges can increase costs sixfold. In 1993, oil may cost about \$1 per gallon, but transportation charges may be up to \$5 per gallon. In this scenario, says Sam Halterman, "a 40% cut in energy usage can literally double a family's usable income."

Most people involved in the ACHP agree that the program is cost-effective. The technical coordinator for Canada's R-2000 program, upon which the ACHP was originally modelled, has noted that the ACHP has made significant accomplishments at a fraction of the cost of other similar programs. (The R-2000 program has had a benefit to cost ratio of 3 to 1, and The Results Center estimated cost of saved energy at about 5 ¢/kWh. See Profile #26.) The late Alaskan state senator Bettye Farhenkamp, who introduced the ACHP, said "I think it is one of the most cost-beneficial programs we have ever established." [R#1]

## **COST PER PARTICIPANT**

While data are not available to calculate a meaningful cost per participant figure, the ACHP has performed some analyses of the additional costs of energy-efficient measures added to new Alaska Craftsman Homes. For example, the cost of the energy-efficient features added to Vica house, which was appraised between \$113,500 and \$125,000, was determined using two approaches. The COST approach, an average of several builders' estimates for the cost of adding ACHP features, determined the value of the features at \$7,900 to \$9,200, or 6% to 8% of the appraisal. Using the Sales Comparison Approach, which compares the appraised values of several homes with and without ACHP features, but with otherwise similar characteristics, the energy features were valued between \$2,000 and \$5,000. [R#4]

## **COST COMPONENTS**

The ACHP budget is applied primarily toward the salaries of its five staff members, who are responsible for implementing most of the program's various components. The ACHP does not have an advertising budget. Program income is used to offset some costs, as described earlier.

# Lessons Learned / Transferability

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## LESSONS LEARNED

Overall, the ACHP has been tremendously successful. Many lessons have been learned over the life of the program. Program staff are responsive to feedback from builder members, Alaska Craftsman Home-owners, workshop attendees, and the multi-faceted board of advisors. Thus, the program has changed to accommodate new ideas and expanding target markets.

One area which has been identified as needing attention is the limited demographics of home owners who are interested in purchasing energy-efficient homes, and similarly, home builders who construct energy-efficient homes solely for this market. The ACHP has turned its attention toward promoting the program to builders who construct new homes for lower and middle income buyers. A companion target market is found in homes built in the rural areas of Alaska, commonly referred to as the Bush.

One problem identified with the rural market is that many new homes constructed outside Alaskan cities are built outside the state, then shipped to the home site, where the home is assembled. Whenever possible, optimal methods for assembling such partially site-built homes are discussed with builders, in order to ensure that the home performs in accordance with its design.

The ACHP staff are also hoping to begin reaching more contractors and customers in the home retrofit market. The potential savings from home retrofits are significant, especially in areas where fuel transportation fees are large. The energy-cost savings potentially realized by low and middle income homeowners could contribute important benefits to the economic welfare of these customers and their communities.

The lessons learned from the evaluation of the Vica house (see the Monitoring and Evaluation section) have also been meaningful. The Vica house analysis pointed to the importance of factoring unusual house uses when evaluating the performance of an energy-efficient home. The garage of the Vica house was used as an auto body repair shop, thus the energy demand of the home's

garage was well above that of a typical garage. Additionally, the evaluation found that the cultivation of house plants, in conjunction with other normal home activities and local weather conditions, was adequate to maintain appropriate winter humidity levels.

## TRANSFERABILITY

While many new home rating programs are in existence in the United States, the ACHP is the first state sponsored program that has promoted a partnership with other public and private entities. The program operates in conjunction with the state cooperative extension service, the Alaska Homebuilders' Association, and the Energy Rated Homes of Alaska, which is administered through the Alaska Home Financing Corporation. The ACHP workshops are promoted through these partnerships – they are available to meet the continuing education requirements for residential contractor licenses, and all energy raters for the Energy Rated Homes of Alaska must take the ACHP ventilation and air tightness courses.

The strong educational component of the ACHP is what has made the program so far-reaching and unique. Even in areas where a new home rating system is already operating, the builder training and workshop elements of the ACHP could be adapted and offered in conjunction with any existing program.

In 1990, the ACHP joined with the Yukon Home Builders Association and the Siberian Branch of the USSR Academy of Science Institute of Northern Development to form the Northern Building Science Alliance. This cooperative effort was formed to facilitate the exchange of ideas among building professionals and to promote energy-efficient design in all buildings in the Northern regions of the world. At the same time, the ACHP signed a similar agreement with the Eastern Zonal Research Institute of Standard and Experimental Projecting of Dwelling and Public Houses in Khabarovsk, USSR. The ACHP has pursued these opportunities in furthering its objectives to educate the population regarding energy-efficient construction. These partnerships demonstrate the transferability of the ACHP and the concepts that it promotes.

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