Bonneville Power Administration

Super Good Cents

Profile #7, 1992

Executive Summary

Bonneville Power Administration (BPA) has spent over a billion dollars on DSM since 1982. BPA's Super Good Cents (SGC) program focuses on increasing the efficiency of new, electrically-heated residential construction by offering incentives for efficiency that met the Northwest Power Planning Council's Model Conservation Standards (MCS).

The Super Good Cents program, which commenced in 1984, was part of a two-pronged implementation effort. The SGC program was a marketing and education program promoting energy-efficient building practices. The other prong of the effort was a building code adoption program called Early Adopter. Both programs were designed to take advantage of the opportunity cost of building new homes to higher energy efficiency standards rather than trying to retrofit them at some later date. Inversely, both programs were designed to avoid the lost opportunity of not building energy-efficient homes in the first place.

The objectives of making both the public and the home builders aware of the SGC program and the advantages of a well-insulated home were largely achieved. The participation rate for certified SGC homes built within the BPA service territory (25%), however, fell short of the program's stated goals.

In 1991 SGC provided BPA and its retail utilities with 30.8 GWh of energy savings and 3.99 average megawatts of capacity, at a cost of $10.9 million. These savings were achieved by providing incentives for increased ceiling, wall, floor, and slab perimeter insulation; duct insulation for heating and cooling systems; double or triple pane windows; and thermally improved doors. Through 1991 BPA paid $1,000 for each site-built home constructed to SGC standards, and $2,000 for new manufactured housing.

The overall results of SGC have to be considered excellent. In 1991 the states of Washington and Oregon, representing 90% of the new home starts within the BPA service territory, adopted building codes whose specifications met the SGC standards. This required BPA to reevaluate the program and to set higher building standards for the 1992 SGC program.

Super Good Cents

Utility:	Bonneville Power Administration (BPA)
Sector:	Residential
Measures:	Promote compliance with the Model Conservation Standards (MCS) in newly constructed electrically-heated homes.
Mechanism:	BPA provides utilities with promotional and technical materials and funds for cooperative advertising, incentives, marketing, and training.
History:	1984-1991 (revised in 1992)

1991 Program Data

Energy Savings:	30.8 GWh
Lifecycle Energy Savings:	2,159 GWh
Peak Capacity Savings:	3.99 aMW winter
Cost:	$10.9 million

1985-1991 Program Data

Energy Savings:	176.8 GWh
Lifecycle Energy Savings:	5,598 GWh
Capacity Savings:	9.79 aMW
Cost:	$36.4 million
Participation rate:	25.2%

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 and operated wholesale electric utility company. 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 the power from the twenty-nine additional federal dams in the region. To accomplish this, BPA has designed and built a network of long distance high-voltage transmission lines which has grown over the last forty-seven years to become the backbone of the transmission system for the Northwest.

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. BPA sells power to 173 wholesale customers made up of 123 public systems, 8 investor-owned utilities, 16 industrial firms, 6 federal agencies, and 20 customers outside the Pacific Northwest. [R#5]

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 Conservation, BPA develops programs that present financial incentives to generators, transmitters, and end users of electricity for the purpose of obtaining the investment in and use of:

- measures 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 1990 STATISTICS

Number of Wholesale Customers	173
Energy Sales	85,200 GWh
Revenue from Energy Sales	$1.945 billion
Summer Peak Demand	17,664 MW
Generating Capacity	23,528 MW
Average MW Delivered	9,700 aMW
Average Electric Rates	
Sold by BPA	1.7-2.8 ¢/kWh
Sold by BPA-Supplied Utilities	1.5-6.0 ¢/kWh
Average Rate to All Utility Customers	4.4 ¢/kWh

Because BPA's electricity is mostly hydro, the average megawatt (aMW) capacity stated in the table above is a more important number than the generating capacity. (The full generating capacity of 23,528 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#11] The 9,700 aMW delivered in 1990 indicates that BPA sold ~1,236 aMW of nonfirm power that year. Although 1991 statistics are not available, the numbers in the table above have not changed significantly in the last three or four years and it is not likely that they changed significantly in 1991. [R#5]

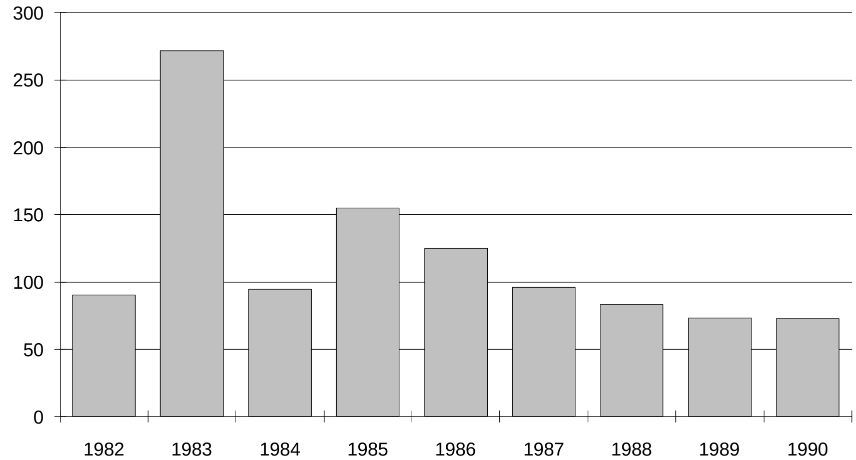
Utility DSM Overview

In order to fulfill the added responsibilities mandated by the Pacific Northwest Electric Power Planning and Conservation Act, it became necessary for 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 1990 BPA spent $1,061.9 million on a wide range of DSM programs.[R#9] In addition, BPA initiated an industrial-sector Conversion and Modification (Con/Mod) program in 1988, whose $69.2 million cost will be spread out over a ten year period but whose savings were realized almost immediately.[R#9] This explains why in 1988, a significant increase in savings was not accompanied by a similar increase in expenditures.

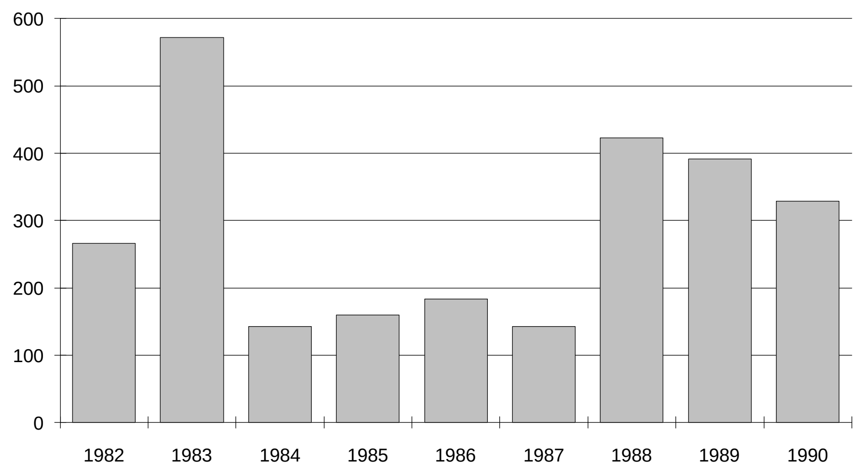
BPA's major effort to save energy through conservation programs began in 1982. Since then the cumulative effects of these program investments have resulted in about 300 aMW in efficiency gains. The following table gives a breakdown of these gains.[R#1]

Utility DSM Overview Table	Annual DSM Expenditure ($ million)	Annual DSM Energy Savings (GWh)	Annual DSM Capacity Savings (aMW)
1982	$90.6	266	30.4
1983	$271.6	572	65.3
1984	$94.5	143	16.3
1985	$155.1	160	18.3
1986	$125.1	184	21.0
1987	$96.0	143	16.3
1988	$83.2	423	48.3
1989	$73.1	392	44.7
1990	$72.7	329	37.5
1991	N/A	N/A	N/A
Total	$1,061.9		

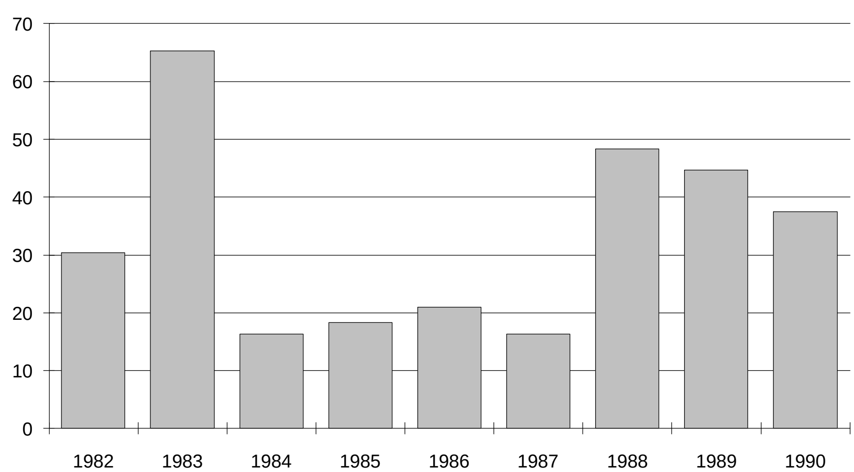
ANNUAL DSM EXPENDITURE ($1,000,000)



ANNUAL DSM ENERGY SAVINGS (GWH)



ANNUAL DSM CAPACITY SAVINGS (aMW)



RESIDENTIAL CONSERVATION PROGRAMS CURRENTLY FUNDED BY BPA

Residential

Residential Weatherization Program
Residential Construction Demonstration Project
Energy-Efficient Manufactured Housing Program
Northwest Energy Code Program
Super Good Cents Program
State Technical Assistance Program
Local Gvt. Financial Assistance Program
Eugene Water and Elec. Board Bond Financing

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
Electric Ideas Clearinghouse
Long-Term Commercial Acquisition Process
Lighting Design Lab
Purchase of Energy Savings FT/Pilot Program
Energy Savings Plan
Aluminum Smelter Con/Mod Program
Sponsor-Designed Program
Irrigated Agriculture Program

Others

Research and Development
Environmental Oversight
The Partnership Program

ANNUAL SAVINGS THROUGH DIRECT BPA EFFICIENCY PROGRAMS (aMW)

Sector/subsector	aMW FY 81 - 90*
Existing Residential	71.0
New Residential	3.2
New Mobile Homes	0.1
Water Heaters	39.5
Commercial 61.7	
Irrigation	7.1
Industrial	15.4
Subtotal	198.0
Direct Service Industries (Con/Mod)	100.1
Total Gains From Efficiency	298.1

* Includes transmission and distribution savings.

Program Overview

The Super Good Cents program began in 1984. Its main objective was to reduce the amount of electricity necessary to provide space heating, water heating, and cooling in newly-constructed, electrically-heated homes. The program initially targeted site-built, electrically-heated single-family and multifamily homes, but in 1988 factory-built manufactured homes were added.

The main impetus for the SGC program was the Northwest Power Planning Council's adoption of the Model Conservation Standards (MCS) in 1983. The goal of the MCS was to ensure that all new electrically-heated buildings served by BPA utilities were constructed to energy efficiency standards that would save energy and were also economical for building owners. Also, implementation of MCS would decrease the size of the energy load that new construction puts on the power system, reduce the need to weatherize buildings at a later date, effectively avoiding "lost opportunities." (Many conservation measures are economical to include when a dwelling is being constructed, but are prohibitively expensive or structurally impossible to add at a later date and thus become lost opportunities if they are not installed when the home is first built.)

To implement the MCS, BPA established two full scale programs:

1. The Super Good Cents (SGC) program -- a marketing program administered by public and private utilities to promote energy-efficient practices within BPA's service territory, and

2. The Early Adopter (EA) program -- a code program adopted and administered by local governments to promote energy efficient-practices within BPA's territory.

There were both incentives and penalties for utilities and municipalities to participate in these MCS programs. The incentives included financial assistance to the adopting jurisdiction or utility. (Some of the financial assistance was used to provide direct incentives to the builders and home buyers.) The penalty was the threat of imposing a surcharge of 10% on BPA power sales to utilities that do not submit a declaration that they would operate SGC (or an equivalent program) or were in an Early Adopter's area of jurisdiction. As of July 1991, the surcharge had not been used, but the provision for its use still exists.

Utility participation in the SGC program increased each year from 1984 (22 utilities) to 1988 (113 utilities). The 1988 participation rate of 88% included nearly all the utilities that could be reasonably expected to join.[R#10] Most of the utilities not participating were either running acceptable alternative programs to the SGC or were covered by Early Adopter or NW Energy Code (NWEC) jurisdictions.

The financial arrangements between BPA and the utilities for implementing the SGC program fell into three categories:

- Utilities that received all of their power from BPA and thus received a 100% reimbursement for the cost of the SGC program.

- Cost-share utilities that received part of their power from BPA and received a percentage of their SGC financing from BPA. (This is not proportional; e.g. if a utility receives 1% of its power from BPA it receives a 75% reimbursement for SGC costs.)

- Exchange agreement utilities which are investor-owned utilities that bought and sold power to BPA but with a zero net exchange. (Even though the power exchange is equal the money exchange is not, as BPA buys the power at a higher price than it sells it.) They were allowed to use the SGC name for their own programs but did not receive funds from BPA.

The Super Good Cents standards were adopted as code by the states of Washington (effective July 1, 1991) and Oregon (effective January 1, 1992). Idaho and Montana are currently considering adopting Super Good Cents standards into their building codes in the near future. These code adoptions prompted BPA to reassess the SGC program.

At the beginning of 1992 the SGC program was reevaluated. The SGC standards were increased and home appliance efficiency standards were added. A complete list of the new SGC specifications is available from a BPA document titled "Long Term Super Good Cents Technical Specifications For Site-Built Single and Multifamily Homes."

Implementation

MARKETING AND DELIVERY

Super Good Cents is mainly a marketing program. Through it BPA offers participating utilities promotional and technical materials and funds for cooperative advertising, marketing and training. The utility offers builders help both in building homes to SGC standards and in selling them. A number of SGC booklets such as Home Buyer's Guide and Builders Guide are published and made available to the participating utilities. These booklets are then distributed to those involved in new home construction. By approaching builders and buyers, both supply and demand are created for these energy-efficient homes.

The SGC program was marketed and delivered in three phases. Phase One took two years (1985 and 1986) and was seen as an introductory period. The emphasis during this phase was to spread information about the program, provide training to utility personnel to help them operate the program, and educate builders about the details of SGC construction. This was accomplished mainly through advertising campaigns. The original campaign was designed to raise curiosity and introduce the program to the region. It consisted of 30-second TV and radio spots, newspaper, magazine, and billboard advertising; all with the SGC logo. This original campaign was followed by a campaign that focused on the features of SGC homes. It included catchy slogans such as "The Most Comfortable Investment You'll Ever Own" and included a regional toll-free information number. In addition to putting together the ad campaign, financial assistance was provided in the form of administrative and advertising support for utilities and incentives for owners or builders of SGC homes.

Phase Two also took two years (1987-1988) and was an adjustment and maturation period for the program. By the end of the first phase not all of the eligible utilities had signed on and the market penetration was short of its goal of 10%. However, the consumer awareness target of 40% had been achieved and the ad campaign shifted its theme to "smart" buildings that are also beautiful. When Phase Two began BPA had just completed a cost-effectiveness analysis of the Model Conservation Standards (MCS). As a result, some changes were made in the program specification and incentives beginning in 1987. The major specification changes were the elimination of the requirement for heat-recovery ventilators and continuous air-vapor barriers. Also the incentives became variable by climate zone instead of being based upon a regionally fixed number. (The area served by BPA is divided into three climate zones based on the number of heating degree days.) The incentives were reduced from a flat $2,000 to $1,000 in Zone 1, $1,250 in Zone 2, and $1,500 in Zone 3.[R#1]

In 1987 BPA implemented its Surcharge Policy which required all utilities to submit a residential MCS plan by the end of the year. As a result many of the remaining eligible utilities were brought into the SGC program. The new Surcharge Policy eliminated the performance-based requirements for utility effort and replaced it with a "good faith" effort criteria. However, it was not clear how good faith would be determined.

Also in the second phase BPA decided to decrease emphasis on the regional effort and focus on local implementation and support. This meant increasing the number of builders building SGC homes, the number of buyers or builders that have house plans reviewed by utilities, utility involvement and support, and making a shift toward more involvement and responsibility for the program by BPA's Area Offices and the utilities themselves. BPA also put together the "Smart Team" whose job it was to provide direct on-site technical assistance for the utilities to implement the program. Expenditures for regional advertising were reduced while expenditures for utility advertising were increased.

Phase Three of the program began in 1989. In this phase BPA continued the program as a voluntary marketing and promotion effort and maintained the incentives. The long-range plan was that the incentives would gradually be decreased until eventually eliminated in 1995.

In 1992 BPA was forced to make an unplanned adjustment into a fourth phase. This was prompted by the adoption of the MCS as standard building codes by the State of Washington in July of 1991 and by Oregon in January of 1992. Because the SGC program was designed to promote greater adoption of the MCS, it seemed no longer necessary for BPA to promote the SGC program in these states. However, instead of terminating the program the standards were raised, where appropriate, to a level 30% above the original SGC standards and the program was expanded to include the promotion of energy-efficient electric end-use devices in the homes. There are also provisions for the use of passive solar design features to meet the new SGC standards.

Through 1991, BPA provided additional incentives for SGC compliance of $1,000 for new site-built homes and $2,000 for new manufactured housing. BPA also provided training programs to utility company personnel who are administering the SGC programs. All of the SGC services continue to be provided at no charge to the customer.

MEASURES INSTALLED

The efficiency measures installed as a result of the SGC program were mainly building shell improvements in new construction. Included among these measures were:

- Ceiling insulation of R-38 to R-60,
- Exterior wall combined insulation of R-19 to R-31,
- Floor insulation of R-19 to R-30,
- Slab perimeter insulation of R-10 to R-15,
- HVAC system ducting insulation of at least R-11,
- Thermally improved, low air leakage, double or triple pane windows,
- Thermally improved doors with a rigid foam insulated core with sealing gaskets.

A complete list of the 1992 SGC standards (which are higher than those listed above) is available from BPA upon request.[R#2]

STAFFING REQUIREMENTS

BPA did not recommend staffing levels to the participating utilities. There was a wide range in the staffing levels at the various utilities for the SGC program from a high of 26 full-time equivalent (FTE) staff people to nearly zero. The average for all the participants, in 1990, was 1.4 FTE staff with the total program staffing in excess of 115 FTE for the entire region. There was also a large range of implementation effectiveness as measured in SGC certifications per FTE. Nearly two-thirds of the utilities with certifications in 1988 had 10 or fewer certifications per FTE. The mean for all utilities was 22 certifications per FTE and the highest was 196. As might be expected there is a strong correlation between the certification per FTE and the SGC home market penetration. The staffing and productivity ranges seem to suggest that there was also a wide range of utility company commitment to the SGC program.

Monitoring and Evaluation

MONITORING

BPA monitors the results of the SGC program in general terms through the SGC home certification process. This is done to help BPA keep track of the number of SGC homes as well as to protect the homeowners who claim the SGC standard when dealing with bank loans or advertising for resale.

The details of the monitoring process are handled by an independent group, John Shearer and Associates. They are paid to monitor the SGC program in two general areas. First, the workings of the offices of the participating utilities are observed. Details such as whether good office files are kept, the quality of computer runs, and how frequently the utility sends field personnel to inspect the SGC homes are noticed. Problems are identified and the necessary corrections are made. The second area of monitoring is on the building site. The utility representatives are accompanied to the home several times during its construction to make sure it is being built to SGC specifications and to note any deviations.

EVALUATION

BPA has prepared two preliminary evaluation reports of the program (the first in 1987 and the second in September of 1988) which were used to make early program adjustments to maximize the effect of the program. A final report titled "Super Good Cents Program Evaluation" was published in July of 1989. This report included an evaluation of the program achievements, the performance and cost of SGC homes, and a process evaluation. These reports are available from BPA. Also, the whole program was reevaluated in 1992 and new standards were set. This reevaluation is not discused here (see Program Overview and Implementation sections). In addition some evaluation of the construction of selected homes was done using blower door testing.

Part of the 1989 evaluation was to determine the level of consumer awareness of the SGC program. It was found that awareness increased each year from 20% in 1985 to 73% in 1987. Although it dropped to 61% in 1988 it later stabilized at around 75%. Awareness among builders followed a similar pattern but stabilized at a slightly higher 82%. Based on these results it was concluded that the program was effective in achieving its awareness objectives.

The evaluation also revealed some interesting attitudes about energy efficiency. A clear majority of the consumers (~70%) felt that energy efficiency was "very important" when considering a new home. A majority also said that they would be willing to spend $4,000 more for energy efficiency features in a new home. This contrasts with builders' attitudes where only 46% in 1987 and 39% in 1988 considered energy efficiency to be "very important" and that they felt consumers would only be willing to spend $1,000-$1,500 additional on energy efficiency features.

The program was also successful in enlisting utility participation. By the end of 1988, 88% of the eligible utilities were operating a SGC program while most of the remaining utilities were involved in an approved alternative program.

The overall assessment of the SGC program found both successes as well as significant drawbacks. Some of the chief successes of the program were:

- It raised region-wide awareness of both energy efficiency and SGC.
- It achieved a high level of participation among utilities.
- It created or sustained jobs and contributed to local economies through related spending.
- It developed support for the Northwest Energy Code.
- It increased the regional capability to offer energy-efficient new construction.

On the downside the evaluation revealed drawbacks such as:

- It is a costly program to operate in terms of labor requirements and in advertising and incentive costs.

- The labor and training for each builder was not spread over many jobs, as many builders built only one home under the program.

- Higher penetration rates appear to require higher program investments.

DATA QUALITY

The most reliable data in this profile is in the Utility Overview Section, the DSM Overview Section, and the Program Cost Section. The possible exception is the program cost in the first couple of years during which time there was less precise record keeping.

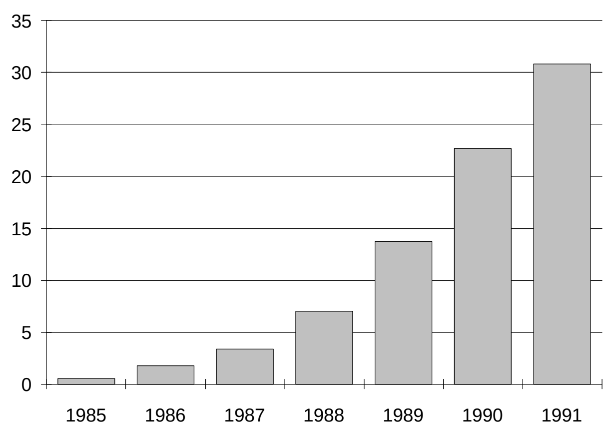
The data in the Savings Section, which includes both kWh and aMW savings, is inherently less precise for any DSM program because it involves some level of estimation. The savings estimates for SGC are based on a combination of engineering estimates and metered results from selected buildings. BPA feels that this method yields a fairly close approximation of actual savings. In fact, the accuracy of the savings estimates for the SGC program is very high relative to other utility DSM programs. BPA estimates the life of the measures at 70 years because most of the measures were building shell improvements designed to last the life of the building. The cost of energy calculations are based on costs, savings estimates, and life of the measure estimates. However, small errors in estimates will not significantly affect these calculations.

The cumulative and lifecycle savings numbers presented assume that there is no attrition of the measures due to technology failure or behavior changes. Because the measures are mostly building shell improvements, this is a fairly safe assumption. (For example, measures such as increased insulation do not have a high failure rate nor are they likely to be tampered with by the home owner.) However, it is acknowledged that there will be some attrition of the measures due to things like insulation settling, broken windows replaced with less energy-efficient ones, and moisture leaks to insulation which lowers its effective R-value; these occurrences are not taken into account when calculating cumulative and lifecycle savings.

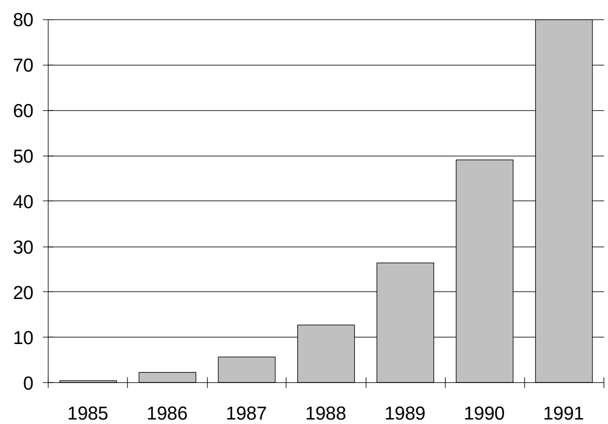
Program Savings

Savings Overview Table	Annual Energy Savings (kWh)	Cumulative Energy Savings (kWh)	Lifecycle Energy Savings (kWh)	Winter Capacity Savings (aMW)	Cumulative Winter Capacity Savings (aMW)
1985	543,000	543,000	38,010,000	0.06	0.06
1986	1,775,000	2,318,000	124,250,000	0.20	0.26
1987	3,373,000	5,691,000	236,110,000	0.39	0.65
1988	7,024,000	12,715,000	491,680,000	0.81	1.46
1989	13,734,000	26,449,000	961,380,000	1.60	3.06
1990	22,682,000	49,131,000	1,587,740,000	2.74	5.80
1991	30,843,000	79,974,000	2,159,010,000	3.99	9.79
Total	79,974,000	176,821,000	5,598,180,000	9.79	

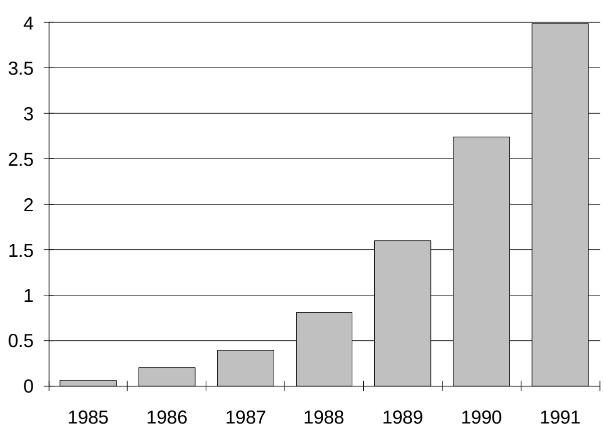
ANNUAL ENERGY SAVINGS (GWH)



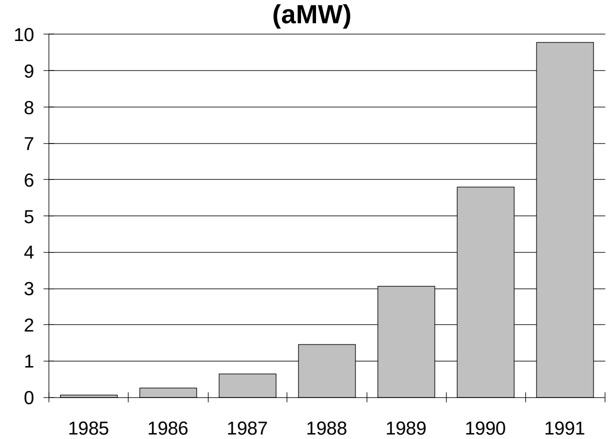
CUMULATIVE ENERGY SAVINGS (GWH)



WINTER CAPACITY SAVINGS (aMW)



CUMULATIVE WINTER CAPACITY SAVINGS (aMW)



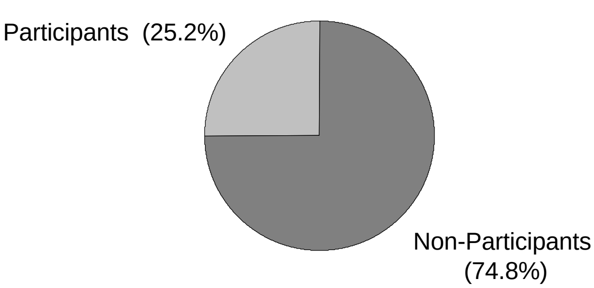
The SGC program covers three different types of homes: single family, multifamily, and manufactured homes. The average annual savings for each type of home is different. Single family homes had an average savings of 2,845 kWh/y, multifamily homes 1,078 kWh/y, and manufactured homes 4,000 kWh/y. Total savings are therefore calculated using these annual savings estimates for each type of home.

MEASURE LIFETIME

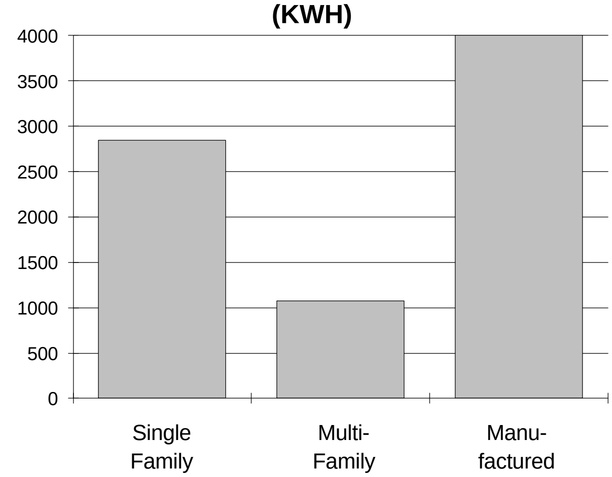
Because the energy savings measures promoted by the SGC program are installed in newly constructed homes, the assumed lifetime of most measures is the same as the lifetime of the building. A notable exception is the windows which are usually replaced or broken sometime during the life of a building. The assumption for average life of the measure made by BPA is 70 years. This number is used in calculating both lifecycle savings and the cost of saved energy table presented in the next section.

PARTICIPATION

The SGC program targeted electrically-heated homes. From 1986 to 1991 a total of 135,212 electrically-heated single and multifamily homes were built in the BPA service territory. Of these 36,743 homes were SGC certified for a participation rate of 27.2%. Manufactured homes were not targeted by the program until 1988. From 1988 to 1991 ~22,300 manufactured homes were built, of which 2,924 were SGC certified, for a 13.1% participation rate. The 1991 SGC participation rates were 41.4% for single and multifamily homes, and 26.2% for manufactured homes. The total participation through 1991 including single-family and multifamily homes since 1986 and manufactured homes since 1988 is 39,667 out of a possible 157,512, for a 25.2% participation rate.



ANNUAL ENERGY SAVINGS PER HOME TYPE (KWH)



SGC Certified Homes	Single Family	Multi-family	Manu-factured	Annual Total
1985	191	0	0	191
1986	525	205	0	730
1987	924	690	0	1,614
1988	1,641	2,077	49	3,767
1989	3,234	3,707	135	7,076
1990	5,172	4,927	664	10,763
1991	4,550	8,900	2,076	15,526
Total	16,237	20,506	2,924	39,667

PROJECTED SAVINGS

Over the 70-year life of the 39,667 homes that received SGC certification through 1991, the estimated lifecycle savings is expected to be approximately 5.6 billion kWh. In addition, because of the adoption of MCS by the states encompassing most of the BPA service territory almost all of the new electrically-heated homes will meet SGC standards. This represents over 41,000 homes annually (about the same as all of the SGC homes built to date). Because the SGC program was partially responsible for the code adoptions, part of the savings these energy-efficient homes accrue can be considered projected SGC program savings. Projected savings for homes meeting the new SGC standards which began in 1992 are not yet available.

Cost of the Program

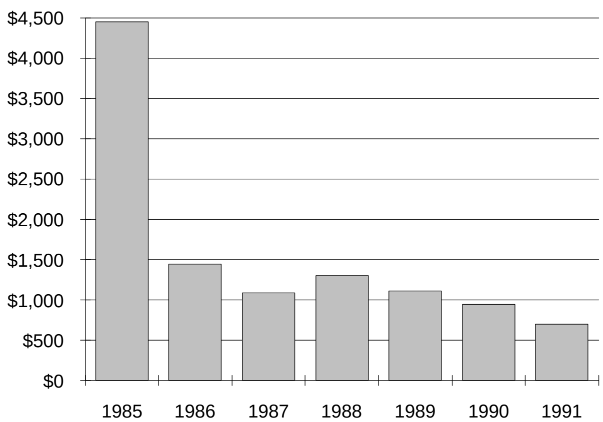
The SGC program costs and expenditures were first reviewed at the end of 1986 after about two and one-half years of program operation. Since then these costs have been reviewed on a regular basis. The total cost of the program through 1991 was $37.5 million.[R#3] However, there is not a clear accounting system for BPA operations costs (staff, equipment, travel, etc.) within the office of the Program Manager and these expenditures remain the most difficult to track down with complete accuracy. Only those expenditures identified by BPA as directly tied to the SGC program are considered here. We can therefore assume that the total cost stated in this section is probably slightly low.

Cost per Participant

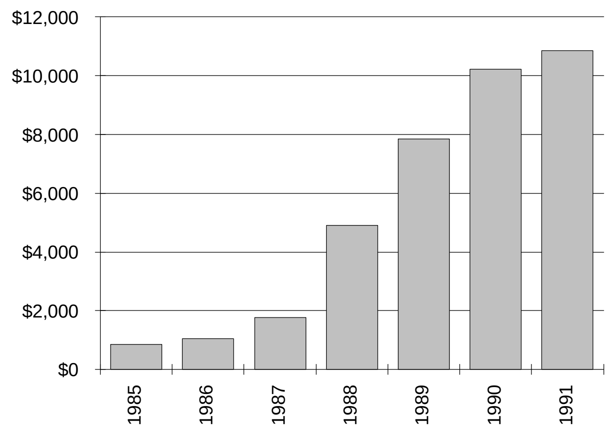
If the total program cost through 1991 of $37.5 million were spread out over the 39,667 certified homes, the average

Costs Overview Table	Annual Program Cost	Cost per Participant
1985	$850,279	$4,452
1986	$1,055,498	$1,446
1987	$1,761,459	$1,091
1988	$4,911,138	$1,304
1989	$7,854,121	$1,110
1990	$10,216,700	$949
1991	$10,856,588	$699
Total	$37,505,783	
Average	$5,357,969	$946

COST PER PARTICIPANT



TOTAL PROGRAM COST (x1,000)



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1985	5.38	6.69	8.10	9.56	11.06	12.58	14.13
1986	2.04	2.54	3.07	3.63	4.20	4.78	5.36
1987	1.79	2.23	2.70	3.19	3.69	4.20	4.71
1988	2.40	2.99	3.61	4.27	4.94	5.62	6.31
1989	1.96	2.44	2.96	3.49	4.04	4.60	5.16
1990	1.55	1.93	2.33	2.75	3.18	3.62	4.06
1991	1.21	1.50	1.82	2.15	2.49	2.83	3.18

cost per SGC home was $946. However, as is indicated by the graph, the program cost per participant varied each year of the program and tended to decline in the later years as more homes were SGC certified.

FREE RIDERSHIP

Many of the elements of the SGC program are not affected by the free ridership issue. Perhaps the one exception might be the incentives paid to the builders and home buyers. Even in this case it is difficult to assess the degree of free ridership based on the statisical information from the surveys. For example, a survey reveled that only ~20% of the home buyers were aware of the financial incentives which implies some free ridership in regards to incentives to the SGC home buyer. However, it is not valid to jump to conclusions based on isolated statistics because the different elements of the program work together, thus making it difficult, if not impossible, to isolate the effect of any one element.

Perhaps the most valid context for determining free ridership, is to compare the number of SGC homes built after the program began with the number built to those standards prior to the program's implementation. Because very few homes were built to SGC standards before the program was implemented, it would appear that free ridership, although present, is not a significant factor.

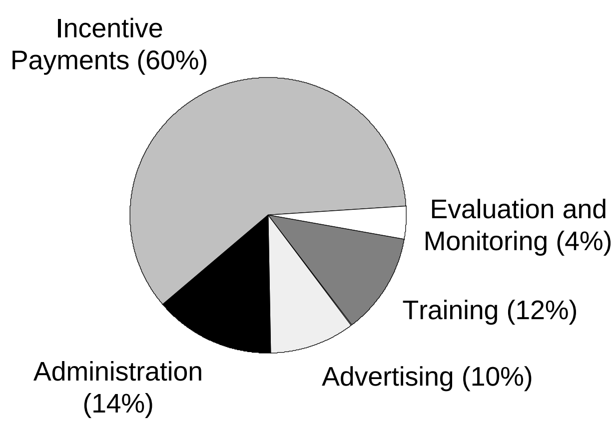
COST COMPONENTS

The general breakdown of costs for the years 1990 and 1991 are as follows: advertising 10%; training 12%; incentive payments 60%; administration 14%; and evaluation, oversight, and monitoring 4%. Over the course of the program some of these percentages varied. The most noticeable variation was with the advertising and incentive percentages. In the earlier years of the program a higher percentage of the expenditures went toward advertising and a lower percentage for incentive payments. The other expenditure percentages remained roughly constant since 1986. The accompanying pie chart shows the cost breakdown for 1990 through 1991.

COST EFFECTIVENESS

The cost of saved energy for the SGC program is presented on page 14 for a variety of discount rates. The numbers in the table can be compared to the average cost of electricity in BPA's service territory of ~4.4¢/kWh to determine cost effectiveness. Associated with this energy savings is a capacity savings which will vary in importance depending on a utility's capacity-to-demand relationship. A hard to quantify but important factor contributing to the cost effectiveness of this program, is the effect the SGC program had on facilitating the adoption of these standards as building codes. The result of this code adoption is that thousands of new homes will be built to 1991 SGC standards without further expenditures.

At a 5% discount rate, the program was well below the 4.4¢/kWh every year except 1985. (The emphasis during 1985 was to simply introduce the program. As a result very few SGC homes were built that year.) The cost of saved energy was especially low for 1990 and 1991 when two-thirds of all the SGC homes were built.



Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
Coal	**Uncontrolled Emissions**					
A	9,400	2.50%	381,226,000	9,044,000	1,828,000	183,000
B	10,000	1.20%	406,511,000	3,501,000	1,181,000	875,000
	Controlled Emissions					
A	9,400	2.50%	381,226,000	904,000	1,828,000	15,000
B	10,000	1.20%	406,511,000	350,000	1,181,000	58,000
C	10,000		406,511,000	2,334,000	1,167,000	58,000
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	406,511,000	1,070,000	584,000	292,000
B	9,400	2.50%	381,226,000	904,000	731,000	55,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	406,511,000	720,000	117,000	292,000
B	9,010		365,666,000	261,000	88,000	18,000
Gas	**Steam**					
A	10,400		221,734,000	0	506,000	0
B	9,224		192,558,000	0	1,206,000	57,000
	Combined Cycle					
1. Existing	9,000		192,558,000	0	739,000	0
2. NSPS*	9,000		192,558,000	0	350,000	0
3. BACT*	9,000		192,558,000	0	49,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	320,930,000	4,863,000	574,000	545,000
B	10,400	2.20%	340,380,000	4,824,000	722,000	350,000
C	10,400	1.00%	340,380,000	689,000	580,000	183,000
D	10,400	0.50%	340,380,000	2,023,000	722,000	111,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	425,962,000	848,000	1,317,000	72,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	505,708,000	1,303,000	1,716,000	381,000

Avoided Emissions Based on 176,821,000 kWh Saved (1985 - 1991)

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 of 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 next page is to allow any user of this profile to apply BPAs level of avoided emissions saved through its Super Good Cents 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 include a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

*** Acronyms used in the table**

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

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.

BPA AVOIDED EMISSIONS

BPA's role as a wholesale provider of electricity in the Pacific Northwest makes it difficult to assign a marginal plant. In its resource planning process, BPA looks at a fifty-year cycle and projects the lowest rainfall. This will determine the amount of water that the utility can spill to generate electricity. The firm capacity is based on that rainfall, and then this capacity is sold to wholesale customers. Excess capacity that is generated during years of greater rainfall than the lowest year is sold as non-firm power to customers who do not rely on this capacity. In times of very high peak demand BPA will sometimes buy out-of-region power from a variety of sources. Therefore, BPA, unlike other utilities profiled by The Results Center, does not have a marginal power plant per se whose use can be either cut back or deferred. However, BPA does analyze it supply options as compared to a coal fired plant.

The two main results of the SGC program are that its savings are effectively transferred into the capability to stretch its firm power to a greater number of its customers and it reduces the amount of expensive out-of-region power purchases. In this context the SGC program's environmental benefits are small. However, if at some future date, BPA needed to build a new power plant to fulfill increased demand, then the environmental benefits (the avoided emissions) of SGC, or any of BPA's DSM programs, that served to avoid the need for additional construction, can be quantified using the table on page 16.

Lessons Learned / Transferability

The program's overall success was due in part to the two-pronged approach of the SGC's marketing emphasis and the Early Adopter's code adoption emphasis. By running these two programs concurrently, the level of awareness of the importance of energy-efficient homes was raised, examples of such homes were built proving viability of the standards, and pressure was put on local governments to adopt the SGC building standards into the local building codes. The effect of successfully changing building codes is greater and more cost effective than a program limited to marketing and incentives. This may be the most important lesson learned from this program.

Another contribution to this program's success was the "feedback loop" that was built into its implementation. By encouraging input from all parties concerned, the program managers became aware of which elements were working and which were not. They then were able to make the necessary adjustments, thereby constantly improving the program.

The issue of free ridership is a consideration when deciding where to appropriate incentives. The low customer awareness of incentives (~20% of those buying a SGC home) indicates that this group is not strongly motivated by incentives when purchasing a new home. Builders on the other hand were much more aware of the incentives and seemed to be motivated by them. Unfortunately, many builders built only one SGC home. This would indicate that incentives should be structured to encourage the same builder to build several SGC homes. (This could be accomplished by requiring a minimum number of SGC homes to be built in order to be eligible for any incentives.) The program would then be more cost effective because the money spent on training builders is spread out over a larger number of homes.

A final lesson might be the importance of considering lost opportunity cost when deciding on a DSM program. With a building it is far cheaper to build it with energy efficiency features than to retrofit them at a later date. Also, the lifetime of such features is so long that the benefits continue for decades thus decreasing the cost of saved energy.

Based on BPA's results, the SGC program can be easily transferred. Already several utilities have adopted similar programs. However, there appear to be varying levels of success. This was true even within the BPA service territory. The commitment to the program by the utility as well as its execution will have a profound effect on the program's result.

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We would like to extend a special thanks to Pat Zimmer, Devona Richards, Bruce Cody, and Susanne Anker, of the BPA SGC program, for their much appreciated help and insights.