
Bonneville Power Administration Manufactured Housing Acquisition Program Profile #30, 1992

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Executive Summary

The Manufactured Housing Acquisition Program (MAP) is one of the most elegant DSM programs that The Results Center has reviewed, yet its apparent simplicity shrouds the years of program development, research, and the consensus building process that ultimately led to the program's fruition. MAP is the result of a collaborative effort of the Northwest Power Planning Council, Bonneville Power Administration, the region's public and investor-owned utilities, and 18 housing manufacturers. These parties reached an agreement whereby all new electrically-heated manufactured homes in the Pacific Northwest will be built to standards that exceed the new proposed Housing and Urban Development (HUD) code by nearly 50%.

The program encompasses the states of Washington, Oregon, Idaho, and Montana, where 10,000 to 13,000 manufactured homes are constructed and sited each year, about 30% of all electrically-heated single family detached homes in the region. Program planners estimate that over 90% of newly-purchased manufactured homes will comply with the MAP program specifications for efficiency. The groundwork for the program began in 1986. Under the auspices of a working group, 150 demonstration manufactured homes were constructed, sited, and monitored for savings throughout the 1989/1990 heating season. Using data generated by these demonstration homes, technical specifications, acquisition payment amounts, and administrative and tracking procedures were developed and agreed upon.

The program that finally resulted is straightforward: all 18 home manufacturers in the region, four more located outside the region who ship into the region, and five of the six investor-owned utilities in the region are participating in the program. Manufacturers voluntarily contracted to build homes to the required specifications; BPA reimburses each manufacturer \$2,500 for each home built.

Both savings and costs are presented in this profile as predicted by BPA since the program has been "on the street" for less than a year. Program savings are based on a comparison to manufactured homes typically constructed in the region. Savings are estimated to be 6,000 kWh/year/home. Since approximately 12,000 homes will be sited each year, the program's annual savings are estimated to be 72 GWh annually resulting in total program lifecycle savings of 12,960 GWh.

MAP is a prototype for DSM programs that seek to transform a market. By aggregating the purchasing power of multiple utilities, MAP has shown how a market can be transformed at the wholesale level. This approach to DSM acquisitions reduces administrative cost and increases program penetration. The successful implementation of MAP demonstrates the importance of negotiation and collaboration in program design. Many different organizations, with highly diverse needs, pulled together to bring MAP into a reality that can be effectively transferred, with slight modifications, to other regions of the country.

Manufactured Housing Acquisition Program

Utility: Bonneville Power Administration

Sector: Residential

Measures: Building envelope

Mechanism: In a unique collaborative, home manufacturers agreed to include energy-efficiency measures in their home designs, in return for a \$2,500 acquisition payment.

History: Planning began in 1986. 150 demonstration manufactured homes constructed and monitored for savings throughout 1989/1990 heating season. First acquisitions made in 1992.

Predicted Annual Program Data

Energy savings:	72 GWh
Lifecycle energy savings:	3,240 GWh
Demand savings:	8.22 aMW
Cost:	\$35,000,000

Conventions

For the entire 1992 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.

Utility Overview

The Bonneville Power Administration (BPA) is a U.S. Government owned agency which provides wholesale power to electric utilities. It was created by Congress in 1937 as the marketing agent for power generated at the Bonneville Dam. Since then it has been organized as part of the Department of Energy and its mission expanded to market power from additional sources in the region, including twenty-nine federal dams, two nuclear plants, and one coal plant. To accomplish this, BPA has designed and built more than 14,000 miles of high-voltage transmission lines. This network has become the backbone of the transmission system for the Northwest over the last forty-seven years.

BPA serves the states of Washington, Oregon, Idaho, and Montana west of the Continental Divide, plus small adjacent portions of California, Nevada, Utah, and Wyoming. The service area covers approximately 300,000 square miles with a population of nearly 9 million people. [R#1] BPA sells power to 174 wholesale customers made up of:

- 136 public systems,
- 12 investor-owned utilities,
- 16 industrial firms, and
- 10 federal agencies.

In 1980, under the Pacific Northwest Electric Power Planning and Conservation Act, BPA was assigned the additional responsibility of meeting the future growth in demand for electricity in the region through the acquisition of new generating resources and conservation measures. Through its Office of Energy Resources, BPA develops programs that purchase resources from generators, utilities, and end users of electricity. The resources themselves are obtained through the investment in and use of:

- measures and practices that increase the efficiency with which electricity is generated, transmitted, or used, and
- measures that employ renewable resources to displace consumption of electricity at the point of end use.

BPA FY 1991 STATISTICS

Number of Wholesale Customers	174
Energy Sales	89,173 GWh
Energy Sales Revenue	\$1.869 billion
Summer Peak Demand	17,998 MW
Generating Capacity	24,093 MW
Average MW Delivered	10,326 aMW
Average Electric Rates	
Sold by BPA	1.6-2.6 ¢/kW
Sold by BPA-Supplied Utilities	1.4-7.2 ¢/kW
Average to All Utility Customers 1990	4.57 ¢/kW

Because BPA's electricity is mostly hydro, the average megawatt (aMW) capacity stated in the table is a more important number than the generating capacity. (The full generating capacity of 24,093 MW could be delivered for a short time but could not be sustained.) Based on rainfall data from the last 50 years, BPA estimates that during a worst case rainfall year they would be able to deliver 8,464 aMW. [R#2] The 10,326 aMW delivered in 1991 indicates that BPA sold ~1,862 aMW of nonfirm power that year.

Utility DSM Overview

In order to fulfill the added responsibilities mandated by the Pacific Northwest Electric Power Planning and Conservation Act, it became necessary for the BPA to become involved in demand-side management (DSM) programs. In 1982, under the title Energy Resources Program/Project, BPA initiated DSM programs in the residential, commercial, industrial, and agricultural sectors. From 1982 through 1991 BPA spent \$1,145 million on a wide range of DSM programs. In addition, BPA initiated its Aluminum Smelter Conservation and Modernization (Con/Mod) program in 1988, whose remaining \$61.6 million cost will be spread out over a six-year period but whose savings were realized almost immediately.

PROGRAMS FUNDED BY BPA

RESIDENTIAL

Residential Weatherization Program (Weatherwise)
 Residential Construction Demonstration Project
Manufactured Housing Acquisition Program
 Washington State Energy Code Program
 Oregon State Energy Code Program
 Super Good Cents Program
 State Technical Assistance Program

COMMERCIAL/INDUSTRIAL/AGRICULTURAL

Northwest Energy Code Program
 Commercial Retrofit & End-Use Study
 Energy Edge Project
 Commercial Incentives Pilot Program
 Institutional Buildings Program Follow On
 Energy Smart Design Program
 Elec. Ideas and The Elec. Ideas Clearinghouse
 Lighting Design Lab
 Energy Savings Plan
 Aluminum Smelter Conservation/Modernization
 Sponsor-Designed Program
 Irrigated Agriculture Program

OTHERS

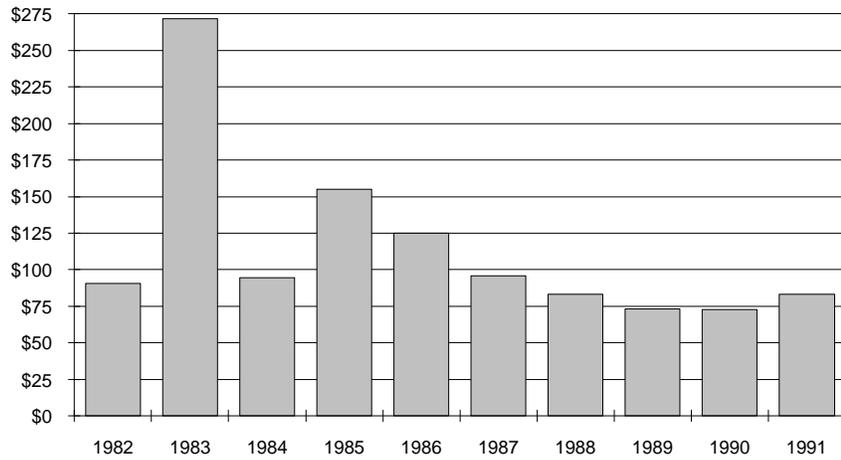
Research and Development
 Environmental Oversight
 The Partnership Program
 Design Wise Program

Utility DSM Overview Table	Annual DSM Expenditure (x1,000,000)	Annual DSM Energy Savings (GWh)	Annual DSM Demand Savings (aMW)
1982	\$90.6	266	30.4
1983	\$271.6	570	65.1
1984	\$94.5	143	16.3
1985	\$155.2	159	18.2
1986	\$125.1	186	21.2
1987	\$95.9	146	16.7
1988	\$83.2	425	48.5
1989	\$73.1	385	43.9
1990	\$72.7	318	36.3
1991	\$83.0	101	11.5
Total	\$1,145.0	2,699	308.1

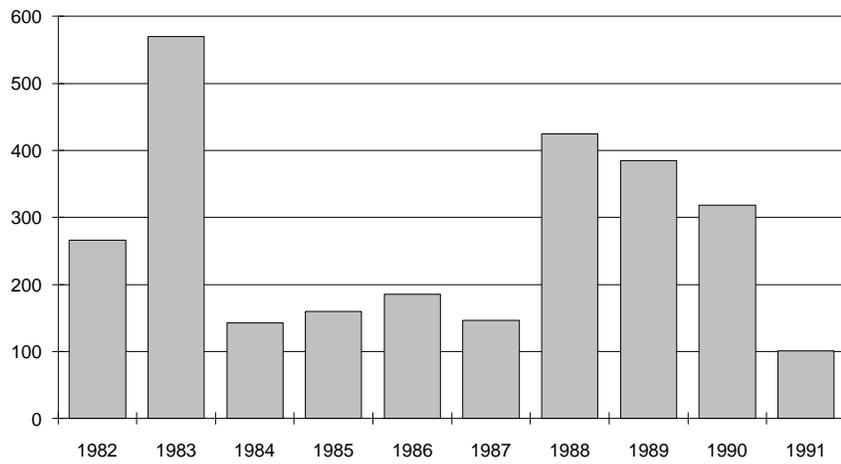
This explains why in 1988, a significant increase in savings was not accompanied by a similar increase in expenditures. [R#4]

BPA's major effort to save energy through conservation programs began in 1982. By 1991, the cumulative effects of these program investments had resulted in over 308 aMW in efficiency gains. [R#4]

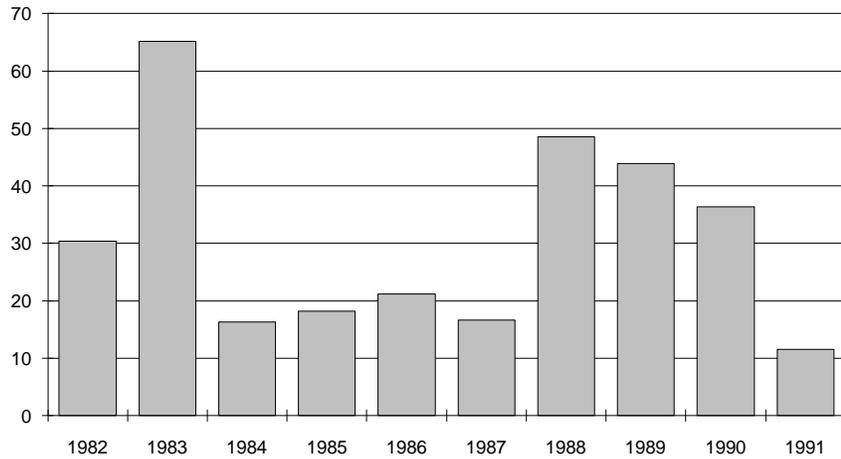
**ANNUAL DSM
EXPENDITURE
(\$1,000,000)**



**ANNUAL ENERGY
SAVINGS (GWH)**



**ANNUAL CAPACITY
SAVINGS (aMW)**



Program Overview

The Manufactured Housing Acquisition Program (MAP) was developed through the efforts of a diverse group of parties. After years of negotiation and planning, the Northwest Power Planning Council, BPA, public and investor-owned utilities in four states, and 18 housing manufacturers were able to reach an agreement by which all new electrically heated manufactured homes in the Pacific Northwest would be built to standards that exceed the new proposed HUD code by nearly 50%. The program encompasses the states of Washington, Oregon, Idaho, and Montana, where 10,000 to 13,000 manufactured homes are constructed and sited each year. These represent about 30% of all new electrically-heated single family detached homes in the region. [R#8]

MAP evolved from the conceptual stage in 1986 to the full-fledged program launched in April, 1992. In November, 1986, when the value of potential savings from manufactured housing was recognized, a Manufactured Housing Work Group was formed. The long-term purpose of this group was to lay the groundwork for development of a regional manufactured housing energy-efficiency program. The Work Group convened with members representing manufacturers, utilities, trade associations, regulatory agencies, the Pacific Northwest Power Planning Council (Council), Pacific Northwest Laboratory, and BPA.

In June, 1987, the Council made a specific recommendation to BPA, suggesting that they aggressively pursue the acquisition of data that could support the formation of a regional manufactured housing program. As a result, the Work Group formulated recommendations to BPA that would serve to further this goal: (1) that manufactured homes be incorporated into the ongoing Super Good Cents program for site-built homes, with utilities having the option of participating and incentive payments being made to either the home buyer, the dealer, or the manufacturer; and (2) that manufactured homes be included in BPA's Residential Construction Demonstration Project, (RCDP), thus allowing the generation of data on cost-effectiveness of specific measures.

Under RCDP, 150 new manufactured homes were built to specifications developed by a subgroup of the Work Group. The homes were sited within the region and data on

energy use were collected during the 1989/90 heating season. In the spring of 1989, after the RCDP project had ended, the Work Group recommended that manufactured homes be included in the SGC program until the data generated by RCDP could be evaluated and the structure of a more permanent manufactured housing program could be finalized.

In January, 1991, a new work group was formed, the Manufacturer's Acquisition Committee (MAC). This group initially had just five members, one representing each of the key parties: BPA, the Council, the manufacturers, the state energy offices, and the public utilities. It soon became evident that in order for the program to work, all of the region's utilities had to participate. The group was subsequently expanded to include representatives from the region's investor-owned utilities and the public utility association. The group met monthly to discuss issues in the development of MAP. Special committees were convened as necessary in which technical issues were discussed among a broader group of participants. Using data generated by RCDP and other current information, technical specifications, incentives, and administrative and tracking procedures were agreed upon among all the groups. Such concurrence was no easy task but through cooperation and collaboration among the participating groups, consensus was reached and the needs of all parties were addressed.

The program that finally resulted from years of research, discussion, and negotiation, is very straightforward. Manufacturers voluntarily agreed to contract with BPA to build homes to the required specifications. BPA reimburses each manufacturer \$2,500 (1992\$), for each home built. The homes are then distributed among dealers throughout the region. After the home has been purchased, the State Energy Office and the local utilities track where it is sited. If the home is sited within a non-BPA utility's service area, the cooperating utility reimburses BPA for the amount of the acquisition payment, plus \$150 to cover a portion of BPA's administrative costs. All 18 home manufacturers and five of the six investor-owned utilities in the region are participating in the voluntary program. In addition, four manufacturers -- one in Nebraska and three in California -- that ship homes into the Pacific Northwest region have also joined MAP.

Implementation

By soliciting the participation of every manufactured housing producer in the region, program designers eliminated the need to market MAP to the approximately 10,000 to 13,000 manufactured home buyers in the region.[R#11]

Some of the local electric utilities also encouraged participation in the program by instituting a sizeable hook-up fee for any home which did not meet Super Good Cents standards. Home manufacturers responded by providing the energy-efficient homes that their customers would be demanding in order to avoid paying the fee.

Since the program began, several advertising initiatives have been pursued. A 30-second television commercial has been produced that is integrated with an ongoing manufacturers' advertising and marketing program, called Northwest Pride. MAP homes were set up for public viewing in downtown Portland and downtown Seattle. These media events were very successful and a similar event is scheduled for Boise. Additionally, the manufacturers and participating utilities have access to the use of the Super Good Cents logo, which is well recognized by customers within the program area. A Super Good Cents manufactured housing exhibit has been displayed at home shows and county fairs throughout the region.[R#12]

MEASURES INSTALLED

Cost-effectiveness was the primary factor considered when program designers chose which measures to include in MAP. The Northwest Power Planning Council ran building simulations in order to identify the cost-effectiveness of particular measures. The results were reviewed by the Technical Advisory Group, who suggested an appropriate combination of measures for inclusion in the program.[R#5]

Much of the information used in developing and validating the computer simulations was based on the results of RCDP and Super Good Cents. Under Super Good Cents, different measures were specified for three different climate zones. For MAP, the manufacturers supported the establishment of a single set of specifications in order to streamline their production processes. The utilities and manufacturers agreed, and the final set of requirements apply for all homes, regardless of the climate zone in which they are sold or sited.[R#6] Both R and U values are specified as shown in the table below. The specifications provide some flexibility in home design, with some different allowable values, depending on the design. For example, flat ceilings require higher insulation levels than sloped ceilings. Additionally, homes

Manufactured Housing Specs	U_o (a)	U_a (b)	Wall (c)	Roof (c,d)	Floor (c)	Door (c)	Glazing (U_o)	Annual Estimated Heating kWh
HUD Code	0.126	640	R-11	R-11	R-7	R-5	0.80	13,800-23,500
Base Home	0.096	530	R-11	R-19	R-11	R-5	0.80	10,900-19,100
SGC/RCDP	0.074	388	R-19	R-38	R-30	R-5	0.45	5,600-10,900
MAP	0.054	305	R-21	R-49	R-33	R-5	0.35	4,000-8,500

(a) U_o is the Transmission Heat Loss Coefficient in Btu/hr-ft²-°F

(b) U_a is the overall heat loss coefficient in Btu/hr-°F

(c) R-values are nominal

(d) MAP specification for sloped (vaulted) ceiling areas is R-38.

[R#6]

Implementation(continued)

with higher efficiency windows may have a higher percentage of glazing than homes with less efficient windows. [R#5,6,7]

In addition to the manufacturing specifications, MAP includes on-site specifications which set-up crews must follow. The manufacturers are also required to provide certain materials to be used by the set-up crews to ensure proper installation. The specifications cover the following:[R#9]

- Damage repair
- Air sealing
- Crawl space moisture control
- Crossover ducts
- Operational checks
- Homeowner information
- Radon reduction measures.

STAFFING REQUIREMENTS

At BPA, the Program Manager, Don Davey, is the central contact person for MAP. Additionally, staff in the New Residences section at BPA assist in the program administration, as do members of BPA's marketing sections.

In the state energy offices, up to three people are involved in MAP. MAP home inspectors, who are certified to do home inspections through HUD, are employed by the

state energy offices. MAP contracts with these inspectors to perform the inspection to MAP standards. Typically 5 or 6 inspectors operate within each state; Oregon currently has one inspector dedicated to performing only MAP inspections. The state energy offices also coordinate training sessions for set-up crews and dealers. Additionally, both the Washington and Oregon state energy offices offer blower door tests to MAP homeowners. The Montana Department of Natural Resources and Conservation offers portable infrared scans to MAP homeowners.[R#12]

Individual utility staffing needs vary, depending on the size of the utility service area and the number of homes sited in the area. Typically, each utility employs two or fewer FTE's to administer and implement MAP. Utilities are responsible for verifying the home siting and conducting on-site inspections if necessary. Currently, only the larger utilities are conducting on-site inspections.

Monitoring and Evaluation

MONITORING

Manufacturer's building designs are reviewed and qualified by State Energy Offices. Each home is inspected and certified at the manufacturing site by an authorized quality-control inspector. Dealers are provided with service area maps and utility contact lists so that they can inform the utility when a MAP home is to be sited in a particular location. After homes are sited, utilities must perform site-verification inspections, which consist of visits to the newly-sited homes, and documentation of the HUD identification numbers on verification forms which are then sent to BPA. Utilities may also inspect the home more thoroughly at the home-site to ensure that on-site specifications and manufacturers instructions have been complied with. If those inspections do occur, the utility fills out a "Comment Form", indicating any discrepancies in compliance and specifics regarding each home.

A vendor was selected by the Oregon Department of Energy to develop a computer tracking system for use by BPA, each manufacturer, and the four state energy offices. It is anticipated that utilities will also eventually make use of the system, which, when fully installed, will simplify the tracking process, allowing information on the status of each manufactured home to be easily transferred among the various agencies. BPA is producing interim monthly reports that show where homes are to be sited, based on information provided by the manufacturers. These reports will continue to be provided to the utilities until the states' tracking system is totally operational.

EVALUATION

A six-month review meeting was held in late October, 1992. All involved in MAP were invited to the meeting, and comments were accepted and considered regarding the program. In general, most participants have been pleased with the program. The manufacturers indicated that implementation had gone smoothly. The utilities were also pleased, except many indicated that they could perform inspections and verifications more efficiently if dealers were more diligent about informing the utility when a home was to be sited in a particular area. BPA was happy that the utilities had been timely in submitting verification and comment forms, along with their incentive reimbursements.

DATA QUALITY

SUNDAY is the computer modeling program used to predict the annual space heating energy use of each MAP home design. A study of 120 RCDP homes heated with

forced air was completed in October, 1991, confirming that SUNDAY predictions were accurate. With this confirmation, the use of SUNDAY to establish which measures were cost-effective was verified. The State Energy Offices now use of simplified version of SUNDAY, called WATTSUN to certify MAP home designs. [R#10,14]

Program savings are based on a comparison to manufactured homes typically constructed in the region, as opposed to the HUD code. (Note that the base home exceeds the HUD Code in insulation levels; program savings based on a comparison to a HUD code home would be even greater.) Specifications are shown in the Manufactured Housing Specs table in the Implementation Section. Expected savings were determined based on submetered data from the 150 RCDP homes, submetered data from a sample of SGC homes, and energy use modeling calculations from SUNDAY. The regionwide average energy savings was thus determined to be 6,710 kWh/year. This average annual savings figure was derived by calculating the climate-zone weighted average savings for houses sited across the region's three climate zones, and for the average house size of 1,445 square feet. Savings were further de-rated by 10% to 6,000 kWh/year. Annual demand savings in aMW were determined by dividing the annual energy savings in kWh/year by 8,760,000. [R#5,14]

Unlike other profiles in this series, savings and costs are presented as predicted by BPA. Because this program has been in operation for less than one year, no actual savings or cost figures are available; however, measure cost data have been verified by BPA, and the results were presented at the six-month review meeting. [R#14] In presenting levelized cost predictions for the four-year expected duration of MAP, The Results Center assumed a constant inflation rate equivalent to the rate for the first half of 1992. Utility costs are not likely to change, as the contract terms state that manufacturers will be paid \$2,500 per home for the duration of the contract.

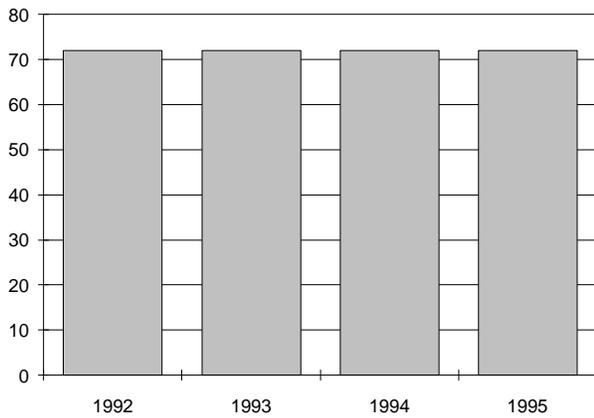
BPA, in calculating a levelized cost for MAP of 2.0 ¢/kWh, assumed a measure life of 45 years, a discount rate of 3%, and 7.5% line loss. Costs were assumed to be \$2,500 per unit incentive costs plus an additional \$670/unit administrative and other indirect costs. [R#5] However administrative costs have dropped, so total costs are likely to be less than those shown in the Costs Overview Table. The Results Center calculated cost of saved energy, as shown in the Cost of the Program section, using most of the same assumptions. The Results Center figures differ slightly from BPA's calculation due to the incorporation of inflation assumptions and the higher discount rate.

Program Savings

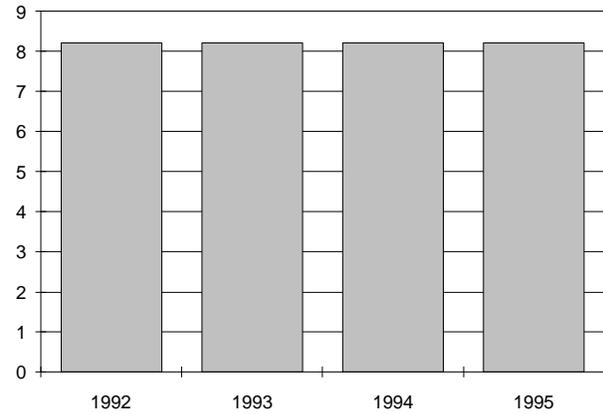
Savings Overview Table	Predicted Annual Energy Savings (MWh)	Predicted Cumulative Energy Savings (MWh)	Predicted Lifecycle Energy Savings (GWh)	Predicted Annual Capacity Savings (aMW)	Predicted Cumulative Capacity Savings (aMW)
1992	72,000	72,000	3,240	8.22	8
1993	72,000	144,000	3,240	8.22	16
1994	72,000	216,000	3,240	8.22	25
1995	72,000	288,000	3,240	8.22	33
Total	288,000	720,000	12,960	32.88	

[R#5]

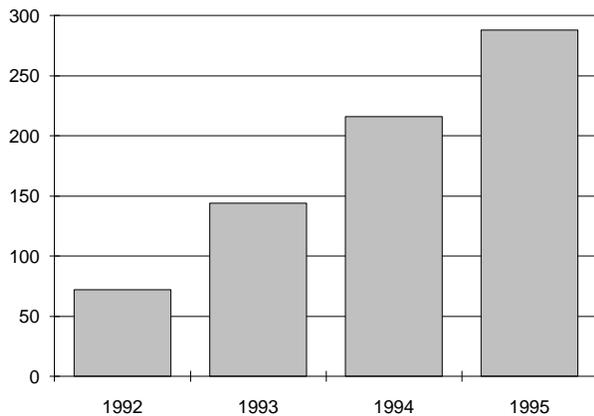
ANNUAL ENERGY SAVINGS (GWH)



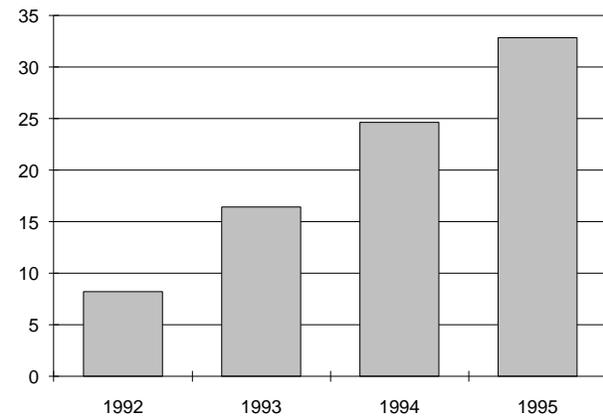
ANNUAL CAPACITY SAVINGS (aMW)



CUMULATIVE ENERGY SAVINGS (GWH)



CUMULATIVE CAPACITY SAVINGS (aMW)



On average, each MAP home is estimated to generate 6,000 kWh in annual savings, and 270 MWh in lifetime savings. (See the Data Quality section.) Approximately 12,000 homes are sited each year, thus savings are expected to be about 72 GWh annually. Annual demand savings are estimated to be 8 aMW.

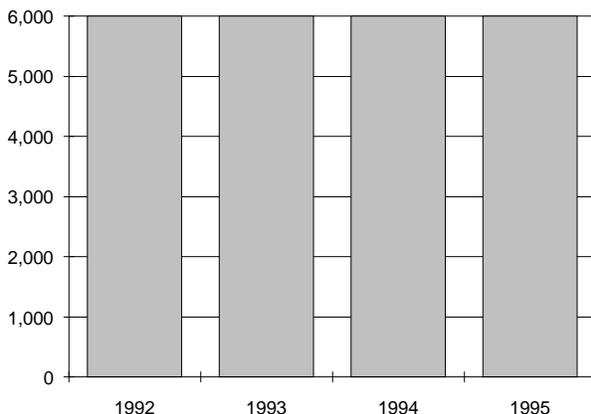
PARTICIPATION RATES

MAP is a multi-faceted program which depends on the participation of a number of entities. Besides enlisting the participation of the 18 home manufacturers in the region, and four outside the region, it was necessary to assure that the appropriate materials would be available to the manufacturers, and that the region's utilities were willing to participate.

Participation Table	Predicted Number of Homes Built and Sited	Annual Energy Savings per Home (kWh)
1992	12,000	6,000
1993	12,000	6,000
1994	12,000	6,000
1995	12,000	6,000
Total	48,000	

[R#5]

ANNUAL ENERGY SAVINGS PER HOME (KWH)



Program designers found that some industries, fearing loss of market share to suppliers of MAP-specified products, were more than happy to make changes in order to meet the needs of the program. For example, the insulation industry began supplying manufacturers with full width batt insulation in order to remain competitive with blown-in insulation products. This product which could be used to more easily achieve the specified level of attic insulation. Similarly, suppliers of vinyl framed windows began marketing sizes that would fit manufactured homes.

BPA also needed to enlist the cooperation of the region's utilities, who are expected to pay the acquisition payment to the manufacturer for homes sited within their service area. Three different types of utility are involved in MAP: BPA full requirement customers, BPA partial requirement customers, and investor-owned utilities. BPA pays the entire cost of DSM programs for its full requirement customers, thus their participation was not a major issue. About 15 partial requirement customers share the cost of DSM programs with BPA, and some negotiation was necessary to reach agreement with these participants. For the investor-owned utilities, participation was encouraged by the state utility commissions, who took a favorable view of MAP and tended to rule positively on MAP program expenditures. By March, 1992, most of the region's utilities had agreed to participate in MAP. The participation rate, based on the number of homes expected to be sited in each participants' territories, is estimated at 92%. (Note, however, that the remaining 8% of HUD code homes are expected to use gas as the primary heating fuel.) [R#5,14]

MEASURE LIFETIME

In calculating cost-effectiveness, BPA used a measure life of 45 years. [R#5]

PROJECTED SAVINGS

MAP is expected to last for four years in its current configuration. Through the agreements with the manufacturers and utilities, the MAP specifications will not change until 1996, unless all parties agree to a revision.

At an average of 12,000 homes manufactured and sited each year, lifetime savings of the four-year program are estimated to be 12,960 GWh.

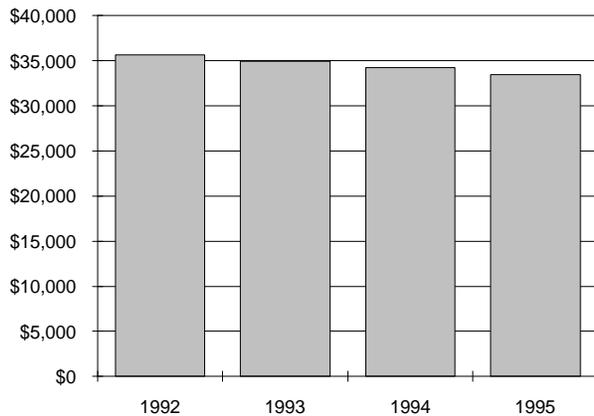
Cost of the Program

Costs Overview Table	Predicted Acquisition Payment (x1000)	Predicted Administrative Costs (x1000)	Total Program Cost (x1000)	Cost per Home
1992	\$28,138.3	\$7,541.1	\$35,679.4	\$2,973.28
1993	\$27,550.2	\$7,383.5	\$34,933.7	\$2,911.14
1994	\$26,974.4	\$7,229.2	\$34,203.6	\$2,850.30
1995	\$26,410.7	\$7,078.1	\$33,488.7	\$2,790.73
Total	\$109,073.7	\$29,231.8	\$138,305.5	

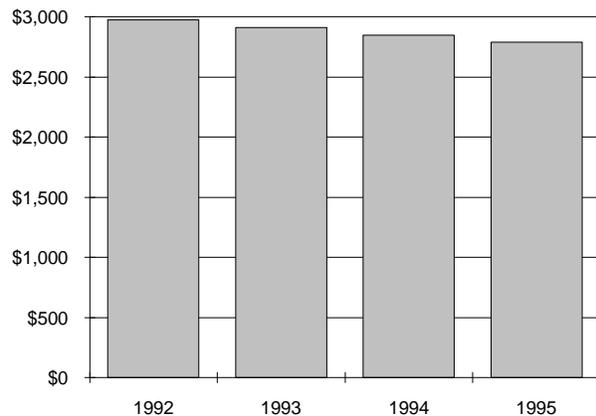
[R#5,6,7]

Note: Costs shown have been leveled based on an assumption of a constant inflation rate.

PREDICTED TOTAL MAP COSTS (X1000)



PREDICTED AVERAGE COST PER HOME



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1992	2.02	2.39	2.79	3.21	3.64	4.09	4.55
1993	1.98	2.34	2.73	3.14	3.57	4.01	4.46
1994	1.94	2.29	2.67	3.07	3.49	3.92	4.37
1995	1.90	2.24	2.62	3.01	3.42	3.84	4.27

Some program costs were incurred prior to the implementation of MAP in April, 1992. The acquisition payment for each home is \$2,500. However, there is provision for a decrease in payments if the HUD code minimums are increased. The manufacturers agreed that such a provision is fair, as they will still have to comply with the HUD code, and by participating in MAP, they are not likely to have to make changes in their manufacturing processes when the codes are changed.

Administrative costs, which include payment to states for technical support and in-plant quality control, as well as BPA's in-house program administration have been estimated at \$670 per unit. [R#5] Investor-owned utilities are required to add a \$150 administrative fee to each reimbursement that they make to BPA, to cover BPA's direct administrative costs (i.e. tracking, state energy office design qualification, and in-plant inspections). Actual internal costs at BPA to implement MAP are estimated to be about 12% of the acquisition payment, or \$300.

COST EFFECTIVENESS

The authors of a paper presented at the Summer Meeting of the American Council for an Energy-Efficient Economy state that the cost of MAP is very attractive. [R#5] The levelized cost, as calculated by BPA, is 2.0 ¢/kWh (assumptions used in that calculation are described in the Data Quality section of this profile). The Results Center cost-effectiveness calculations are shown in the Cost of Saved Energy Table for various discount rates. BPA typically spends about 3.0 ¢/kWh on DSM programs, and the avoided cost of conventional thermal generation could easily reach 6.0 ¢/kWh.

COST PER PARTICIPANT

The average cost per home sited and built under MAP is not expected to change over the four-year duration of the program. Acquisition payments will remain constant at \$2,500 per home, so the real dollar cost of the acquisition payments will decline at inflation. Including administrative costs, the levelized cost per home ranges from \$2,800 to \$3,000, as shown in the Cost Overview Table.

FREE RIDERSHIP

As discussed in the Implementation section of this profile, prior to the implementation of MAP, most home manufacturers were building to specifications slightly above the HUD requirement. However, none were manufacturing homes that met the high standards of MAP. Thus, MAP can be credited with the increased energy-efficiency of most, if not all, of the manufactured homes in the Pacific Northwest.

"When designing a DSM program that is intended to transform an entire market, there are no free-riders, because once the transformation takes place, there is no 'world' where someone can do DSM outside the program."
Tom Eckman, Northwest Power Planning Council

COST COMPONENTS

The majority of the expense for this program is the acquisition payment. Administrative costs at BPA represent about 12% of the total acquisition payment per home.

Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
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Coal Uncontrolled Emissions

A	9,400	2.50%	1,552,320,000	36,828,000	7,445,000	744,000
B	10,000	1.20%	1,655,280,000	14,256,000	4,807,000	3,564,000

Controlled Emissions

A	9,400	2.50%	1,552,320,000	3,683,000	7,445,000	60,000
B	10,000	1.20%	1,655,280,000	1,426,000	4,807,000	238,000
C	10,000		1,655,280,000	9,504,000	4,752,000	238,000

Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	1,655,280,000	4,356,000	2,376,000	1,188,000
B	9,400	2.50%	1,552,320,000	3,683,000	2,978,000	223,000

Integrated Gasification Combined Cycle

A	10,000	0.45%	1,655,280,000	2,930,000	475,000	1,188,000
B	9,010		1,488,960,000	1,061,000	357,000	71,000

Gas Steam

A	10,400		902,880,000	0	2,059,000	0
B	9,224		784,080,000	0	4,910,000	232,000

Combined Cycle

1. Existing	9,000		784,080,000	0	3,010,000	0
2. NSPS*	9,000		784,080,000	0	1,426,000	0
3. BACT*	9,000		784,080,000	0	198,000	0

Oil Steam--#6 Oil

A	9,840	2.00%	1,306,800,000	19,800,000	2,336,000	2,218,000
B	10,400	2.20%	1,386,000,000	19,642,000	2,938,000	1,426,000
C	10,400	1.00%	1,386,000,000	2,804,000	2,360,000	744,000
D	10,400	0.50%	1,386,000,000	8,237,000	2,938,000	453,000

Combustion Turbine

#2 Diesel	13,600	0.30%	1,734,480,000	3,453,000	5,362,000	293,000
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Refuse Derived Fuel

Conventional	15,000	0.20%	2,059,200,000	5,306,000	6,985,000	1,552,000
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Avoided Emissions Based on 720,000,000 kWh Saved (1992-1995)

In addition to the traditional costs and benefits there are several hidden environmental costs of electricity use that are incurred when one considers the whole system of electrical generation from the mine-mouth to the wall outlet. These costs, which to date have been considered externalities, are real and have profound long term effects and are borne by society as a whole. Some environmental costs are beginning to be factored into utility resource planning. Because energy efficiency programs present the opportunity for utilities to avoid environmental damages, environmental considerations can be considered a benefit in addition to the direct dollar savings to customers from reduced electricity use.

The environmental benefits of energy efficiency programs can include avoided pollution of the air, the land, and the water. Because of immediate concerns about urban air quality, acid deposition, and global warming, the first step in calculating the environmental benefit of a particular DSM program focuses on avoided air pollution. Within this domain we have limited our presentation to the emission of carbon dioxide, sulfur dioxide, nitrous oxides, and particulates. (Dollar values for environmental benefits are not presented given the variety of values currently being used in various states.)

HOW TO USE THE TABLE

1. The purpose of the previous page is to allow any user of this profile to apply BPA's level of avoided emissions saved through its Manufactured Housing Acquisition Program to a particular situation. Simply move down the left-hand column to your marginal power plant type, and then read across the page to determine the values for avoided emissions that you will accrue should you implement this DSM program. Note that several generic power plants (labelled A, B, C,...) are presented which reflect differences in heat rate and fuel sulfur content.

2. All of the values for avoided emissions presented in both tables includes a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

3. Various forms of power generation create specific pollutants. Coal-fired generation, for example, creates bottom ash (a solid waste issue) and methane, while garbage-burning plants release toxic airborne emissions including dioxin and furans and solid wastes which contain an array of heavy metals. We recommend that when calculating the environmental benefit for a particular program that credit is taken for the air pollutants listed below, plus air pollutants unique to a form of marginal generation, plus key land and water pollutants for a particular form of marginal power generation.

4. All the values presented represent approximations and were drawn largely from "The Environmental Costs of Electricity" (Ottinger et al, Oceana Publications, 1990). The coefficients used in the formulas that determine the values in the tables presented are drawn from a variety of government and independent sources.

* Acronyms used in the table

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

Lessons Learned / Transferability

LESSONS LEARNED

MAP is a prototype for DSM programs that seek to transform a market through consortia contracting. In a paper presented at the 1992 Summer Study of the ACEEE, Tom Eckman and his co-authors identified three elements deemed critical to MAP's success: the magnitude of the market; the existence of a single contracting entity or "broker" (BPA); and the ability to negotiate with a limited number of potential suppliers and distributors. [R#16]

The successful implementation of MAP demonstrates the importance of negotiation and collaboration in the design of such a program. With so many different entities whose needs had to be satisfied, the collaboration process was well tested in the MAP design period. The utilities wanted to ensure that they were getting a good return on the investment they would be making in acquisition payments to the manufacturers. The manufacturers in turn had to be certain that the specifications were reasonable and could be feasibly implemented, and that the resulting energy-efficient homes would meet the needs of their customers. In advocating the design and implementation of MAP, BPA and the Council found that their experience with the pilot projects was invaluable in the negotiation process. The availability of verified data eased the task of convincing the manufacturers that construction of energy-efficient homes was not only possible, but likely to be beneficial.

Home dealer cooperation also had to be enlisted to assist in informing the utilities where homes were being sited. An agreement had to be reached whereby the state energy offices in the region, whose staff conduct home inspections for HUD as required by federal code, could also implement the MAP inspections. The state energy offices have provided support to MAP in other ways, by organizing training sessions and facilitating the design and installation of the computer tracking system.

By establishing specific guidelines for home inspection and certification, MAP administrators believe that many potential problems have been avoided. Additionally, once the tracking system installation is complete, program implementation is expected to become more streamlined. The one complaint that was voiced at a six-month review meeting was that the utilities needed the dealers to be more diligent about informing the proper utility of a planned home siting in the utility's service area. Once the computer tracking system installation has been completed, such problems will be less likely to occur, and the efficiency of implementation process as a whole is expected to improve.

BPA has been able to streamline approval of home designs by encouraging manufacturers to upload their design specifications at night when the computer system is less busy. Manufacturers in Oregon have taken advantage of this process, transferring information and receiving design approval by the beginning of the next business day.

Those involved with the MAP program from design to implementation have identified five elements key to the success of MAP. First, the establishment of a research and demonstration project was vital to providing necessary data for the development of the specifications for MAP. Second, the manufacturers were able to cooperate with state energy offices in order to determine how specifications could be met with a minimum of disturbance of the ongoing manufacturing process. Third, by making use of the existing quality assurance system, the program avoided development of a complex new system for that purpose. Fourth, through implementation of the Super Good Cents program, market acceptability had been established, and thus was not an issue in promoting MAP to manufacturers and utilities. Finally, the adoption of hook up fees in some areas served as a catalyst to the finalization of MAP.

TRANSFERABILITY

In its present form, MAP is phenomenally successful. Nonetheless, there are opportunities for different methods of program implementation, depending on the specific characteristics of a region in which such a program is to be operated. For example, the system of BPA paying acquisition payments directly to the manufacturers, with utilities later reimbursing BPA, could be modified to have each utility in a region pay the manufacturer directly. This approach was discussed in the MAP negotiations, but was not used for two reasons: (1) the manufacturers did not want to contract with over 120 individual utilities and (2) the utilities did not want to contract with 18 different manufacturers. Additionally, the use of BPA as a broker reduced the administrative costs of the program. [R#14]

The use of state energy office HUD inspectors for conducting MAP inspections is logical and efficient, however other building inspection methods could also be developed. In other regions, the technical specifications for qualified homes would have to be modified, and these could be developed in the same manner that the MAP specifications were designed -- through pilot projects and existing new site-built home standards. (Most regions currently have some type of site-built home rating program.)

MAP has been so well thought-out and negotiated, that it is certainly the best method of implementing such a program in the Pacific Northwest. While some regional changes may be desirable if a similar program were to be implemented elsewhere, the general configuration of the program, including the method by which it was designed, would not need to be altered.

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