ORIGINAL

Decision No. 92251 September 16, 1980

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Investigation on the Commission's own motion into the feasibility of establishing various methods of providing low-interest, long-term financing of solar energy systems for utility customers.	OII No. 42 (Filed April 24, 1979)

(Appearances are listed in Appendix G.)

OPINION AND ORDER

Demonstration Solar Financing Program

TO: ALL APPEARANCES ORDER INSTITUTING INVESTIGATION NUMBER 42

Enclosed is an advance copy of Commission Decision No. 92251 ordering Pacific Gas and Electric Company, Southern California Gas Company, Southern California Edison Company, and San Diego Gas and Electric Company to begin the implementation of solar water heater financial incentive programs. We anticipate that several minor corrections and clarifications in this order will be proposed to the Commission in the next few weeks. This mailing is to give all parties an opportunity to review the order at the earliest possible date.

The staff will recommend that the Commission take appropriate action to ensure that all parties have the full statutory period in which to petition for review of the order.

Very truly yours,

JOSEPH E. BODOVITZ
Executive Director

SUMMARY OF ORDER

DEMONSTRATION SOLAR FINANCING PROGRAM

WHO: The program will be available to 375,000 residential customers served by PG&E, SDG&E, So Cal Gas and So Cal Edison. Anyone is eligible.

WHAT: Utility financing assistance will be provided for the purchase of solar water heaters (pools and spas not included). The assistance will vary according to type of water heating currently being used and depending on which utility is offering the incentive. (Details attached)

WHEN: Cash payments are available for any solar water heater installed after January 29, 1980 and which meets requirements for the state solar tax credit. Beginning January 15, 1981, a more detailed set of system and installation requirements must be met. 6%, 20 year utility loans will become available from PG&E and So Cal Gas in early 1981 for single family homes with gas water heaters.

WHERE: Installations are to be distributed throughout the state on a reasonably balanced basis.

HOW: Participants will purchase their solar water heaters directly from licensed contractors, not from the utilities. Do-it-yourself installations are also eligible. A utility inspection is necessary for all installations to be sure that all minimum system, installation and warranty requirements have been met.

COST: The savings produced by the solar systems will exceed the cost of the program over the life of the systems. Maximum monthly cost for a typical residential customer will be less than the cost of a postage stamp and this maximum will occur in only one year. Total program costs are estimated to be $182 million over twenty years. Total savings are estimated to be $615 million over twenty years. Net savings from the program are estimated to be $433 million over twenty years.

WHY: Solar water heating is ready for the market. The program is intended to demonstrate this to the market and to determine whether the technology will be accepted by the market on a large scale basis. If the demonstration is a success, solar water heating may eventually be able to displace as much as 21 million barrels of oil a year by 1990. If the demonstration fails, new supply sources will have to be developed that could otherwise have been avoided.

ENERGY SAVINGS: The program, when fully implemented, will save 218 million kwh per year and 39.5 million therms of gas a year. This is the equivalent of 1,000,000 barrels of oil a year.

WHEN AND HOW TO APPLY:

1. People who have purchased solar systems since January 29 1980 should contact their utility for instructions on how to qualify for the cash rebates.

2. Those interested in buying a solar water heater and participating in the program should contact a licensed contractor for information.

3. Some time should be allowed for detailed program rules to be distributed to the utilities and licensed contractors.

Following is a summary of the various programs by utility:

PACIFIC GAS & ELECTRIC

Single family electric -- goal of 37,140 customers	$20/month paid quarterly for 3 years
Single family gas -- goal of 18,000 customers	$20/month paid quarterly for 4 years, or 6% loan payable for 20 years
Multi-family -- goal of 102,100 customers	$8/month per unit served for three years

SAN DIEGO GAS & ELECTRIC

Single family electric -- goal of 7,800 customers	$20/monthly paid quarterly for three years
Single family gas -- goal of 2,500 customers	$20/month paid quarterly for four years
Multi-family -- goal of 19,000 customers	$8/month per unit served for three years

SOUTHERN CALIFORNIA EDISON

Single family electric -- goal of 26,000 customers	An annual payment beginning at about $350 and declining to 0 in about four years

SOUTHERN CALIFORNIA GAS

Single family -- goal of 19,000 customers	$20/month paid quarterly for four years, or 6% loan payable over 20 years
Multi-family -- goal of 145,000 customers	$8/month per unit served for three years

Special provision is made in each service area for low income people. Approximately 2,000 low income homeowners will receive solar water heaters at no cost to them.

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OII No. 42 /el

I. OVERVIEW

A. PURPOSES OF DEMONSTRATION

Since 1974, utility rates have increased at a compound annual rate of 24.9% for gas and 15.2% for electricity. Since 1972, fuel oil prices have increased at a compound annual rate of 27.2%. All of these increases exceed the general rate of increase in the Consumer Price Index which has been 7.7% a year since 1974.[1/] Use of solar energy to heat water is one of many ways to help slow the rate of energy cost increases and to displace conventional fuel use.[2/]

In our rapidly changing energy situation, the adequacy and reliability of energy supplies depends largely on our ability to reduce dependence on foreign oil and increase the rate at which utilities can augment energy supplies in the short term. There is clear State and Federal policy to promote the maximum utilization of solar energy to this end. Official statements of the President and Governor Brown, findings of the Congress and the California Legislature and previous findings of this Commission have concluded that the use of solar energy will reduce dependence on foreign oil, increase national security, improve the national balance of payments, reduce pollution, increase jobs in the domestic energy sector, increase the rate at which utilities can augment energy supplies in the short term and reduce inflationary pressures.[3/]

1/ Decision No. 91272, Finding 1.
2/ Ibid., Finding 3.
3/ Ibid., Finding 3.

In 1976, we began a Joint Investigation with the California Energy Commission concerning the development of solar energy in California. In the resulting Decision No. 89582 we determined that:

> "It is vital that solar energy use be implemented on a large scale basis now so that when future energy shortages occur and/or the prices of fossil fuels escalate further, there will be a reliable, established and competitive source of energy to which California consumers may turn."

We further, expressed our intention:

> "to selectively employ the resources of the state and the state's utilities to promote the rapid widespread implementation of solar energy systems, particularly passive space conditioning and solar water heating systems."

In the intervening years, we have seen the introduction of state and federal tax credits and the enactment of the National Energy Act, all intended to increase the implementation of solar and other conservation measures. We have also seen the provision of loans through conventional lending institutions at market interest rates. Nonetheless, we have not seen the substantial increase in the sales of solar domestic water heaters which is necessary if they are to play a significant role in displacing conventional resources.

It is incumbent on this Commission to determine the extent to which solar water heating can be relied upon to provide adequate and reliable supplies of energy and to reduce utility costs to consumers. Lacking adequate information on the practical potential of solar water heating in the marketplace could lead to serious errors of judgment regarding the need for other energy resources. If we underestimate the potential, we risk squandering ratepayer funds on other unneeded resources. If we overestimate the potential, we risk failing to provide for adequate energy from other resources.

One significant barrier to the increased utilization of solar water heaters is the high initial cost of the solar system.

Consumers are generally unaware of the potential for savings over the life of the system despite the high initial cost.[4] Other barriers to increased utilization of solar energy include:[5]

a) Lack of consumer confidence in the installation and operation of solar systems, and

b) Inadequate information about the uses, costs, and current availability of solar energy.

Each of these barriers must be overcome before increased solar utilization can be expected.[6]

The evidence available does not permit firm conclusions as to which financing assistance programs are likely to stimulate the greatest consumer interest.[7] Nor is it clear whether financing incentives or tax credits are a preferred method of promoting the use of solar water heaters. The California Legislature has ordered this Commission, as part of any demonstration program to evaluate solar financing options, to "evaluate whether some methods of financing may accelerate utilization of such devices more rapidly than tax credits alone."[8]

Further, financing assistance alone is not likely to overcome market barriers to solar energy systems other than the barrier of high initial costs. Solar financing programs should be accompanied by expanded programs to improve consumer information and consumer confidence in the installation and operation of solar water heaters.[9]

4/ Ibid., Finding 4.
5/ Ibid., Finding 5.
6/ Ibid., Finding 6.
7/ Ibid., Finding 15.
8/ AB 2036; Enacted September, 1980; Amending Section 23601 of the Revenue and Taxation Code.
9/ Ibid., Finding 17.

Vigorous demonstration programs are necessary to evaluate the costs of various financing options.[10/] Vigorous demonstration programs are necessary to evaluate preferences and the acceptability of various financing and non-financing options.[11/] Vigorous demonstration programs would contribute substantially to increased consumer confidence in, and information about solar water heaters.[12/]

The demonstration program is being established so that this Commission can continue to fulfill its responsibility to the ratepayers to assure adequate and reliable supplies of energy at the lowest reasonable rates.[13/]

Only with this demonstration program can we make properly informed decisions regarding the reasonableness of rates[14/] or the reasonableness and adequacy of equipment, facilities, and service[15/] of the utilities. As we found in Decision No. 91272:

> The demonstration financing program should be substantial in size and of sufficient duration to permit realistic evaluation of several factors including:[16/]
>
> a) Economics of scale that could reduce the per unit cost of promotion or administration;
>
> b) Impacts on both participating and non-participating ratepayers;
>
> c) Start-up costs that would not be part of an ongoing program;
>
> d) Impacts on different utility financial structures;

10/ Ibid., Finding 20
11/ Ibid., Finding 21.
12/ Ibid., Finding 22.
13/ California Constitution, Article 12, Section 1, et seq.; Public Utilities Code Sections 451, 454, 701, 702, 728 and 761.
14/ Public Utilities Code, Section 728.
15/ Public Utilities Code, Section 761.
16/ Decision No. 91272, Finding 23.

e) Differences in consumer acceptance and ratepayer reaction;

f) Differences in means to divide costs and benefits among ratepayers.

Many additional questions have arisen since the issuance of Decision No. 91272. What is necessary to encourage consumer acceptance of solar water heating? Can the solar industry deliver adequate supplies at reasonable prices? Will the solar industry provide adequate quality and service? Will banks, savings and loans, and credit unions provide adequate and attractive financing? Should or must utilities play an active role in consumer protection? If so, what limits to utility activity are necessary to preserve competition? Without the demonstration programs, we would be reduced to sheer speculation on these and other questions of fundamental importance.

The market survey conducted on behalf of this Commission by Marylander Associates provides a further compelling purpose for this demonstration. According to Mr. Howard Marylander, the survey indicated that if people became convinced that solar systems were suitable for use now, purchase interest would increase and the number of actual purchases would increase. We believe the best way to convince the public of the current viability of solar water heating is to stimulate the installation of a significant number of systems in neighborhoods throughout the state. When solar devices are in each neighborhood, it will become readily apparent that the technology is available now. When people hear by word of mouth about system performance, an industry reputation will be established.

This demonstration is of a different character than most demonstrations authorized by this Commission. Most demonstrations have sought to demonstrate for a known market, the utilities, that a promising technology can produce energy in a reliable and cost-effective manner. During the demonstration, technological adjustments are made to overcome problems of scaling up to large scale production.

In this demonstration, the objective is to demonstrate a known technology, solar water heating, to a promising market. Adjustments will be necessary as marketing is scaled up to a larger scale. Reliability will be evaluated largely on the basis of market response.

Both types of demonstrations address the key barriers to implementations of the respective technologies. If the demonstration is successful, ratepayer assistance is terminated and the technology moves into the market on its own strength. If the demonstration is not successful, the technology is rejected as unreliable or not cost-effective.

This demonstration will run for three years. After three years, it should be reasonably clear whether solar water heating will be accepted by a large market on a reliable basis.

This Commission emphasizes that this is a demonstration limited to three years and that there is no commitment or intention to continue with any part of the demonstration beyond three years. After eighteen months, we shall conduct an interim review of the demonstration to adjust the scope of the program as necessary or appropriate. The subsequent rate proceedings for each utility shall focus on the first eighteen months.

B. CONTEXT

The demonstration program is among the many actions of this Commission to promote three broad objectives:

1) Conserve fossil fuels,
2) Promote development of alternate energy sources; and
3) Encourage greater use of decentralized energy technologies.

The promotion of these objectives is essential to permit

this Commission to continue to discharge its responsibility to assure adequate and reliable energy supplies at the lowest reasonable rates.

1) Conserve Fossil Fuels

There is a pressing state and national need to conserve fossil fuels. There is a more specific state and national interest in limiting the use of imported oil and gas.

The Commission has taken many actions to promote both the conservation and efficient utilization of fossil fuels by regulated utilities and their customers. These actions include implementation of the California Voltage Reduction Program,[17] adoption of increasing block rates;[18] adoption of rates and policies to promote co-generation,[19] and encouragement of our utilities to implement broad conservation programs.[20]

Most recently, we have approved a zero interest loan program for residential conservation measures proposed by the Pacific Power and Light Company[21] and are in the process of considering a similar large-scale loan program by Pacific Gas and Electric Co.[22] We expect programs of this nature to play the leading role in achievement of our recently announced goal to obtain "effective market saturation of cost-effective conservation measures by 1985.[23]

These actions have been designed to achieve the greatest conservation of energy at the lowest possible cost in the shortest period of time. The energy savings flowing from these actions will be the "cream" of the conservation potential.

17/ Letter from Commission President Batinovich to each utility, February 16, 1977
18/ Decisions Nos. 87585, 87586, and 87587.
19/ Decision No. 91109.
20/ Decision No. 84902
21/ Decision No. 91497
22/ A. 59537
23/ Decision No. 91107.

The demonstration solar financing program will produce substantial savings:

39,500,000 Therms/year
218,000,000 Kwh/year

This is the equivalent of 1,000,000 barrels of oil per year. Yet the commission does not believe that solar water heating has the same potential to save energy at as low cost as the programs described above. Solar water heating is cost-effective for most applications today[24/] but is nevertheless a more costly means to save energy than those described above. Further, even though the solar water heating technology and industry are well developed, the technology does not appear to be as widely accepted as such conservation measures as ceiling insulation or low-flow showerheads.

Thus, the conservation objective of the demonstration solar financing program is different from that of the larger scale programs. We hope to determine whether consumers will accept solar water heating technology on a large scale and whether it can be relied upon in the future as a significant option to displace oil and natural gas. During the demonstration, while we are concerned with how such energy can be saved, we are also concerned about learning to what extent solar water heating will be accepted in the market and how reliable it is on a larger scale than currently exists.

2) Promote Alternate Sources of Energy

While encouraging the conservation and efficient use of existing energy resources, the Commission has also taken many actions to promote the development of new energy resources. These actions include approval of the Heber Binary Geothermal plant,[25/] approval of the Coolwater Coal Gasification plant,[26/] and institution of OII-26 to consider a wide range of energy resources for use by PG&E.

24/ See discussion of cost-effectiveness, infra. at p.
25/ Decision No. 91271.
26/ Decision No. 92115.

While solar water heating conserves existing energy resources, it also relies primarily on another resource--solar energy. Although new, efficient gas or electric water heaters can reduce water heating energy requirements for relatively little cost, they still perpetuate total reliance on existing resources to heat water. Solar water heaters, even though a conventional energy back-up is required, add a new resource to our energy mix.

For purposes of this demonstration program, an objective of the Commission is to determine whether solar water heating is likely to become a significant new energy resource on a practical basis. If the demonstration supports the often stated assumption that solar water heating can make a substantial contribution to future energy supplies, this will bring a flexibility to resource planning that does not currently exist.

3) Encourage Decentralized Energy Technologies

Many advocates of new directions in energy policy have urged greater use of decentralized energy resources to improve the economics of energy production. It is claimed that incorporating smaller, dispersed resources into the energy supply will increase service reliability, lower costs of reserve margins through increased diversity, permit more rapid return on utility investment, and create more flexibility for responding to continued uncertainty in energy supplies and demands.

We have found substantial merit in these claims and have taken many actions to promote greater utilization of decentralized energy resources. These actions include the promotion of co-generation[27/] and the promotion of small energy producers.[28/]

27/ Decision No. 91109.
28/ Decision No. 91109.

Most of the facilities being promoted by these actions are substantially smaller than conventional production or delivery facilities. Still, none have approached a scale suitable for use in residences. Solar water heating will be the first decentralized technology to be encouraged by this Commission for which the initial market will be residential customers. This creates a series of unique questions and problems which the demonstration program can help resolve. Many of these have been mentioned previously in this decision. In summary, there is a substantial difference in marketing a new technology to residential customers as opposed to utilities and large energy users who have sophisticated technical, financial, and economic analytical capabilities.

C. SCALE

We have adopted programs which, in our opinion, are large enough to provide a full sense of the performance of large scale programs while not so large or lengthy as to dictate the future of the solar market. In determining a proper size for the programs, we have been guided by the experience of industry in moving other new energy technologies from technical feasibility to commercial scale. A demonstration scale project is utilized to uncover problems of large scale operation without making a full commitment of funds necessary for a commerical scale project. Examples of such demonstrations for which this commission has recently approved ratepayer funding are the Heber Binary Geothermal plant and the Coolwater Coal Gasification Generating Plant. The Heber facility will have a capacity of 55MW when completed with the Coolwater plant having a capacity of 100MW. At the federal level, a comparable facility is the recently completed DOR/Exxon Solvent Donor Coal Liquefaction Plant in Baytown, Texas which is designed to produce 600 barrels of oil a day. The programs we order today will produce somewhat smaller amounts of energy than most of these demonstrations and will cost less as well.

D. STATEWIDE UNIFORMITY

Several parties to the proceeding, including CalSEIA and Mr. Matassarin of Tor Sun Company have raised concern that if different programs are implemented in different parts of the state, consumers will become confused and the solar market will be dampened. Clarity is certainly an important part of a demonstration program. However, we are not convinced that the presence of different programs in different parts of the state will unduly confuse consumers. A burgeoning market for solar systems would be characterized by a wide diversity of systems and options whether or not there is a demonstration program.

The commission concludes that for purposes of a demonstration program, the terms and conditions of loans and financial assistance programs need not be uniform statewide. Not enough is yet known to determine what programs, if any, should be available uniformly. In fact, uniformity would limit the amount of useful information gathered in the demonstration. Nor is it clear that it would be appropriate to impose uniformity given the differing situations among the several utilities and their service areas.

With respect to measures to assure consumer confidence, a somewhat different situation prevails. To have different quality standards for both systems and installations in different service areas would be very detrimental to the solar industry. Manufacturers would be unable to achieve economies of scale due to variations necessary to meet minimum standards in different areas. Contractors operating in different areas would be hard pressed to adequately train and supervise employees who would have to install systems differently in different areas. We conclude that quality control standards should be uniform throughout the state.

E. COST-EFFECTIVENESS

Despite our findings in Decision No. 91272, discussion of cost-effectiveness issues continued in the second phase of our hearings. In this proceeding, we have made specific findings regarding the role of cost-effectiveness analysis in the demonstration. Decision No. 91272 contained the following findings:

1. Solar water heaters are clearly cost effective to the purchaser as retrofit additions to electric water heaters. Considering the rates consumers pay for gas, including both average and lifeline rates, and considering the solar tax credit, solar water heaters are cost effective retrofit additions to gas water heaters for middle and upper income people and are likely to become cost effective during 1980 for persons of lower income if historical escalation rates for the cost of gas continue. (Finding 9)

2. Large scale financing assistance provided by the utilities or the government should provide benefits to society equal to or in excess of costs. (Finding 10)

3. A policy to encourage the use of solar water heaters is clearly justified a) if the cost of a solar system to the consumer is no more than the cost of other options, on a life-cycle basis; or b) as part of a demonstration program; or c) in response to societal objectives as stated in Finding 3. (Finding 8)

4. Those cost/benefit analyses submitted to the Commission to evaluate solar financing options are insufficient in that they consider only the dollar savings produced by solar water heaters but do not consider the other primary benefits of solar energy as set forth in Finding 3. (Finding 12)

5. There is clear State and Federal policy to promote the maximum utilization of solar energy. Official statements of the President and the Governor, findings of the Congress and the California Legislature and previous findings of this Commission have concluded that the use of solar energy will reduce dependence on foreign oil, increase national security, improve the national balance of payments, reduce pollution, increase jobs in the domestic energy sector, increase the rate at which utilities can augment energy supplies in the short term and reduce inflationary pressures. (Finding 3)

6. Vigorous demonstration programs are necessary to evaluate the costs of various options. (Finding 20)

7. A demonstration or experimental program need not strictly comply with established cost effectiveness criteria. (Finding 24)

We reiterate these findings in this decision. In particular, we emphasize that no new methodologies for evaluating cost-effectiveness of solar financing programs have been offered to the Commission. We also emphasize that the programs ordered in this decision are of a demonstration nature and have as one objective the better determination of large scale program costs.

The matter of cost-effectiveness has been presented from four different perspectives: 1) the program participant, 2) the non-participant, 3) the utility, and 4) society. We commented generally on these perspectives in our report to the Legislature on solar financing.[29/] These perspectives have been explored in even greater detail in Application No. 59537, the application of PG&E to offer zero-interest deferred payment financing for conservation measures. Because the solar financing programs we adopt herein are demonstration programs, we do not feel it appropriate to resolve this controversy at this time. We intend to deal completely with policy determinations respecting cost-effectiveness in our decision on Application No. 59537.

29/ Financing the Solar Transition, California Public Utilities Commission, January 2, 1980.

While we are not bound by any particular cost-effectiveness criteria for purposes of this demonstration, we have a great responsibility to the ratepayers not to add unduly to their rapidly increasing utility bills. Representatives of the cities of Los Angeles, San Diego, and San Francisco strongly recommended either a heavy or exclusive emphasis on the electric retrofit market as a menas to reduce the cost of the demonstration program. Excessive emphasis on the electric market would defeat two primary objectives of the demonstration: demonstrating the technology in the largest potential market, the gas retrofit market, and achieving widespread distribution of systems, which cannot be accomplished in the limited electric retrofit market. Nevertheless the contentions of the cities are well taken. We have adjusted the market penetration goals of the demonstration so that there will be no cost to the typical ratepayer on a net present value basis and to produce a substantial savings to California ratepayers as a whole over the life of the systems to be installed.[30/] In addition, the programs adopted in this order will produce energy at a cost significantly less than the marginal cost of energy.

30/ References to the cost of energy saved, program costs and so called "non-participant" are estimates and should be used only for purposes of comparison with other programs. One objective of the demonstration program is to determine more precisely the actual costs of such programs.

TABLE 1

MONTHLY AND 20-YEAR COST PER RESIDENTIAL CUSTOMER

Item	PGandE	SoCal Gas	SDG&E	SCE
I. SOLAR/GAS PROGRAMS				
A. Monthly Cost Per Res.Cust.				
Year 1	2¢	3¢	2¢	-
2	4	7	7	-
3	10	13	13	-
4	12	11	13	-
5	6	10	15	
6	4	4	3	
B. 20-Year Cost Per Res. Cust.	$2.24	$2.53	$2.62	-
II. SOLAR/ELECTRIC PROGRAMS				
A. Monthly Cost Per Res.Cust.				
Year 1	1¢	-	2¢	1¢
2	2	-	3	1
3	5	-	6	2
4	5	-	6	1
5	2	-	1	(1)
6	(2)	-	(3)	(2)
B. 20-Year Cost Per Res. Cust.	$(2.66)	-	$(2.75)	$(2.00)
III. 20-Year Cost Per Residential Customer Per Utility	(0.42)	2.53	(0.13)	(2.00)

(Indicates negative number)

TABLE II

SUMMARY OF COSTS AND SAVINGS STATEWIDE (ALL PROGRAMS)
($000)

Item	Gross Revenue Requirement	Savings	Net
Year 1	$ 7,227	$ 348	$ 6,879
2	21,288	1,834	19,454
3	43,985	5,532	38,453
4	48,424	9,033	39,391
5	30,982	10,609	20,376
6	18,313	12,481	5,832
7	2,529	13,902	(11,373)
8	1,536	15,493	(13,957)
9	1,315	17,801	(16,486)
10	1,135	19,266	(18,131)
11	989	21,468	(20,479)
12	865	23,666	(22,801)
13	760	26,801	(26,041)
14	665	29,322	(28,657)
15	576	32,619	(32,043)
16	495	36,297	(35,802)
17	424	40,754	(40,330)
18	360	45,582	(45,222)
19	302	51,019	(50,717)
20	75	57,117	(57,042)
21	43	61,299	(61,256)
22	30	54,273	(54,243)
23		29,007	(29,007)
	$182,318	$615,523	$(433,202)

(Indicates savings)

TABLE III

ESTIMATED PROGRAM COST
(Net Present Value)

Utility	Residential: Units Served	Net Present Value: Gross Revenue Requirement ($000)	Net Present Value: Savings to Utility	Net Utility: Revenue Requirement
	(a)	(b)	(c)	(e)
Southern California Gas –	165,300			
a. Single Family 6% Loans 1/	9,500	$ 7,050	$ (1,800)	$ 5,250
b. Single Family Gas Credits 2/	9,500	6,900	(1,800)	5,100
c. Multi-Family Gas Credits 3/	145,500	29,640	(18,460)	11,180
d. Utility Investment Program 6/	800	2,960	(145)	2,815
Net Cost to Ratepayer				$ 24,345
Southern California Edison –	26,000			
a. Single Family Index Credit 4/	26,000	$ 9,500	$(29,400)	$(19,900)
Pacific Gas and Electric –	158,040			
a. Single Family Gas 6% Loans 1/	9,000	$ 7,150	$ (1,730)	$ 5,420
b. Single Family Gas Credits 2/	9,000	6,190	(1,730)	4,460
c. Muti-Family Gas Credits 3/	102,100	20,600	(13,080)	7,520
d. Single Family Electric Credits 5/	37,140	18,650	(42,000)	(23,350)
e. Utility Investment Program 6/	800	2,960	150	2,810
Net Cost to Ratepayer				$ (3,140)
San Diego Gas & Electric –	29,480			
a. Single Family Gas Credits 2/	2,500	$ 1,680	$ 470	$ 1,210
b. Multi Family Gas Credits 3/	19,000	3,930	2,320	1,610
c. Single Family Electric Credits 5/	7,800	4,040	8,840	(4,800)
d. Utility Investment Program 6/	180	670	35	635
Net Cost to Ratepayer				$ (1,345)
Total Net Revenue Requirement (Statewide)				$ (40)

1/
2/ $20 per month, 48 months = $960 single family residence.
3/ $8 per month/unit, 36 months = $288 per apartment.
4/ Credit based on difference between monthly loan payment and solar savings.
5/ $20 per month 36 months = $720 single family residence.
6/ Utility program for low income ratepayers.

(Indicates negative number)

TABLE IV

MARGINAL COST OF SUPPLY VS SOLAR COST

	PG&E	SoCal Gas	SDG&E	SCE
Marginal Cost of Gas (¢/Therm)	47.2¢	47.2¢	47.2¢	
Cost of Gas Saved (¢/Therm) By Solar Program	5.4¢	5.0¢	5.0¢	
Marginal Cost of Electricity (¢/Kwh)	7.22		7.22	7.22
Cost of Electricity Saved (¢/Kwh) By Solar Program	.88		.70	.88

If the demonstration is successful there will be tremendous long-term benefits for consumers. Estimates of the costs and benefits of solar water heating indicate that widespread use of the technology can reduce rates for electricity and significantly slow the increase in gas rates.[31]

Compared to the utility costs we have had to pass on to the ratepayers for fuel cost increases in the last two years, we are convinced the cost of these programs is a small price to pay to demonstrate the viability of solar water heating on a large scale.

F. RETROFIT INSTALLATIONS

The programs adopted herein are to encourage and evaluate solar water heating installations in residential buildings which were occupied as of January 29, 1980. Issues concerning incentives for solar water heating installations in new construction are being addressed in Case No. 10260, the Line Extension case.

31/ Financing the Solar Transition, California Public Utilities Commission, January 2, 1980.

II. FINANCING

Order Instituting Investigation No. 42 (OII-42) was issued on April 24, 1979 for the purpose of exploring low-interest, long-term financing of solar energy systems. Twenty-four days of hearings were held in the matter commencing August 13, 1979 and concluding December 5, 1979. Over 70 possible financing programs for solar water heaters were considered in those hearings. Based on our analysis of these options, the commission submitted a report with recommendations to the Legislature on January 2, 1980 and issued an order to the respondent utilities on January 29, 1980.

The order called for the utilities to submit proposed demonstration financing programs to the commission within 60 days. Ordering paragraph 2 set forth the parameters for the proposed programs as follows:

2. The demonstration financing program should be designed to retrofit 2% of the gas water heaters and 10% of the electric water heaters which are furnished energy by and are within the service territory of each utility. The programs should include all single family and multi-family residential markets and be designed to reach a wide range of geographic areas and income groups.

The program should offer, to single family dwelling owners, sufficient funds (in combination with tax credit funds) to finance the full cost of reasonably priced systems and to provide the installation at no initial cost to the homeowner. Full financing should be provided for multi-family dwelling installations at no initial cost to the building owner.

The utility may propose to include the funds advanced in the rate base or to have them treated as expenses, and should fully discuss the reasons for selecting the proposed treatment of expenditures. Each program shall provide for consumer choice of repayment in equal monthly installments over a twenty-year term, in monthly installments indexed to rising utility rates, or in lump sum upon resale of the building. Installment payment programs shall include provisions to terminate installments upon resale of the building. Each utility shall also propose a plan in which the funds advanced are treated as a utility investment for which the consumer has no repayment obligation.

Despite widespread publicity and notice of the hearings, participation by the solar industry was notably lacking in the proceeding except for a general statement of support for financing assistance by CalSEIA. Although every bank savings and loan and credit union in the state was served notice of our proceeding, only one savings and loan appeared to offer a brief general comment.

Immediately after issuance of the January 29 order, CalSEIA representatives petitioned the Commission requesting the opportunity to present additional financing options during consideration of the proposed utility plans and requesting the Commission to order the utilities to consider the CalSEIA proposals as well. On March 6, 1980, Administrative Law Judge Orville I. Wright issued a ruling permitting CalSEIA and any other party to submit new proposals and permitting the utilities to propose financing programs in addition to those included in the January 29 order.

In keeping with this ruling, many new financing proposals and issues were raised in the subsequent hearings. As a result, the hearings ran much longer than had been originally expected, consuming 28 days between April 21 and June 13. We have now heard from over 100 witnesses presenting a spectrum of views and interests which is certainly among the broadest ever represented in a commission proceeding. We believe our record, which includes some 5,500 pages of transcript and 100 exhibits, contains the most extensive discussion of issues and options in solar financing that has ever been compiled.

A. Program Options[32/]

Financing Alternatives

Utility Investment/Grant Plan. These programs, as presented, call for the utility to purchase solar equipment and arrange for its installation at no cost to the customer.

Some plans have provided for the utility maintaining title to the equipment, while other proposals give title to the customer.

32/ This summary was prepared by Joyce Barkavich, Marcy Beck, Lyndon Comstock and Sara Weinheimer of the Graduate School of Business Administration at the University of California at Berkeley. (Exhibit 95)

All utilities have recommended that these plans be implemented only for low-income customers. San Diego Gas and Electric Company* and Southern California Edison Company** also recommended that owners of multi-family dwellings be provided this option.

Utility-Direct Lending Plans -- Zero-Interest/Low-Interest Alternatives.

Loan structure. This structure would involve direct lending by the utility to solar water heater buyers, with several principal or principal/interest repayment options offered to the customer:

-- level monthly payments over a 20-year term;

-- full payment upon sale of home;

-- monthly payments indexed to rising utility rates for up to a 20-year term.

San Diego Gas and Electric opposes an indexing plan, citing the high administrative cost involved in recalculations as well as the difficulty of explaining recalculations to customers.

PG&E*** had not recommended 20-year level payments under their low-interest plan, although they are an option under their zero-interest proposal.

Southern California Edison suggests only the full payment upon sale of home for a direct lending utility role.

Southern California Gas**** has suggested that multi-family dwellings be offered zero-interest loans and the three repayment options, with an additional incentive to this group of no monthly payment required until the eighth year after installation.

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* Response of San Diego Gas and Electric to Decision No. 91272, April 14, 1980. (Hereafter cited: SDG&E Report.)

** Compliance Filing of Southern California Edison Company, April 7, 1980. (Hereafter cited: So. Cal. Edison Report.)

*** Report of Pacific Gas and Electric on Demonstration Financing Program for Solar Water Heater Retrofit, March 31, 1980. (Hereafter cited: PG&E Report.)

**** Compliance Filing of Southern California Gas Company, March 31, 1980. (Hereafter cited: So. Cal. Gas Report.)

Loan subsidy levels. Three different proposals have been made regarding the setting of limits on the solar loan amounts which the utility might offer.

1. The loan amount could cover the entire cost of the system for both 2% of gas and 10% of electric customers (San Diego Gas and Electric).

2. The loan amount could cover the entire cost of the system for 10% of all electric water heaters and for both electric and gas-heated multi-family dwellings. Partial financing up to a utility-determined "cost-effective" limit would be available to single family gas customers (PG&E).

3. The loan amount would not be specified but a dollar limit on the amount of subsidy which the utility could supply would be set (Southern California Gas).

PG&E is the only utility to identify an interest rate for a low-interest loan program. Their recommended rate is 8-1/2%.

Utility Credit Tie-in with Conventional Lending Institutions. This plan was not addressed in the PUC directive to the utilities, and consequently has the most variations among approaches.

Under these programs, the customer would obtain his own loan and loan terms from existing lending institutions. The utility could be involved in one of several ways:

-- San Diego Gas and Electric has proposed that utilities provide customers with credit on their utility bills equivalent to the customer's monthly interest owed to the bank or savings and loan. Credit carryovers would be refunded once per year.

-- Southern California Edison has proposed a cash rebate plan whereby customers receive a monthly payment from the utility which is indexed to the customer's electric bill savings, which So. Cal. Edison estimates would tend to offset the customer's loan payments.

-- Southern California Edison has also proposed a type of credit plan in which the utility subsidizes full or partial interest through utility payments to the lending institution. The customer pays the balance of the monthly loan amount to the bank or savings and loan for up to a 20-year term.

-- The California Solar Energy Industries Association has presented a utility interest credit plan whereby the customer would receive a single lump-sum credit, equivalent to a 100% interest subsidy, payable upon completion of the solar installation.*

Neither PG&E nor Southern California Gas Company presented a plan of this type as a financing option.

Sunny Mac. Proposed by CalSEIA, Sunny Mac** would be a secondary financing institution for solar loans modeled after the Federal Home Loan Mortgage Association (Freddie Mac). Sunny Mac would have two major functions: 1) to provide a secondary market for market-rate solar loans that are made by existing lending institutions, and 2) to provide a vehicle through which banks and savings and loan associations could make subsidized loans to consumers.

Solar industry representatives have suggested three possible roles for utilities in the Sunny Mac structure:

-- purchase of market rate securities to assist in capitalizing Sunny Mac;

-- direct purchase of loan packages from Sunny Mac;

-- provision of a subsidy on loan interest to bring costs down from the market rate to an as yet unspecified lower interest level.

Utility Administrative Structure for Financing Alternatives

Three structures have been proposed for utility administration of solar subsidies or investments.

-- Establish an administrative structure within utility corporation (San Diego Gas and Electric, Southern California Edison).

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* California Solar Energy Industries Association (CALSEIA), "Solar Financing Through Utility Credits, A Proposal by the Solar Industry," March 29, 1980. (Hereafter cited: CalSEIA Proposal.)

** "Sunny Mac: A Proposal for Secondary Solar Financing" Hereafter cited: Sunny Mac.)

-- Create a wholly-owned non-utility subsidiary which would serve as the financing mechanism. The subsidiary would bill the utility for the amount of any loan interest subsidy as well as administrative costs on the amount financed (PG&E).

-- Create a non-utility affiliate for holding notes receivable under a zero-interest loan plan and for holding assets of non-repayment obligations under a utility investment plan (Southern California Gas).

B. General Discussion of Options

1. Zero-interest loan with no repayment until sale of home

There is little doubt that a financing incentive of this type would have a powerful impact on the sales of solar water heaters. There is also little doubt that to offer such an incentive would create the greatest cost to the utilities and the greatest impact on the ratepayers. We estimate that the cost to the ratepayers to fully achieve our established market penetration goals relying exclusively on this incentive would exceed $600,000,000 over 20 years.[33] Lacking clear evidence that this level of incentive is necessary to achieve our objectives, we conclude that zero-interest loans with no repayment until sale of home should not be among the options included in the demonstration program.

2. Sunny Mac

The commission believes that a secondary market for solar loans could be a significant stimulus to conventional lending institutions to increase the amount and attractiveness of funds available for solar loans. Sunny Mac may be such a vehicle. However, it is possible that Sunny Mac would merely duplicate the functions of existing secondary institutions such as Freddy Mac and

33/ Exhibit 91.

Fannie Mae. Nor is it clear whether conventional financial institutions support the concept of Sunny Mac or merely the concept of a secondary market.[34/] We also doubt that Sunny Mac can be organized rapidly enough to be available as an option at the commencement of the demonstration programs.

A secondary financing mechanism is not dependent on utility participation. Further, it can function concurrently with utility assisted financing programs. Therefore, although we view this proposal with interest, it is not a proposal which requires commission action at this time.

3. No program

TURN has proposed that no utility assistance for any type of financing program be permitted. TURN contends that utilities will obstruct and delay the program because they are not sufficiently committed to solar energy development, that ratepayer assistance for solar financing programs is contrary to the consumer interest, and that this commission lacks the authority to order utilities to undertake any of the program options under consideration.

We find no merit to TURN's contentions. Historically, it is correct to state that development of solar energy was contrary to the interest of utilities. When the cost of capital was low and when marginal costs of new energy resources were declining, utilities made more profit by investing greater sums in large new facilities. Today, with capital costs at record levels and with marginal costs of energy resources escalating uncontrollably, it is clearly in the best interest of the utilities to minimize investments in large new facilities and supply sources and to promote conservation and solar options.

We cannot agree with TURN's position that ratepayer assistance for solar financing programs is contrary to the consumer interest. We find that the consumer interest requires rapid implementation of programs that can assist consumers to bring their skyrocketing utility bills under control and lessen our reliance on imported oil and gas. It is our responsibility to see that such programs are implemented is a timely manner.

34/ Tx p. 3700 and 3707.

There is a cost to implementing these programs. But the cost of the program we order today is small, and unlike other energy resource programs, the cost will gradually be repaid over the life of the solar systems producing a net savings to ratepayers as a whole.

We have previously discussed the necessary and proper role this demonstration program will play in permitting this Commission to continue to fulfill its responsibilities to the ratepayers. We do not reiterate that discussion here.

4. Utility financing and utility credits

The remaining options fall within two categories: direct utility financing and utility credits. Unquestionably the most significant controversy in our proceeding to date has been whether utilities should be permitted to make direct loans to consumers at low or no interest or whether utilities should merely be permitted to offer credits to consumers who either financed their purchases at a conventional institution or paid cash. There are advantages and disadvantages to each approach as summarized below:

UTILITY CREDITS

The notion of utility credits or rebates was first introduced in an exhibit by "The Solar Industry", a group comprised of individual solar business people and a representative of the California Solar Energy Industries Association. Although this idea was not brought out in the original OII-42 hearings in 1979, nor mentioned in Decision 91272, it has garnered a significant following among those who would be affected by this program and deserves to be carefully and thoughtfully scrutinized.

Under a utility credit plan, a customer would purchase a solar system and either pay cash or obtain financing from a conventional lending institution. After a determination that the installation meets minimum requirements, the customer would receive a credit from the utility. The credit could be in the form of a reduction in the customer's monthly utility bill, a lump sum cash payment, or periodic payments on a monthly, quarterly, or annual basis.

Advantages of the Utility Credit Plan

1. COSTS MORE CONTROLLABLE - Since the amount of each credit is fixed, the cost of a program to provide credits to a given number of customers can be readily determined.

2. INCENTIVE FOR CASH PAYMENT - Credits can be given to customers whether or not they choose to obtain a loan.

3. PRESERVE RELATIONSHIP BETWEEN SOLAR CONTRACTORS AND CONVENTIONAL LENDING INSTITUTIONS - Many contractors have developed financing relationships with conventional institutions. These relationships are important to the growth of the solar industry and would not be disturbed by a credit incentive.

4. MAINTAIN ROLE OF CONVENTIONAL LENDING INSTITUTIONS - If solar systems become widely accepted in the market, conventional lending institutions should serve to finance the bulk of the purchases. It is useful to have these institutions become increasingly involved in making solar loans. The credit approach should encourage more lending by conventional institutions.

5. NO NEED TO LIMIT AMOUNT OF INCENTIVE - Since the credits are of a fixed amount, there is no need to limit the amount of incentive that any customer could obtain.

6. EASE OF RETROACTIVE APPLICATION - No refinancing would be required for the customer to obtain the benefit of the credit plan for a purchase made before the incentives are made available.

7. EASE OF ADMINISTRATION MAY REDUCE COSTS- Issuing credits will require less work for the utility than making and handling loans. This may reduce program costs although these costs would be passed on to the solar customer in the form of bank lending fees.

Disadvantage of Utility Credit Plan

1. DEPENDS ON STATE OF THE MONEY MARKET - Rapid shifts in interest rates and credit availability would make solar implementation dependent on market forces which give little consideration to solar energy.

2. WOULD DISCRIMINATE AGAINST MANY RATEPAYERS - Customers who could not qualify for financing at a conventional lending institution would be unable to obtain the benefit of credits.

3. CANNOT BE TARGETED TO SPECIFIC MARKETS - Credits must be given on a first-come-first-served basis regardless of the equity of distribution in different geographic or income markets.

4. COULD CONFUSE THE CONSUMER - To purchase a system from a solar contractor, obtain a loan from a bank, and then to obtain a credit from the utility could confuse many customers.

DIRECT LOANS

Decision No. 91272, the commission directed the respondent utilities to come forward with direct loan programs. Under this concept, a utility would make no- or low-interest, 20-year loans to consumers which would then be repaid through the existing utility bill or in one lump sum upon sale of the home.

Advantages of the Direct Utility Loan Plan

1. ABILITY TO TARGET - Because the distribution of the loans given out in a direct loan program is in the hands of the utilities under the guidance and authority of the commission, the program can be designed to reach the targeted constituencies of low income homeowners and renters and achieve the appropriate geographical dispersion.

2. EASY TO UNDERSTAND - Virtually every consumer understands a low-interest loan with no down-payment. A direct loan program would stand out as a very clear, major incentive to purchase a solar system now. A direct loan program would be very likely to achieve the commission's goals.

3. NO CREDIT-WORTHINESS PROBLEM - Past payment of a utility bill need be the only credit standard for a direct loan program with or without a lien on the home.

4. LESS DEPENDENT UPON FLUCTUATIONS IN LOAN MARKET, INTEREST RATES - Economic conditions which might impede a bank or savings and loan association from offering loans at any particular point would not affect a direct loan program. Therefore, no threat of a major hiatus or dramatic swing in demand would exist; rather, a more steady pace would prevail. This would be an asset for the development of the solar industry, particularly for newer companies more vulnerable to an intemperate economy.

Disadvantages of Utility Loans

1. Could Be More Costly - although utilities bill their customers once a month and have established low interest loan programs for energy conservation, the processing of loans is more complex than the issuance of credits. This could increase the cost of the program to the utilities. In addition, utilities would have to raise both the amount of the loan and the amount of the incentive in capital markets.

2. Requires Some Method to Limit Loan Amounts - Absent a limit on loan amounts, the utility would have to issue loans for any amount, no matter how costly the system. This could create de facto price limitations on solar systems.

3. Could Drive Conventional Lenders Out of the Market - If the incentive in a utility loan were too great compared to what is made available to those who do not use utility loans, conventional lenders would not be able to compete and would be driven from the market.

4. No Incentive for Cash Payment - The incentive in utility loans would only be available to those who borrow from the utility.

CalSEIA has argued that the advantages of utility credits are so overwhelming that only credits should be offered by utilities. SoCal Gas has argued that the advantages of utility loans are so overwhelming that only utility loans should be offered by utilities. Many others, including PG&E, Western Sun, and the commission staff have suggested that both credits and loans be utilized.

We find that there is no reason, legal or factual, to limit utilities to either loans or credits. To the contrary, our record contains a wide range of opinions and speculation on this question but very little specific evidence on which to base a prudent decision.

C. Adopted Financing Programs

In Decision No. 91272, we established market penetration guidelines for utility financing programs to retrofit 10% of the electric water heaters and 2% of the gas water heaters. The decision did not specify a particular division among single and multi-family installations or a particular set aside for installations for low income families.

The record clearly established that ratepayer assistance for the retrofit of electric water heaters produces absolute savings to all ratepayers within a few years of the investment,[35] that assistance for multi-family gas water heater retrofits places a lesser burden on the ratepayers than assistance for single-family retrofits,[36] and that a portion of the funds must be set aside to assure that the low income market is reached.[37] To produce the greatest benefit at the least cost to ratepayers and to bring about the widest distribution of solar systems in the demonstration, we therefore adopt the following penetration objectives for the demonstration programs (approximate percent of market indicated in parentheses):

1. 70,940 single family electric water heaters (15%)
2. 266,700 housing units in buildings with four or more units served by central water heaters (10%)
3. 39,500 single family gas water heaters (1%)
4. 10% of total funds authorized for the program for each utility shall be set aside for low income, single family installations - 1,780 installations

35/ Exhibit 91.
36/ Exhibit 91.
37/ Brief of California-Nevada Community Action Association and Tx. 5566.

We also conclude from the record that different incentives are justified for solar retrofits to different types of water heaters. Retrofits to electric water heaters and multi-family gas water heaters are far more cost effective to the customer and require a lesser incentive.[38] Tax considerations and the ready availability of conventional financing for larger installations are likely to make utility credits more appealing than utility loans in the multi-family market.[39]

The record contains many suggestions as to the amount of utility credit that should be offered to the solar customer. None of these were proposed with sufficient evidentiary backing as to be clearly preferable. We select a credit of $20 a month for 36 months for the single family electric water heater market. While this is a somewhat smaller credit than many have suggested, we believe it constitutes a reasonable balance among the credits proposed and the value to the utility of the energy saved, the value to the customer of the energy saved, typical monthly loan payments the customer may assume, and the need for a simple and understandable incentive.

While we were not persuaded by CalSEIA's insistence on statewide uniformity of incentives, we feel that there should be a certain degree of uniformity within each utility service area. Customers of PG&E and SDG&E could become confused if a $20 a month credit were offered for electric water heater retrofits and some other amount for gas water heater retrofits. We conclude that the same $20 a month credit should be offered for single family gas water heater retrofits. However, to take into account that the gas retrofits will generally be less cost-effective to the customer than the electric retrofits, the credit for gas water heater retrofits should extend over 48 months.

The record is clear that almost all multi-family installations will be retrofits to gas water heaters and that these installations cost about one-third as much per residential unit served as a single family installation. We conclude that an appropriate credit in the multi-family market is $8 per month for 36 months.

38/ Exhibit 91.
39/ CalSEIA brief.

We further conclude that for purposes of a demonstration the availability of direct utility loans should be limited. While we have not been convinced that the presence of direct utility loans will drive conventional lenders from the market, as some have claimed, it is important that a demonstration program avoid any possibility of restricting conventional lending. By limiting utility loans to a portion of the market for the limited purpose of obtaining information, we assure that conventional lenders will remain in the market and we may stimulate more creative lending practices among conventional lenders.

Utility loans should be made available only as an option for solar retrofits to single family gas water heaters. This market ultimately is the largest market for solar water heating. Parallel utility loans and credits should be offered in this market during the demonstration so we can obtain information with the broadest applicability.

The record is mixed regarding a proper interest rate to be charged to the consumer of direct utility loans. PG&E stated that an 8½% interest rate may not attract sufficient sales to meet the stated market penetration goals while SoCal Gas claimed it would have to offer a 0% interest rate to meet the Commssion's objectives. On the other hand, CalSEIA and others claimed that a 0% interest rate was an excessive inducement.

Of course, the market itself will render the best judgment regarding what interest rate must be offered to meet the market penetration goals set forth in this order. We find that there is no evidence currently available that will permit this commission to select a specific interest rate for utility loans using market penetration as the criteria. It is clear, however, that a higher interest rate will reduce costs of the program to other ratepayers and will permit downward reduction if market penetration goals are not being achieved.

Our selection of an interest rate is based on our desire to obtain information on consumer response to economically comparable incentives offered as loans and credits. Having decided that a $20 per month credit for 48 months is an appropriate credit to offer in the single familygas water heater market, we conclude that a loan of 6% for 20 years offers a comparable incentive to the consumer in present value assuming a typical loan is repaid within eight years on sale of the home.

There have been many suggestions on the manner of paying utility credits to the solar customer. These include a monthly credit against the utility bill, a monthly payment by check, an annual payment by check, and a single lump sum credit upon purchase of the solar system. Each of these proposals has been made with a variety of claims regarding the ease and cost of administration and the strength of the incentive to the potential customer. Again, there is no clear evidence to support any particular proposal. We adopt a monthly credit, payable quarterly, as the method most likely to balance a strong customer incentive with a low cost of administration.

Therefore, we adopt the following basic structure of utility incentives subject to certain exceptions discussed later:

1. Only utility credits shall be available for single family electric water heater retrofits. These credits shall be $20 per month for 36 months payable quarterly or until sale of the home whichever occurs first. ($720)

2. Only utility credits shall be available for multi-family water heater retrofits. These credits shall be $8 per unit served per month for 36 months payable quarterly or until sale of the building, whichever occurs first. ($288/unit)

3. Both utility credits and utility loans shall be available for single-family gas water heater retrofits. Utility credits shall be $20 per month for 48 months payable quarterly or until sale of the home, whichever occurs first. ($960) Utility loans shall be at 6% interest to be repaid with monthly payments over 20 years or upon sale

of the residence, whichever occurs first. We find these credit and loan terms to be economically comparable incentives which should provide a clear evaluation of consumer preference, if any, during the demonstration program. The utility shall not promote either loans or credits as a preferred option. The utility shall cease making loans when one-half of targeted number of single family gas participants have received a utility loan.

4. Installations for low-income families shall be made as an investment of the utility with no repayment obligation on the part of the recipient.

D. Exceptions

For San Diego Gas and Electric and SoCal Edison, we adopt modifications of this basic framework. SDG&E has emphasized to us its particular financial condition and the difficulty it would have in raising the necessary funds to implement a loan program without further jeopardizing its situation.[40/] In response to Decision No. 91272, SDG&E proposed a credit only financial assistance program with credits to be applied against the monthly utility bill of the customer.

We agree with SDG&E that it implementation of a utility loan program would hinder its ability to achieve its admirable goals of financial stability. Therefore, we do not adopt a direct loan program for SDG&E. We also have reservations about the concept of applying a utility credit against the utility bill of the customer. We believe this would act as a damper to further energy conservation by the customer by giving false price signals. We also fear the customer would not gain a true sense of the savings flowing from the solar system until the credits terminated. We conclude that SDG&E should offer credits in the amount and duration described above to be paid on a quarterly basis.

SCE has urged the adoption of its unique proposal to pay declining annual credit designed to assure the solar customer a positive cash flow from the moment the solar system is installed.

40/ Exhibit 59

There has been no evidence to suggest that this program will not achieve our market penetration goals or will be any more costly than the program we have adopted for the other utilities. There appears to be substantial merit to evaluating this approach during the demonstration and will adopt the financing aspects of the SCE proposal for its use.

A final exception to the general framework we have adopted for the demonstration program relates to sales made directly by contractors without a utility referral. CalSEIA has urged the commission to minimize external interference in the direct sales efforts of solar contractors. CalSEIA has opposed any utility loan programs on the grounds that such programs would require multifaceted utility interference in their marketing campaigns, including the use of an unacceptable price limiting mechanism.

While we do not necessarily agree with all of the points raised by CalSEIA in opposition to utility loan programs, we believe that to make utility loans available for sales made directly by contractors could necessitate imposition of price limitations on these sales. We conclude that such limitations would be contrary to the purposes of the demonstration, could be detrimental to proper development of the solar contracting industry, and would represent an unwise intrusion into the operation of the free market. Therefore, utility loans shall not be available for sales made directly by contractors without a utility referral; and utility incentives in such sales shall be limited to utility credits.

E. Financing Limits

Consideration of direct utility loans inevitably leads to the question of whether limits should be placed on the size of loan available for any particular installation. Absent such limits, we believe prices will tend to rise simply because the utility will finance any price for any system. The higher prices will become an increasing burden on the ratepayers who are assisting in the financing.

CalSEIA contends that this problem is so serious as to require rejection of utility loans as a financial assistance mechanism. We find no basis for this conclusion. As we have discussed, the utility credit mechanism supported by CalSEIA has its own limitations.

We have considered many means by which a price limitation can be established. In evaluating the options, we have been guided by the following criteria:

1. Maintenance of marketplace forces, if possible.
2. Maintenance of price competition.
3. No incentive to unduly increase prices.
4. No incentive to reduce quality under price pressure.

We have considered the following options:

1. No price limit - any price the dealer can command should be financed.
2. Fixed price limit - For example, Mr. Czahar of our staff has suggested that the commission determine the average market price for a typical solar water retrofit and limit utility loans to no more than this average and 50% of anything over the average.41/
3. Variable price limit - Recognizing that installations will vary in size and complexity, it has been suggested that a limit vary based on the number of bedrooms or the number of fittings in the installation.42/

41/ Exhibit 91.
42/ Exhibit 53.

4. Cost-effectiveness - PG&E has proposed to audit each prospective installation to determine how much financial assistance it would be "cost-effective" for the utility to provide with this amount becoming the size of the loan that would be made available.43/

5. Three bids - Southern California Gas and others have suggested that a requirement of three bids would best replicate the operation of the marketplace.44/ There are several permutations of this option that we have considered:

   a. Finance the lowest bid only
   b. Finance the amount of the lowest bid but let the customer select a higher cost system with the customer to pay the difference
   c. Finance up to the average of the three bids and let the customer select the system.
   d. Finance either of the two lowest bids
   e. Finance any of the three bids and let the customer select the system.

We find that none of the options we have considered meet all of our criteria. We have thus sought the option which best meets our criteria with the fewest negative implications. We have also kept in mind that utility loans will not be available for retrofits of electric water heaters or multi-family gas water heaters or for direct contractor sales for 50% of the utility referred sales of single-family gas water heater retrofits. Thus, we will have an opportunity to evaluate any potential harm or benefit of a price limiting mechanism in the specific context of utility referred single-family gas water heater retrofits while observing market forces prevailing in the remainder of the installations.

We conclude that a three-bid requirement for those receiving utility loans will best meet our criteria, will be readily understood by consumers, and is most compatible with the utility referral process itself. We also conclude that either of the two lowest bids should be financed. This will permit the customer

43/ Exhibit 70.
44/ Exhibit 52.

to reject a low bid on quality, service, or reliability grounds while protecting the ratepayers from "gold-plating" that could develop if any of the three bids could be financed. We believe this flexibility is not unlike that which a typical consumer might exercise in any major purchase. We also believe this will permit higher quality, higher-priced systems to compete in the demonstration program without being required to reduce quality to meet low-bid requirements. We adopt this approach for Southern California Gas.

Another reasonable approach would be to provide a low-interest loan only up to a prescribed limit, but to offer any additional amounts necessary to complete the purchase at the interest rates experienced by the utility in acquiring such funds. In this manner, the customer is given the capability of making an entirely independent purchase decision which will create no additional costs to the ratepayers even if a high cost system is selected. The precise limit to funds available at low interest becomes less critical since additional funds will still be made available although at higher interest rates. Both the limit of low interest financing and the rate of interest for funds advanced above the limit can be periodically revised to account for inflation and fluctuations in utility borrowing costs.

We adopt this approach for PG&E and defer to the subsequent rate case our determination of the limit of funds available at low interest and the initial interest rate for funds exceeding the limit. PG&E has suggested that loans should be limited to the level at which the purchase would be cost effective to the utility. This concept has merit, although we are reluctant to place the utilities in the position of making this determination for each loan applicant. We will order PG&E to develop and maintain a schedule of cost-effectiveness to the utility for a variety of typical installations assuming 60% displacement of conventional fuel. Both PG&E and the staff should present such a proposed schedule in the subsequent rate adjustment proceedings.

F. Utility Investments for Low-Income Consumers

Decision No. 91272 instructed the respondent utilities to assure that a representative cross section of consumers from different income groups would be reached during the demonstration program. The order also includes utility investments with no repayment obligation as one financing mechanism to be utilized by the utilities. During the hearings on the utility proposals, a consensus developed to utilize the utility investment option exclusively to reach low-income consumers.

There is no evidence in our record that utility investments with no repayment obligation are necessary in order to achieve the market penetration goals established for the demonstration program. It has been argued that low-income consumers may not be able to participate in the demonstration without utility investments.45/ We conclude that financing by utility investment with no repayment obligation should be utilized solely to reach the low-income market during the demonstration program.

There is a consensus that the utilities should not be charged with the responsibility to determine eligibility for the low-income program. Some parties suggested that the commission make these determinations.46/ Yet this commission has neither the staff, the budget, nor the expertise to make these decisions. We adopt a recommendation of the California-Nevada Community Action

45/ Brief of California-Nevada Community Action Association.
46/ Exhibit 64.

Council (Cal-Neva) and PG&E that eligibility for utility investment financing be determined using the same criteria and decision-making agencies that are used to determine eligibility for federal energy grants to low-income people.[47] These criteria have been thoroughly considered by the U.S. Congress and the determination mechanism is in place today.

Concern has also been expressed that our general statement of intent that low-income consumers receive fair access to the demonstration program is not adequate to ensure this in fact occurs. It has been recommended by Cal-Neva that a specific reservation of funds be made for installation for low-income consumers and that punitive measure be employed to ensure utilities achieve the low-income targets.[48]

We agree that a specific set aside of funds should be made for the low-income market. This appears to be a simple and straightforward method by which utility performance in reaching this community can be measured. Therefore, we conclude that 10% of all funds authorized for demonstration solar financing programs shall be allocated to the low-income market. However, we see no need to adopt punitive measures. The ability of the utilities to reach the low-income market will be one of several criteria by which utility performance will be evaluated.

G. Security for Utility Loans

All parties with the exception of PG&E and staff witness Czahar recommended that all utility loans be secured by a lien. Several arguments have been raised against such liens. One is that many people, particularly those of lower incomes and senior citizens, would be unwilling to place a lien on a primary asset and would thus be precluded from the demonstration program.[49] Also it is feared that if utilities hold liens, they may foreclose in the event of non-payment.[50]

47/ Tx p. 5566 and Exhibit 70.
48/ Brief of California-Nevada Community Action Association.
49/ Tx p. 4346.
50/ Tx p. 4394.

While the placing of liens would add to administrative costs, this is a relatively routine function which is not likely to become a significant expense item. While we have no evidence on this point, it seems reasonable to conclude losses from uncollected loans would easily exceed the cost of placing liens.

It seems imprudent to ask the ratepayers to provide financing assistance in the form of loans without providing even minimal security for repayment. Thus, we will require the utilities to record security instruments on all properties on which they make loans for solar water heater retrofits. These security instruments shall be restricted in two ways. First, a utility shall not be able to foreclose for non-payment but shall recover proceeds of the loan only upon sale or transfer of the property. Any payments not made in a timely fashion shall accrue interest at the rate of 14% per year until paid. Second, the utility security shall be subordinated to all other liens until one day prior to sale or transfer of the property.

H. Estimated Costs and Savings

Detailed estimates of costs and savings of the adopted programs are contained in Appendix A.

III. CONSUMER PROTECTION AND CONFIDENCE

Market survey information developed for this proceeding clearly indicates that a lack of consumer confidence in solar water heating systems and installations is a principal barrier to wider use of the technology. Consequently, in our order of January 29, 1980, we directed the responding utilities to suggest means to improve consumer confidence in solar water-heaters. In addition to the responses of the utilities, we have received suggestions from persons affiliated with the solar industry.

During the course of our second round of hearings, the California Energy Commission (CEC) was conducting a simultaneous proceeding to prepare a State Plan for a Residential Conservation Service (RCS) as required by Section 456.3 of the National Energy Conservation Policy Act of 1978. Our staff, the respondent utilities, and many other parties to OII-42 participated in development of the RCS Plan. Many components of the State Plan specifically address issues relevant to OII-42. To avoid needless duplication of effort and likely confusion of the public, we incorporate those elements of the State Plan that are relevant to this order. We also take official notice of the California State Plan for a Residential Conservation Service filed with the U.S. Department of Energy in June 1980.

We view the RCS as the core of residential conservation and solar programs in California. It is not our intention, in adopting a demonstration solar financing program, to deviate from the State Plan. Rather, we view the demonstration program as an additional service to residential customers. This service should be provided in a manner consistent with RCS.

The RCS addresses several of the consumer confidence and protection concerns that are relevant to the demonstration solar financing program. However, some of the measures included in the RCS may not be appropriate for a demonstration program. The RCS is designed to stimulate wide-spread implementation of highly

cost-effective conservation measures. Our demonstration financing program is designed to determine whether solar water heaters may become one of those measures. The few elements of this order which may be at variance with the State Plan for RCS are, in our opinion, necessary strictly for purposes of making this evaluation.

A. Energy Audits

A key element of the RCS is the home energy audit and the related renewable resources audit. Each utility subject to the RCS is required to make available to residential consumers, upon request, a conservation or renewable resources audit.[51] Section 456.307 of the State Plan contains specific procedures by which these audits will be offered and how they will be conducted.

While each of our respondent utilities will be required to offer either type of audit upon request by a consumer, a major issue in this proceeding has been whether either type of audit will be required as a condition of obtaining financing. Some parties have urged that a solar audit be required as a condition of financing to determine whether a solar water heater is cost-effective for the particular application.[52] It has also been suggested that a conservation audit be completed prior to financing and that the consumer be required to complete more cost-effective conservation measures before becoming eligible for solar financing.[53]

We conclude that neither type of audit nor the completion of more cost-effective conservation measures should be required as a condition of receiving solar financing in the demonstration program. This conclusion is reached in light of the purposes of the demonstration. Such requirements may be appropriate for permanent, unlimited programs but could actually obstruct the purposes of the demonstration.

51/ 92 Stat. 3215.
52/ Exhibits 59 and 70.
53/ Letter from Natural Resources Defense Council dated March 20, 1980.

We reiterate that the purpose of the demonstration is not to determine how much energy can be saved at the lowest cost by a given number of solar systems. There is adequate expert opinion on this today. What is in doubt is the interaction between the solar consumer and the solar salesperson during the sales process. While market surveys can offer some insights, only a broad demonstration as we are ordering can give a real indication of how a large scale market may function.

Audits emphasize cost and payback periods as the primary basis for a decision. This is clearly an important factor. But other factors may also be present. These could include a desire to gain a limited degree of energy self-determination, concern that utility rates will increase faster than projected in an audit, or a desire to contribute to the national effort to reduce reliance on imported fuels. We would not be surprised to find unforeseen factors play a role in a consumer decision to install a solar water heater.

In addition, there is little relationship between a solar audit and items recommended in a conservation audit. Solar water heating is a discrete measure in relation to ceiling insulation, weatherstripping, or furnace modifications. Installation of such items as water heater wraps and low flow showerheads are required to obtain solar tax credit. To require a conservation audit as a condition of receiving solar financing would simply make more complex an already difficult purchase decision.

There is also a significant concern that delays could arise in scheduling audits with the result that solar sales would actually be impeded. Substantial delays have occurred in existing utility audit programs.[54/] Similar delays would have a detrimental impact on the demonstration program.

54/ Tx. 4023 and 3846.

Undoubtedly, sales abuses will occur during the demonstration program. These will be found in the course of inspections and program evaluations. Determining the extent and nature of such abuses is an important objective of the demonstration. If the demonstration is structured so that no abuse can occur, we will have failed to learn what types of consumer protection measures are truly necessary in the open market. If sales abuses appear to be a serious problem during the demonstration, this will provide the necessary information to structure an appropriate role for either the utilities or the government in the solar sales process. Absent this information, we run a serious risk of overregulation which could hinder proper growth of solar utilization.

Therefore, neither audits nor the completion of more cost-effective conservation measures should be required as a condition of solar financing in the demonstration program. Nor should utilities suggest or urge the conduct of such audits or the completion of other measures during the solar financing intake process. Those consumers who are aware of the availability of audits through the general promotion of the RCS, on the other hand, should receive audits upon request irrespective of their application for solar financing.

B. Installation

Another major controversy in this proceeding has been whether a solar water heater will be eligible for financing regardless of who installs it. Concern has been expressed that utilities may favor some contractors over others if they are given unfettered discretion in financing.[55] Others feel that some controls must be exercised to ensure that ratepayer funds are not used to finance sales by unscrupulous operators.[56]

Our record does not contain clear evidence of sales or installation abuses by solar contractors. Those urging establishment of stringent criteria for eligibility of contractors base their case on fears of what could happen without such criteria. We find these concerns to be legitimate, but we do not find them an appropriate basis on which to institute a set of restrictive standards at the outset of a demonstration program.

55/ Tx. 3555.
56/ Exhibit 87.

Again, we turn to the purposes of the demonstration to guide our decision. It is important both for this Commission and the general public to become more familiar with solar water heater sales and installation practices. If certain patterns of abuse arise, specific remedies can then be employed to protect consumers. To institute remedies before the problems are known would be a disservice to the industry, to the market and to the long term interests of consumers. After the demonstration, there would be no basis on which to recommend removal of certain protections.

We conclude that the standards for contractor eligibility to participate in the demonstration program should be the same as those adopted in the State RCS Plan for eligibility to be included on referral lists. We will incorporate the RCS standards by reference. Adjustments to the RCS standards will become adjustments to our standards. Our standards will also include the delisting and grievance procedures included in the RCS plan. Thus, any contractor who is eligible to be included on an RCS referral list for solar water heater installations shall be eligible to install systems which can be financed pursuant to this demonstration.

However, we do intend to maintain flexibility to respond to patterns of abuse which may arise. To the extent a clear pattern of abuse is demonstrated, we will adopt more stringent requirements than those contained in the RCS plan as necessary to protect consumers.

During the period of the demonstration programs, it is important that RCS referral lists not become the sole source of sales leads for the solar industry. To the contrary, utility referrals should become simply a supplementary source of leads complementing many other sources included in a marketing strategy. Therefore, sales by RCS eligible contractors shall be eligible for participation in the demonstration program whether or not they resulted from a utility referral or were developed by the sales initiative of the contractors. Further, any sale developed directly by a contractor shall not be considered a referral for purposes of any rotation system employed by a utility in designating certain contractors to prospective solar customers.

It is also important to acknowledge that do-it-yourself installations may become a significant factor in the market as consumers learn more about the basic simplicity of solar water heating systems. To ensure that this market is permitted to blossom, do-it-yourself installations which have been inspected and which meet all criteria for the demonstration program shall be eligible for participation in the program.

C. Systems

A similar controversy has arisen regarding standards for solar systems. We are particularly concerned that solar water heaters financed with assistance from ratepayers, in addition to available tax credits, be durable and perform well.[57] Although we are concerned that we not establish standards that will slow innovation,[58] we are equally concerned that negative backlash from low quality or undersized systems may act to widely dampen public faith that solar water heating can be practical.

There are widely accepted standards for several components of solar water heaters. As much as possible, we intend to utilize such standards. However, there are no accepted standards for entire solar water heating systems. If widely accepted minimum standards for solar water heating systems are developed during the demonstration program, we intend to evaluate them and may incorporate them into the program.

Presently, we will adopt minimum standards which we feel best balance our concerns to not stifle innovation while offering reasonable protection to consumers. Our record is replete with recommendations for such standards. Several different recommendations were made by representatives of both solar contractors and solar manufacturers. Other recommendations have come from our staff and from the utilities. We adopt, with some modifications, the standards suggested by Mr. Robert Ladner of the San Diego Gas and Electric Co. and generally supported by our staff.[59]

57/ Exhibit 87.
58/ Exhibit 64.
59/ Exhibits 87 and 59. See also Tx 3607.

We reject Edison's proposal that it reserve the right to substitute unspecified equipment which it feels is comparable or superior to these standards. We encourage Edison instead to propose any changes in standards which it believe to be warranted by new information or technological progress.

These standards focus on durability concerns. Performance standards are even more difficult to impose. There is currently no generally accepted testing program or methodology to evaluate the performance of solar water heaters. This creates serious problems for the solar industry, consumers and government agencies such as the Commission. The absence of performance testing and standards produces serious pressure to adopt increasingly stringent prescriptive standards. While we reject stringent prescriptive standards at this time, we feel there will be an inexorable tendency to implement such standards unless responsible parties develop acceptable performance standards. This concern is discussed in greater detail in the section of this decision commenting on the proposal for an expanded CalSEAL program.

One of the most difficult issues of systems standards relates to the proper sizing of the solar water heater for the specific situation. A system that is oversized may displace more energy but will cost substantially more than necessary. A system that is undersized will neither displace adequate energy nor give good value to the customer.

Proper sizing depends to a large degree on the size and efficiency of the collectors, the efficiency of other components of the system, and the size of the storage system. The interrelationship among these components is so complex that use of a full system performance testing procedure is the only method to truly protect the consumer. We regret that no such system exists today.

Even if there were an accepted system performance test, there remain certain subjective judgments that must be made for each installation. The principal subjective question is whether to size the system for the building or for the people in it. Clearly a large family with on premises clothes washing, large quantities of dishes and many showers a day will consume much more hot water than a single person who eats and launders away from home. During the

estimated twenty-year life of solar water heater, many people with many usage patterns must utilize a single system. This is particularly true regarding multi-family dwellings with a high turnover.

We therefore see little reason to size a solar water heater on the basis of the current occupants of a building. What is properly sized for one group of occupants may be oversized or undersized for the next. We conclude that sizing judgments for systems to be financed in the demonstration program should be based on the number of bedrooms and the presence of certain appliances in the building. While this may not assure optimum sizing in all cases, we believe that by assuming a typical usage pattern for a specific dwelling the size of the system can be optimized over its life.

We will adopt a modification of the minimum sizing method for flat plate collectors proposed by the Energy Conservation Branch of the commission in Exhibit 87 and included in Appendix C. This method shall be used in sizing all installations made after January 15, 1981. When applying the sizing formula, the system should be sized to displace 60% of the assumed usage of conventional energy. Consistent failure to size equipment to meet this objective on the part of any contractor or the industry as a whole will be a factor that could lead to imposition of more rigid standard for system performance. Contractors not using flat plate collectors shall provide the Energy Conservation Branch of this commission with sizing criteria or methodologies and adequate supporting data to permit adoption of alternative sizing procedures for such systems.

D. Inspections

We have already stated our conclusion that maximum flexibility should be provided regarding system selection, contractor selection, installation, and financing. We believe this to be a wise course not only because of the state of development of the solar industry but also as a matter of limiting government intrusion into to the marketplace.

Nevertheless, when we are asking the ratepayers to assist in financing to provide a demonstration for the benefit of all ratepayers, and when we place the imprimatur of government approval behind a particular technology, we have a special obligation to assure both the ratepayers and the solar consumers that they are getting their money's worth. We believe this can best be accomplished by post-installation inspections.

Inspections will disclose any deviations from the minimum system and installation standards to be employed in the demonstration program. Inspections will also provide the most accurate information about system and installation problems which may require remedial action. Finally, inspections will create a valuable data base to assist in evaluating the program.

There have been several suggestions regarding the appropriate frequency of inspection which is necessary to provide adequate quality assurance and adequate information. Some believe that inspection of every installation is required.[60/] Others believe a spot check system limited to a small number of installations would be adequate.[61/]

We find we must balance conflicting considerations. It is clear that the best protection and the best information will be provided by complete inspection of all installations. Yet we are not convinced that the cost or administrative problems that could arise from 100% inspection are justified for the duration of the demonstration. Particularly as individual systems and contractors develop reputations for competency, 100% inspection may be unwarranted.

We conclude that each installation of each participating contractor should be inspected at the outset. As a track record of performance is developed, it may be possible to reduce to a random sample basis. We will remain open to the proposals of any interested party regarding random sample inspections once there has been sufficient experience in the field.

60/ Exhibits 87 and 52.
61/ Tr. 2782

There have also been a variety of proposals regarding who should conduct inspections. These have included self-inspection by the contractor who would file a certificate of completion, inspection by industry association, inspection by the utility, inspection by local building inspectors, inspection by a representative of a state agency such as the PUC or Department of Consumer Affairs, and inspection by an independent organization.

Two of these proposals we reject out of hand. One is inspection by a state agency. We do not believe it is a proper role for state government to institute a broad inspection program for consumer transactions which have few health and safety implications. The other is inspection by industry association. This would be a classic case of putting the fox in charge of the hen house. It would violate clear rules of the RCS plan as well as the dictates of common sense.

There is a certain logic to the concept of inspection by local building inspectors. Most solar water heating installations require a building permit and would thus be inspected by local inspectors anyway. It would be both simple and efficient to have the building inspector complete the inspection of the solar system.

Unfortunately, the role of the building inspector is to inspect for code compliance only. Since the minimum standards to be utilized in this demonstration program are not in codes nor intended to become codes, building inspectors would have no training

Therefore, we cannot prudently rely on local building inspectors to conduct inspections for this demonstration program. However, we find such merit in the concept of a single inspection for each installation that we encourage development of cooperative arrangements between the solar industry, the utilities and local building departments to provide single inspections.

Presently only the utilities have a sufficient field infrastructure and technical expertise to conduct a reliable inspection program. The utilities have field offices and technical personnel in every area of the state. In fact, it appears that the demonstration programs will be implemented through these field offices. Furthermore, the utilities have established recruitment and training organizations including solar installation training. The utilities have indicated both a willingness and a desire to conduct inspections and we have no doubt about their ability to implement a competent inspection program.

Yet there is substantial opposition to utility inspection programs within the solar industry. Representatives of the solar industry claim that utilities lack the technical expertise to conduct inspections, would not conduct the inspections on a timely basis, and would utilize inspections as a means to manipulate solar contractors in the self interest of the utility. While there may be legitimate concerns, our record does not adequately bear them out. If there is merit to any of these concerns, it should become apparent early on in the demonstration program.

Still another option is the concept of self-inspection by the installing contractor. This too is unacceptable as an exclusive mechanism because of the obvious conflict of interest present in the contractor. However, we find that there is a valid and useful role to be performed by self-inspection. Coupled with utility spot inspections, self-inspection can improve the quality of installations if the self-inspection becomes the basis for subsequent comparison with a utility inspection. Since all installations will utilize a common checklist, filing of improper self-inspection certification by contractors can be utilized as a basis for disciplinary action when later discovered by the utility. Thus, there is a clear role for contractor self-inspection in the demonstration programs.

Finally, we find that an excellent case has been made for the establishment of an independent organization to conduct inspection under the supervision of a cross section of interests including consumer groups, utilities, contractors and manufacturers and government agencies. No such organization currently exists. Still, we

can state that we would be pleased to consider any proposals from such an organization to conduct inspections during the demonstration program.

We conclude that inspections for the demonstration program must be conducted by the utilities. There is no prudent alternative in place. At the same time, we encourage the formation of an independent organization and of cooperative agreements with local building departments as alternative means to provide inspections.

A final issue remains relating to inspections. Should each utility or other inspecting entity develop and utilize its own inspection format or should there be a standardized checklist? On the one hand, it appears that much could be learned by observing different approaches to inspection in operation. On the other hand, different inspection criteria could create widespread confusion in the solar industry. We conclude that the risk of confusion is greater than the benefit of diversity and consequently adopt a standardized checklist to be employed in all inspections in the demonstration program. Such a checklist has been introduced into the record by SDG&E and modified by our staff; we adopt it with further modifications to conform to the standards we adopt herein. The checklist is found in Appendix D.

E. Payment to Contractors

An issue frequently raised during the hearings in conjunction with a discussion of inspections is the question of timing of payments to contractors. More specifically, if inspections were required, would payment to the contractor be withheld pending the inspection?

Throughout the proceeding, many contractors voiced a serious concern that if utilities were engaged in financing, payments to contractors would be delayed.[62/] Payment delays are particularly harmful to small contractors who do not have access to lines of credit to finance accumulations of accounts receivable. Evidence was introduced to the effect that payment delays have occurred in similar programs involving utility financing of insulation.[63/]

62/ Tx. 3791.
63/ Tx. 3574.

This Commission recognizes that prompt payment for services rendered is essential to both the survival and continued growth of the solar industry. Prompt payment should be made irrespective of who writes the check to finance the installation. Payment should be no slower merely because a utility is the financing entity.

Yet several parties have urged the Commission not to permit or require payment to contractors until there has been an inspection and any problems have been rectified. It is argued that once payment is made, a contractor will have no incentive to return to the job to correct problems found by the inspection. Of course, contractors who fail to rectify problems found by an inspection could be declared ineligible to participate in the demonstration program. While we intend to utilize such discipline as a measure of last resort, we think it somewhat drastic to be employed as a first line of defense.

There are certain practices not uncommon in the construction industry which can resolve both of these compelling concerns. These are generally referred to as progress payments in which payments are made gradually as progress is made toward completion. Of course, most single family solar water heater installations are accomplished so quickly that progress payments would make little sense. However, a type of progress payment can be employed even in this situation; an initial payment which covers most or all of out of pocket costs and final payment upon final inspection and completion.64/

We adopt a progress payment approach where utility financing is employed to assure both prompt payment and the protection of consumer and ratepayer interests. The contractor shall submit to the utility a certificate of completion each job. The utility shall pay 60% of obligation on the installation within 48 hours of receipt of the certificate and inspection. All inspections shall be conducted within ten days of receipt of the certificate and self-inspection. If a utility cannot schedule an inspection within ten days, it may conduct a less thorough inspection or waive the inspection. Final payment shall be made within 48 hours of completion of any remedial work necessary and final inspection. If the inspection is waived, final payment shall be made within 48 hours' notice of waiver has been issued.

64/ See Tx. 3608.

This approach should permit contractors to recover most if not all their out of pocket costs immediately upon completion of the installation. Those who accurately conduct self-inspections would have final payment in less than two weeks after utility inspections or waivers of inspection. Only those who have improperly conducted self-inspection of the installation will have a delay in obtaining payment. We conclude that these are precisely the situations in which a delay in payment is warranted.

For those installations in which the utility will not provide financing but will instead provide a credit, a similar approach will be utilized although there is no need for a progress payment. Credits will only be issued upon receipt of the certificate of completion and self-inspection and inspection or waiver of inspection by the utility within 10 days. Here, however, the solar customer bears a risk that a credit will not be paid if the contractor fails to adequately remedy any deficiencies found during inspection of the installation. Therefore, we will urge solar customers to not make final payment until they have been specifically informed by the utility that their installation is eligible for a credit.

F. Service, Maintenance and Warranties

A clear finding of the market survey conducted for the Commission in this proceeding last year was that utility-provided maintenance would be a substantial inducement for consumers to purchase solar water heaters. Many parties submitted testimony regarding the propriety of utility maintenance in the subsequent hearings. On the basis of our record, we conclude that utilities should not offer or provide maintenance for solar water heaters.

We have little doubt that utility-provided maintenance could stimulate additional sales of solar devices. However, the long term implications of utilities entering this segment of the solar business are negative and substantial.

There is clear evidence that the development of a substantial service business is vital for both the profitability and infrastructure development of the solar industry.[65] There is also substantial doubt that utilities will be able to maintain adequately trained service representatives throughout their service areas with the capability to service any of hundreds of combinations of components in this rapidly changing technology. Finally, we can think of no better way to assure the growth of a solar industry insensitive to quality considerations than to tell the industry the utilities will handle all the service problems.

Therefore, we will limit utility maintenance of solar water heaters to so-called "screwdriver" maintenance--the minor adjustments comparable to those now performed by utility personnel on other types of appliances. Service and maintenance must remain the responsibility of the manufacturer and installer of the solar system.

There is much less clarity regarding the terms by which service and maintenance should be provided. A wide range of proposals has been presented on the record including: mandatory warranties of 1 to 20 years' duration, mandatory service agreements, optional service agreements, payment by consumers on a cost of service basis, five-year warranty with additional five-year service agreement, and "last resort" service provided by an industry or independent organization in the event a manufacturer or installer fails to provide service as agreed. In addition, there have been proposals for annual diagnostic inspections at no cost to the consumer or at nominal charge to be provided by the utility or by an industry association.

We see merit to each of these concepts amd can see no reason to declare any of them unacceptable for use in the demonstration program. We also note that our record contains little evidence of service or warranty abuse by the solar industry. However, the record is clear that the availability of reliable service is important to building consumer confidence in solar water heaters.

65/ Tx. 2544.

Therefore, we feel compelled to establish credible and easily understood minimum service requirements. The need for minimum service requirements is further underscored by our decision not to establish rigid prescriptive standards for the systems themselves.

Initially, we shall require all systems financed in the demonstration program to meet the warranty requirements for tax credit eligibility. All installations made on or after January 15, 1981 shall be required to have a full five-year parts and labor warranty and an extended prorata parts warranty for an additional five years to be eligible for participating in the demonstration program. This is not unlike warranties commonly found on conventional water heaters today and is similar to the proposal of Martin and Associates.[66/] While this warranty is substantially greater than that required for the tax credit, we feel this additional protection is necessary and proper given the additional incentives being offered by the ratepayers and the absence of prescriptive standards in this order. While some members of the solar industry may take exception to such warranty requirements, we feel the overwhelming majority of producers and installers of quality equipment will be more than willing to stand behind their products and will be pleased that their competitors will have to offer comparable quality as well.

We shall also include a diagnostic inspection to be provided by the utility at no charge at the end of the first and fifth years after installation and at a nominal charge thereafter.

The utilities shall also make available to any participant, on request and for a reasonable fee to cover all costs, a service agreement limited to necessary repairs during the warranty period in the event the installing contractor fails to honor the warranty.

G. Alternative Consumer Protection Concepts

Our record contains two concepts for promoting consumer protection and confidence which could be viewed as alternatives to the measures adopted herein. These concepts are an expanded CalSEAL program and industry sponsored insurance pool.

66/ Exhibit 85 and Tx. 4655.

1. Expanded CalSEAL Program

The CalSEAL program is a solar tax credit labeling program designed to provide assurance to consumers that their solar systems were installed in conformance with California's solar tax credit regulations. The program is administered by the California Solar Energy Industries Association (CalSEIA) in cooperation with the California Energy Commission.

At the urging of our staff, CalSEIA has presented a proposal to broaden both the leadership and the functions of the CalSEAL program so that CalSEAL would become an independent and balanced organization with primary responsibility to protect consumers.[67] It is proposed that CalSEAL be established as an independent, non-profit corporation, governed by a Board of Directors composed of representatives from governmental agencies, private trade associations, and major utilities. Funding would be generated from participating contractors through registration fees, from solar consumers through label sales, and from the utilities through subscription rates. Other funds could come from utility grants, state and federal grants, and subscription sales to other large institutions and agencies. Through set-aside of a certain percentage of each label sold, the establishment of two special funds for program promotion and installation insurance is recommended.

CalSEAL would adopt installation standards, a code of ethics for participating contractors, and a system testing and certification procedure. CalSEAL would also conduct inspection and discipline or delist contractors as necessary.

2. Martin and Associates

Martin and Associates, an investment and business consulting firm, filed testimony on several topics including measures to promote consumer protection and consumer confidence.[68] The basic concept of the Martin consumer protection measures is a passive role for the utilities with responsibility for system quality resting directly on the solar industry.

67/ Exhibit 93 (marked for identification only).
68/ Exhibit 85.

Every licensed contractor that opts to participate in the financing program would have to contribute to a service insurance fund by paying a fee equal to $500.00 initially. Every manufacturer who wished to have his product sold by participating contractors would contribute $5,000 initially to the fund.

Thereafter, an amount equal to seven- and one-half percent, (7.5%) of the retail price of each installation, or 7.5% of the amount financed through the utilities, would automatically be placed in the insurance fund. The monies would be disbursed to the fund by the utility directly as part of the financing assistance. The contractors and manufacturers would negotiate what percentage of the total deduction would be borne by manufacturers. But this would be an industry problem only. If the amount of financing made available through this demonstration program is $500,000,000 contributions at 7.5% would total $37,500,000 plus the initial fee amounts.

Every installation financed through the utilities would be unconditionally guaranteed, except for vandalism or acts of God, for parts and labor, as follows:

First five years:
1. All emergency service
2. All parts
3. One automatic annual inspection

There would be a nominal charge to owners of systems, payable to the installing contractor, for the second five years and that charge would be based on the number of collectors as follows:

	Annual Service Charge Per Collector in the System
Sixth year	$25.00
Seventh year	30.00
Eighth year	35.00
Ninth year	40.00
Tenth year	45.00

During the last five years the plan would provide all parts and labor and would include one annual inspection call. For the owner of a two collector system, the sixth year would cost $50.00 and the tenth year $90.00. This would represent a total out-of-pocket service expense for the entire 10-year period of $350.00 or $35.00 per year if this amount is amortized.

The first responsible party would be the contractor that sells the system. Only if the contractor fails to perform would the insurance fund be triggered into action.

All customers participating in the utility financed installations throughout the state would have an 800 number line to phone for service. This line would lead to the central offices of the service insurance fund where an operator would record the call by the customer's number and type of problem. This information would be relayed to the selling contractor immediately and also fed into a computer for record keeping purposes. The customer would be advised over the phone to call back central service if not completely satisfied with the services received. If the customer calls again regarding the same problem, then the central service would phone an alternative contractor in the same area and pay that contractor for time, mileage and parts if any. The original contractor would still be held liable by the insurance fund for costs, but these procedures would not have an adverse effect on the customer who needs service right away. In the event a contractor went out of business or left the area, then a new contractor would be assigned the account and he would be paid by the fund. Hence under this program the fund comes into play only after the original contractor fails.

Under this program, the contractor would make certain that his installations are right from the outset. In addition to controls from local building codes and the initial utility inspection, he would be faced with future out-of-pocket costs plus exposure to losing his privilege of participating in the financing program if his workmanship were not of the highest standards.

Manufacturers of defective products would also have serious exposure, as they could be expelled from the organization and their products no longer used in installations where the subsidized financing was used. They would also be liable for costs incurred as a result of their defective products.

Manufacturers that wished to sell their products through th financing would be required to extend a 10-year warranty for their product.

3. Future Action

We believe there is great merit to the basic concepts of these two approaches to consumer protection. Because they were submitted late in the proceeding, there was little opportunity for extensive examination of important details of the proposals. Therefore, we do not adopt, in whole or in part, either of the proposals at the present time.

However, we strongly recommend that the proponents of both proposals take steps to refine the proposals and bring them to fruition. We further recommend that the proponents work together to obtain the unified support of the many interests that must be included in programs. The proposals are not inconsistent. On the contrary, we find them highly compatible.

We also encourage the filing with this commission, by the authorized leadership of either or both programs, of a plan to assume responsibility for consumer protection functions in this demonstration. Such a filing should include a thorough description of proposed budgets, methods of operation, manner of organization, and an indication of voluntary subscription broad enough to be considered a reasonable alternative to any or all of the consumer protection measures adopted in this order. Upon receipt of such a filing, we will initiate supplementary hearings to fully consider the plans.

IV. COMPETITION, OTHER TECHNOLOGIES AND OTHER PROGRAMS

A. The Impact Of Recent Federal Legislation

Congress recently enacted S. 932, the Energy Security Act, which has important implications affecting any solar energy or conservation financing program to be undertaken by California utilities.[69/] The Act removed previous prohibitions and limitations on utility financing programs which were contained in Section 216 of the National Energy Conservation Policy Act. Now, states are free to establish such programs without DOE approval.[70/] However, DOE is empowered to terminate any utility financing program after determining that: (1) the program utilizes unreasonable rates or unreasonable terms and conditions, or (2) the program has substantial adverse affect upon competition or involves the use of unfair, deceptive or anticompetitive acts or practices. Such a determination must be preceded by notice and public hearings as well as consultation with the Federal Trade Commission. The limits of DOE's oversight role are in keeping with this Commission's determination to permit only programs which will preserve competition and will be founded on fair business practices.

S. 932 further amended the National Energy Conservation Policy Act by clearly stating that utility subsidies for the purchase of energy conservation measures, including solar systems, shall not be included in gross income for tax purposes. This resolves one of several tax questions raised during the proceeding and should promote consumer acceptance of the demonstration program.[71/]

The Act also creates the Solar Energy and Energy Conservation Bank. The Bank, which will cease to exist on September 30, 1987, is empowered to disperse as much as $100 million in financial incentives

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69/ A Summary of the relevant provisions of S. 932 is included in Appendix E.

70/ S. 932, Section 547

71/ S. 932, Section 545

to purchasers of solar energy systems in fiscal year 1981, $200 million in 1982, and $225 million in 1983. For these purposes, solar systems include any addition, alteration or improvement which is designed to utilize wind energy, energy produced by a wood-burning appliance, or solar energy (active or passive process) 72/

Bank funds can be applied directly to utility financing programs. However, Congress has expressly limited the utilities to 10 percent of the funds to be dispersed, spread across the nation in a representative manner. 73/ Bank funds are available to encourage single family and multifamily residential, small commercial and agricultural installations. A complex series of

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72/ The Conference Report accompanying S. 932 states, at p. 279,

> "The definition of 'solar energy system' is purposefully broad in order to include any solar technology likely to be commercially available during the life of the Bank. Some technologies such as photovoltaics and other solar electric devices are presently in transition from a developmental phase and may not be currently commercially viable in all applications. The Conferees expect the Bank, during its first years of operations, to focus on subsidizing commercially viable solar technologies and to specify the circumstances under which products presently under development could be considered commercially viable and eligible for subsidy. The criteria developed by the Bank are not to discriminate against simple passive or hybrid solar energy systems."

The wording of Section 504(8) and the above Conference Reports comments suggest that the Bank funds will be dispersed to encourage the commercialization of many technologies other than solar domestic water heaters. Not only will wind and wood energy devices be financed, but a variety of solar energy technologies will also be included.

73/ At its own discretion, the Bank can increase the utility share to as much as 20 percent. The Board of Directors of the Bank is to report to Congress within two years concerning the merits of this share limitation.

rules limit the amount of funds which can be disseminated to benefit a given building owner or resident.74/ The federal tax credit cannot be received by those receiving the benfits of Bank subsidies. The funds can be dispersed in two different ways:

1. Reductions of loan principle for loans to owners of existing buildings for the purchase and installation of solar energy systems, to builders of new homes for solar energy systems, and to purchases of new homes which have solar energy systems.

2. Prepayments of interest otherwise due for the same types of loans.

Bank funds made available to subsidize solar domestic water heater retrofits in California could interact with a utility financial incentive program in one of two ways:

1. Where credits or payments are being offered by the utility and the purchasers choose to acquire a conventional loan, Bank funds could be used to save money for the purchaser by subsidizing the loan principle or prepaying some of the interest otherwise due. One might argue that with the creation of such new incentives, the level of payment offered by the utility should be lowered. However, a customer receiving benefits from the Bank would not be allowed to claim a federal solar tax credit. Therefore, it is likely that the need for a utility incentive would not be diminished. Also, this type of Bank offering provides no incentive for a cash purchaser since the subsidies are only reflected through the reduction of loan principle or interest.

74/ The amount of financing and financial assistance which can be offered is limited by both the cost of the improvement and the income of the consumer. For instance, an owner or tenant of a single family dwelling whose income is between 100 percent and 120 percent of the median area income could receive an amount equal to 30 percent of the cost of the residential energy conservation improvement not to exceed $750. Similarly, the owner or purchaser of a single family dwelling whose income is between 80 and 160 percent of the median area income could receive an amount equal to 50 percent of the cost of the solar energy system not to exceed $5,000.

2. Where a utility loan is used, Bank funds might be offered to either reduce principle or prepay interest. The same limitations would apply in this instance, although the utilities would then be able to offer less expensive loans without adding to the burden on other ratepayers.

The Bank is also empowered to create a secondary market for solar energy loans. Under prior law, the Secretary of Housing and Urban Development had the authority to direct the Government National Mortgage Association (Ginnie Mae) to purchase conservation loans. This authority has been shifted to the Bank which must set up such a program unless the Board of Directors finds such a step unnecessary in order to advance the national program of energy conservation in residential buildings (Section 581). The Act also permits the Federal Home Loan and Mortgage Corporation (Freddie Mac) to purchase residential mortgages from any public utility which has extended such funds to finance the installation of solar energy systems. Finally, the Federal National Mortgage Association (Fannie Mae) is empowered by the Act to purchase utility loans or advances made for the purpose of financing the installation of a solar energy system. 75/

Thus, Federal law now allows for the establishment of an extensive secondary money market to support loan activities related to solar energy purchases. If these programs are implemented, not only will conventional lending institutions be able to sell solar energy loans and thereby free up funds for further loans, but utilities providing such loans would also be able to sell them, allowing for greatly reduced impacts on all ratepayers.

There are many uncertainties as to what type of program will finally be offered by the Bank and when the benefits will be expected to flow. However, the paths which are available for the Bank to follow do not appear to be inconsistent with the utility program which we are approving today. There are likely to be ways to

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75/ See discussion of Sunny Mac, supra, p. 21

utilize Bank funds to increase purchase incentive and to lower program costs. When Bank funds become available, the Staff should prepare a report to the Commission, advising us of potential impacts on the costs and attractiveness of the utility program resulting from the use of those funds, and suggesting any ways in which the utility programs might be revised to eliminate unnecessary expenses and help reach the program goals.

B. Competition

In Northern California Power Agency v. Public Utilities Commission, 5 C.3d 370, (1971) the California Supreme Court held that, in establishing a new program, this Commission "must place the important public policy in favor of free competition in the scale along with the other rights and interests of the general public." The Court stated that while the Commission is not necessarily bound by the limits of state and federal antitrust law, it must determine that any marketplace disturbance which might result from a new program is in the public interest.

Various parties to this proceeding have cited Northern California Power in order to assure that we not neglect our duty to consider potential effects of a utility financing program on the solar water heater sales, service and loan markets. E-TECH, a heat pump water heater manufacturer, has gone further to suggest that we must also take into account effects on sales of other products designed to save energy and money while heating water.

While Northern California Power stands as a constant reminder of our responsibility to protect the public interest, more specific protection of competition is dictated by provisions of the National Energy Conservation Policy Act. Section 216(g)(2) now states:

> "...no public utility may make any loan or finance...any residential energy conservation measure if the Secretary [of Energy] has determined, after notice and opportunity for public hearing, and after consultation with the Federal Trade Commission, that--
>
> "(A) such loans are being made...by such utility at unreasonable terms and conditions, or

> "(B) such loans made...by such utility have a substantial adverse effect upon competition or involve the use of unfair, deceptive, or anticompetitive acts or practices..."

The solar energy industry is characterized by the competitive interaction of many small, medium and large-sized firms, offering a variety of designs and options tailored to a particular consumer's end-use needs. Our intent is to provide a stimulus for increased participation by potential consumers in that competitive market. It is in the public interest to take all reasonable measures to assure that this stimulus does not serve to undermine the forces which provide for healthy competition in that market.

In the solar market, as elsewhere, the essence of competition is consumer choice. Potential customers must be able to respond to normal market signals when making a purchase decision. Those signals include a perception of the purpose which the product serves, the relative cost of various products and brands, the perceived quality and value of a particular seller's commodity, the history and reputation of the seller, the impact of advertising and sales techniques, as well as the inclusion of added features which increase the fundamental attractiveness of a commodity. The programs approved by this Commission should avoid a substantial adverse effect on these signals consistent with meeting other objectives of the programs.

Parties to this proceeding have suggested that three markets are potentially affected by this program: (1) the market for the sales and installation of solar domestic hot water heaters in existing residential buildings, (2) the market for products designed to save energy and money while producing domestic hot water, and (3) the market for loans to make such purchases. In each area, we will attempt to define the relevant market, determine the effect of our actions on competition and determine the reasonableness of any restraints on competition which are discovered.

1. Manufacturers, Sellers And Installers Of Domestic Solar Water Heaters

In California, there are several hundred manufacturers and installers of active solar energy devices.[76/] Firms may vary as to whether they offer products and services to both new and existing housing. Some are primarily interested in multi-family building installations, while most primarily furnish their products to single family buildings. These firms are very competitive and each year many new competing firms are introduced and many others are eliminated. It is also evident that if a utility demonstration program were successful in reaching the stated penetration goals, the rate of sales and installations during the period of the program would be several times greater than the rate currently experienced by the industry. Industry representatives expressed confidence that the industry has the capability to meet any such accelerated demand.[76a/]

The record in this proceeding suggests several ways in which an improperly designed demonstration program could have an adverse effect on competition among these firms:

a. Any rule which serves to arbitrarily preclude certain contractors and installers from the program unreasonably restricts consumer choice.

It is self-evident that anyone capable of selling and or competently installing a reliable solar domestic hot water heating system should be allowed to take advantage of the incentives being offered through this program. Lists of installers and contractors are to be created and maintained by each utility under the direction of the Energy Commission in compliance with the Residential Conservation Service program. Any installer or contractor contained on those lists should be eligible for participation

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76/ Tx. 3538
76a/ Tx. 3543

in this Demonstration program. Names should be removed from these lists only when a history of uncorrected complaints develops and after compliance with procedures established by the Energy Commission for the removal of names from those lists. These procedures will not unreasonably restrict the consumer's ability to choose among solar business when utilizing the Demonstration program incentives and will not unreasonably restrict the ability of solar business to compete. We adopt such procedures herein.

b. Rules which arbitrarily limit eligible types of solar domestic water heater systems would unreasonably restrict consumer choice. This in turn would serve to favor some solar businesses over others and might stifle innovation.

It is reasonable to establish rules for program eligibility which assure the use of reliable materials and designs. However, this Commission is not in a position to make judgments as to which types of collector systems are unacceptable. We would be most secure with the reliability of the investment if only all-copper, flat-plate collector systems were encouraged. However, this would provide a disincentive for the emergence of innovative technologies in California and companies utilizing other currently available technologies might be unreasonably penalized.

The San Diego Gas and Electric Company, with the concurrence of the Commission staff, has prepared a list of system and installation requirements which, with some modification, appear to be adaptable to any currently available system type and appear to allow for new processes to qualify as they are developed. These guidelines should be applied across the state as determinants of program eligibility, with the understanding that experience may dictate the need for revisions as the program develops. These standards have been revised and adopted as included herein.

c. Competition in providing service would be harmed if utilities provide service at below-market rates.

Since no one is proposing that utility service programs be developed, this is not a matter of concern for the Commission at this time.

d. Bias against multi-function systems may develop if loans are provided for domestic hot water systems only.

There was testimony during these hearings to the effect that many solar businesses offer systems and installations for solar space and pool heating at the same time water heating systems are purchased. CALSEIA suggests that such multi-function purchases will be discouraged if solar water heater loans are offered. We do not agree with this contention. A customer seeking this type of complex installation must currently seek conventional financing and could still do so during the Demonstration program period. In fact, out of the pool of customers tempted to purchase solar water heaters because of this program, new potential multi-function customers could be developed, encouraged by the knowledge that at least a portion of the system could be financed at highly favorable rates, or that an incentive utility credit would be provided.

e. Innovation would be stifled and competition to produce high quality products and minimize price are impaired if low or high limits are placed on utility loans.

Price regulation would interfere with some elements of competition. A large scale program with strict system price limits could have the effect of price regulation. Such limits become unnecessary where utility credits of a fixed amount are being offered. There is a need to protect utility ratepayers from subsidizing unreasonably high loan amounts where direct utility loans are used.

Various parties have suggested that a preferred means of setting limits would be to require customers seeking utility loans to obtain three bids. The loan amount would then be limited in some way to reflect the relative bids. Either the loan amount would be limited to the level of the lowest bid or the second lowest bid, or an average of the bids would be used. We have adopted a three-bid requirement applicable only in those cases where the utility is asked to refer contractors and make a loan. By permitting the customer to select either of the two lowest bids, we have allowed flexibility for the customer to make a decision not unlike that which is typically made for other large purchases.

We have also adopted a mechanism which protects ratepayers from subsidizing unreasonably large loans while permitting a potential customer to buy a solar water heater regardless of price. This approach will permit the utility to make a low interest loan available up to a specified limit and then to provide any additional financing necessary at an interest rate equal to the cost of money to the utility. By permitting the customer to select a solar system regardless of price, the program will not unreasonably restrict innovation, price, or quality.

2. Energy Saving Domestic Hot Water Heating Products

There are products, other than solar water heaters, which can save both energy and money when used in place of or in conjunction with conventional gas and electric water heaters. Flow restricting shower heads, insulating blankets for hot water heaters where gas service is available all are means of creating savings. None of these products are incompatible with solar water heating. In fact, customers should be encouraged to acquire as many of these products as they wish in that each added step will lead to added energy savings.

Representatives of E-TECH have asserted that their product competes for the same market as solar water heaters. E-TECH asserts that its product, if properly installed, can cut hot water heating electricity requirements in half. It also states that its product is substantially less expensive than a solar water heating system (an initial cost of $600-800 as compared to approximately $3,000 for a solar system).77/

This Commission has no record of utility experience or widespred market experience in testing and utilizing this technology such as it has regarding solar water heating technology. This is for good reason, since heat pump water heaters were not commercially available in California prior to our interim order in this proceeding in January of 1980, and no utility test installations occurred until well into the second phase of this proceeding. It is too early to say with confidence that heat pumps will be useful for California ratepayers, that the product will have a reasonably long service life and that there is indeed a retrofit market for this product in California. We have received evidence to the contrary in this proceeding. For instance, Mr. Caster, representing another manufacturer of heat pumps, states that his company will not even approach the retrofit market in California until substantially more field experience has been obtained.78/

Our record also indicates that the heat pump water heater has technological limitations. It can be utilized only on electric water heaters and mainly on those housed in a building's interior. In such cases, it draws heat from the building's internal space and pumps that heat into the water heater. To the extent that it draws its warmth from artificially heated air, it is diminishing the efficiency of the space heating system. E-TECH's represenatives acknowledge that the product is useful in only a small portion of electric water heating applications.

77/ Exhibit 80

78/ Tx. 4419

A program designed as a demonstration of solar water heating technology should not become a means of stifling the development and sales of a competing energy saving technology. If the heat pump water heater can be demonstrated to be a reliable, available and competitve technology, the utilities should provide an incentive for its purchase and use if an incentive for solar hot water heaters is to be provided. There are, however, too many pieces missing in this puzzle to confidently go forward with a heat pump incentive program today.

E-TECH and other heat pump manufacturers are encouraged to petition this Commission when this information is available. At that time we will determine if heat pump incentives should also be provided under this program or as an addition to broader conservation programs.

3. Loan Market

Every bank, savings and loan and credit union in the state was informed of these proceedings. We wanted to know whether a utility loan program would be perceived as an intrusion upon a market being developed by conventional lending institutions. Nonetheless, only two representatives of savings and loans participated in our year-long proceeding. Although we are very appreciative of the contributions to our record made by Mr. Dennis Campbell of San Diego Home Federal Savings and by Mr. Jerome Dodson of Continental Savings, their participation hardly suggests an overriding interest in solar water heater retrofit loans by conventional lending institutions in this state. In addition, Mr. John Lannan of the California Savings and Loan League also testified in support of a secondary financing program but offered no opinion concerning utility financing. These representatives of the savings and loans were not convincing in suggesting that a loan program such as we are approving herein would have unreasonable anticompetitive effects

on those conventional institutions. Similar arguments were made by representatives of CALSEIA and deserve to be addressed here.

In order to assess potential impacts, we must first determine the relevant market. Many have suggested that there exists a distinct market for solar water heater retrofit loans. Nonetheless, in terms of magnitude, qualification requirements and loan conditions, most such loans seem indistinguishable from home improvement loans in general. As Mr. Dodson illustrated through the example of his institution, such solar loans are a tiny fraction of the annual home loan market.79/ Even if this program would eliminate the reasonable potential for his institution to market such loans (which we find it would not do) the impact on his home loan business would not be unreasonably anticompetitive.

In fact, however, we find it more reasonable to predict that the demonstration program, if successful, will create a far greater opportunity for solar water heater loan business. The bulk of the incentives will be in the form of credits which should encourage purchasers who would seek conventional loans. In the limited case where utility loans will be available, we find that the conventional institutions, if so motivated, could provide loans to be used in combination with utility credits which will be at least as attractive as those the utilities will be able to offer. We therefore find that the demonstration program will not have an unreasonable anticompetitive effect on the conventional lending market.

79/ Tr. 5322

V. IMPLEMENTATION ISSUES

A. Utilities

Several issues have arisen regarding the implementation of the demonstration programs. These include utility administrative structure, utility ownership of solar water heaters, utility liability for system failures, community outreach, marketing, and rate treatment. We address each of these issues separately.

1. Rate Treatment

OII-42 has been conducted as a generic investigation into options for financial incentives to accelerate utilization of solar water heaters. There has been widespread publicity and public participation in the proceeding. Nevertheless, we have not purported to thoroughly evaluate rate issues in the proceeding nor have we followed formal notice procedures for a rate proceeding. Several parties have expressed concern about this and have strongly urged us not to decide rate questions in the context of OII-42.[80]

These concerns are well taken. We make no decision at this time regarding rate treatment of expenses incurred by the utilities in implementing this order. Each of the utilities has filed a separate application for rate relief and has followed formal procedures in providing notice to the public.[81] Rate decisions shall be reserved for those proceedings within the parameters of the programs as set forth in this order.

Each of the utilities has indicated that 60 to 120 days of preparatory time will be necessary before the programs can be implemented. If this preparatory period were not to commence until the conclusion of rate proceedings, there could be substantial delays which would be contrary to the purpose of this order. We conclude that preparatory work should commence immediately. We further conclude, based on the estimates of administrative costs filed by the utilities, that these costs during the few months until a decision on rates is issued will be minimal in comparison to overall program costs and should be recoverable in subsequent rate proceedings to the extent they are reasonably incurred. These costs should be accumulated in separate accounts and shall not exceed $500,000 for any of the utilities.

80/ A. 59671

81/ A.59596, A.59724, A.59869

2. Utility Administrative Structure and Procedures

Utilities have proposed various administrative structures by which to raise, account for and distribute funds for the demonstration programs. (See page 20 , supra.) We believe that questions relating to these administrative structures and procedures are intimately related to rate treatment. Therefore, we reserve final judgment on these questions for the rate proceedings.

Generally, we note that each utility has suggested the structure and procedures it feels will minimize costs to the ratepayer in light of its particular financial situation. It will be useful in the demonstration program to evaluate both the cost and ease of operation of differing administrative structures. Absent clear reasons of cost or infeasibility being presented in the rate proceedings, we are inclined to permit the utilities to utilize their suggested administrative structures for purposes of comparison.

3. Utility Liability

The respondent utilities have each expressed concern that by offering financial assistance for the purchase of solar water heaters they will become responsible for a variety of service, maintenance and damage claims. The obligation has been referred to as either legal or de facto in nature.

The concern for a legal obligation flows from the role of the utility in referring contractors, conducting inspections, enforcing standards, and providing credits or financing. It is feared that these elements of involvement in the transaction between the customer and the solar contractor could give rise to a legal obligation to maintain, service, or replace units which fail to perform properly. There is further concern that the involvement of the utility could create a broader legal exposure to claims for damage resulting from improper installation.

The concern for a de facto obligation flows from the importance of the utility protecting its reputation with the customer. Thus, even though the utility may have no legal obligations toward the customer, the utility may feel obliged to respond to certain kinds of claims in order to maintain its goodwill.

Both of these concerns are well taken. They could create a continuing exposure not only to the utility but to the ratepayers as well. It is our intent to minimize this exposure to the maximum extent possible, both for reasons of cost and for the reasons we have expressed in deciding to minimize the role of the utilities in service and maintenance. (See section III(F), supra.)

Because exposure to either legal or de facto claims could affect both the cost of the demonstration program and rates, we shall defer final decision on the means to minimize this exposure to the rate proceedings. In those proceedings, each utility, the staff and any interested party should offer specific proposals on the proper limits of utility responsibility and the means by which those limits can be established, including the content of any written disclaimers to be utilized. Each utility, the staff and any interested party is also requested to brief fully the relevant law of implied obligations as it may apply to transactions in the demonstration program.

4. Utility Ownership

A narrow question of utility ownership of solar water heaters has arisen during the proceeding. There has been no proposal that utilities should own solar water heaters which are financed by customers whether or not the financing is provided by the utility. However, SoCal Gas and PG&E have proposed that they retain title to the solar systems in which they invest the full purchase price and the customer has no repayment obligation.[82/] SDG&E has proposed that title remain with the customer under the utility investment option.[83/] The position of Edison is unclear.

82/ Tx 4369 and Exhibit 52
83/ Exhibit 59

In Section II(F) of this decision, we concluded that the utility investment option should be reserved as a means to reach the low income community. In this context, the utility investment is in the nature of a grant. We find no justification for the utility to retain ownership of the solar water heater when the utility investment is viewed as a grant.

To the contrary, we can see a new series of problems arising from utility ownership. First, utility ownership is the most extreme manner of utility involvement in the solar marketplace. It is by no means clear that utility ownership would pass legal muster under applicable state and federal statutes. Second, we fear that public reaction to "utilities owning the sun" could undermine the demonstration program. Third, there is evidence that the intended beneficiaries of grants, low income homeowners, might refuse to participate in the program if the utilities took liens on their property.[84] Utility ownership could enhance this negative reaction. Finally, utility ownership would lead to a result contrary to our decision in Sections III(F) and IV(A)3 above to limit the exposure of utilities to long term liability and maintenance responsibilities.

We conclude that utilities should not take or hold title to any solar water heaters installed during the demonstration programs regardless of the type of utility financial assistance provided.

5. Municipal Solar Utilities

Harvey Eder of the Public Solar Power Coalition has urged us to reject all proposals that would have investor owned utilities offer any financial assistance for the purchase of solar water heaters.[85] Instead, Mr. Eder would leave all financial assistance for solar systems to municipal solar utilities. It is not clear whether Mr. Eder is referring to solar financing programs to be instituted by existing municipal utilities or to the special municipal solar utilities being developed in six California cities in conjunction with the California Energy Commission.[86]

84/ TX.4346
85/ Brief of Public Solar Power Coalition
86/ The six cities are Bakersfield, Los Angeles, Palo Alto, San Dimas, Santa Monica, and Ukiah.

We cannot accept Mr. Eder's contention that investor owned utilities have no role to play in promoting the wider use of solar technologies. If solar energy options are to make a significant contribution to future energy supplies, many segments of the society, including investor owned utilities, will have to be involved. To reject financing assistance by investor owned utilities before fully evaluating this possibility is to foreclose a potentially significant option for no factual reason.

On the other hand, the solar demonstration financing program which we are ordering certain investor owned utilities to undertake should not preclude the implementation of various solar programs by municipal utilities or municipal solar utilities. Each of the utilities subject to this order should cooperate with those municipal utilities and municipal solar utilities which are developing programs that could have an effect on the programs ordered herein. The programs of all the utilities should benefit from cooperation and the sharing of experience and information.

B. General

1. Retroactivity Procedures

Decision No. 91272 included a specific provision for retroactive application of the financing programs. This provision, ordering paragraph 12, is as follows:

> "Each proposal shall provide that persons who purchase solar water heaters during the period between the date of this order and the implementation of the demonstration program shall receive preference for selection to participate in the demonstration program to the extent such selection is consistent with program guidelines as stated in Ordering Paragraphs 2 and 7. Customers who qualify pursuant to these limitations shall be offered the opportunity to refinance their solar water heater purchases through the demonstration solar financing program within a reasonable period of time after implementation of the program."

Our decision today clarifies the "program guidelines" with which an installation must conform to be eligible for financial assistance. Many of these guidelines, particularly the quality standards for systems and installations, may not have been generally applicable in the solar industry during the period since January 29, 1980. To impose these standards retroactively could prejudice many consumers who purchased what they felt were quality systems in anticipation of gaining preference for the demonstration program.

By letter dated February 26, 1980, CalSEIA, with the ostensible support of most of the respondent utilities, proposed interim standards for use between January 29 and the date of this order.[87/] Lacking any factual basis on which to consider such a request, we took no action in the proposed standards.

The recommended interim standards were:

1. The system must have a CalSeal label (and thus meet the standards for the state tax credit, including warranties);
2. The installation must have a valid building permit and have been inspected and approved by a local building official;
3. The contractor must provide an operations manual and schematic diagram;
4. The purchaser must submit a valid contract or invoice dated after January 29, 1980.

We agree with the position of CalSEIA that to adopt interim standards other than the standards for tax credit eligibility would be a great disservice to those who have done the best they can to become eligible for the demonstration program. We adopt the tax credit eligibility standards as the basis for eligibility for financing for any installation for which a contract was executed between January 29, 1980 and January 15, 1981. We also adopt the CalSEIA recommendations regarding building permits and inspections and the provision of an operations manual and schematic.

However, we have already noted that building permits and building inspections offer no assurance that the system meets tax credit eligibility standards. Therefore, before eligibility for financing can be established for interim installations, we will

87/ Exhibit 72

require a utility inspection. In addition to providing assurance that tax credit standards have been met, these inspections should also permit the utilities and contractors to begin to develop working relationships on inspection procedures before the full programs go into effect.

We also note that, by definition, all installations during the interim period have been developed by contractor direct sales. No formal utility referral programs were in effect during this period. Therefore, no utility loans will be made available to those who purchased during the interim; only credits will be available.

To begin processing of financing requests for interim installations, contractors should begin immediately to provide the appropriate utility with names of customers who are likely to be eligible for the demonstration program and shall provide evidence of compliance with our interim standards. Within 45 days of the date of this order, utilities should commence certification of interim installations. Utilities should commence payment of the first quarterly credits for certified interim installations 90 days after certification is granted for an installation.

2. Start-up Procedures

PG&E has proposed a trial program of 6 to 12 months in three divisions. SoCal Gas has proposed a six-month test period in two divisions. Both utilities contend that implementation must be phased in this manner so they may make necessary program adjustment and complete staff training prior to making the programs available systemwide.

CalSEIA and several solar contractors have expressed alarm at the concept of phased implementation.[88/] They fear that once the demonstration programs are implemented in one region, customers in other regions will not purchase solar systems until the programs are made available in their areas.

We find merit in both of these positions. However, we conclude that they need not be mutually exclusive. The order we adopt will require the utilities to begin making inspections of systems installed since January 29 within 45 days of the date of

88/ Tx. 3564

the order and to be prepared to make credit payments within three months after the inspections. Since only credits will be made available for direct contractor sales, we see no reason why contractor sales made during PG&E and SoCal Gas trial periods cannot and should not be treated as interim sales. Thus, contractors may continue their direct sales efforts and consumers may be assured they will be eligible for credits. Areas not participating in the trial programs will be lacking only utility promotion of credits and direct loans and utility referrals to contractors.

Therefore, we will permit PG&E and SoCal Gas to implement their programs on a phased basis as proposed with the provision that credits be made available for direct contractor sales outside the trial areas on the same basis as for interim sales.

3. Marketing

SoCal Gas has proposed an extensive and multi-faceted marketing program including cooperative advertising with solar distributors, community training classes, and special efforts to reach low income customers. Reaction to these proposals has ranged from enthusiastic support to claims of overkill.

The SoCal Gas marketing proposals are undeniably the most aggressive before the Commission. There is no evidence in our record on which we could base a decision to limit or prohibit implementation of any of the proposed marketing activities. Note that each of the other utilities has proposed marketing efforts which are less ambitious in varying degrees. To the extent that any of the proposed marketing activities proves either overly aggressive or inadequate, adjustments can be made during the demonstration. It would be premature to pass judgment on any of these proposals until more experience is gained.

While we take no action in this decision regarding the marketing activities proposed by the utilities in OII-42, we take care to distinguish these activities from utility marketing proposals which have been the subject of bitter controversy in our companion proceeding, OII-13. The marketing activities at issue in OII-13 relate to direct sales by utilities in competition with other solar businesses rather than marketing support activities by utilities in support of solar businesses.

Also at issue in OII-13 are utility ownership and installation of solar water heaters. Utility ownership of solar water heaters has been proposed by SoCal Gas in the limited cases in which it makes actual investments in systems to be placed on the homes of low income people. This decision does not permit such ownership by utilities. (See page 74, supra.) The installation of solar water heaters by utilities has been neither proposed nor considered in OII-42.

4. Community Outreach

Decision No. 91272 included several parameters describing how the market penetration objectives of the demonstration programs were to be met. Included was the requirement that the programs include "all single family and multi-family residential markets and be designed to reach a wide range of geographic and income groups."

Despite this provisions of Decision No. 91272, some parties to the proceeding have expressed concern that the programs proposed by the utilities will deprive low income people, renters, and minorities of fair access to the demonstration programs.[89] This commission is determined that such a result not occur. Our commitment to fair access to the demonstration is founded in fundamental concepts of equity as well as the need to assure balanced information.

We have previously discussed the specific measures included in this order to ensure participation by low income customers and renters. (See page 36, supra.) While these measures are expressed in numbers, it is the people that must be reached. We have no doubt that the participating utilities can reach all of the people described in this order. The utilities serve almost everyone in their service areas either directly or indirectly and are established in every community they serve. Yet we do not intend to rely on an expression of confidence in the utilities. Success in bringing the demonstration program to a broad community will be one of the criteria on which utility performance will be evaluated.

89/ Tx. 5561

Because the programs we are ordering are demonstration programs, it behooves the Commission to leave maximum flexibility to the utilities in achieving this objective. In this way, we can also learn what techniques are most successful in reaching differing communities. Therefore, with one exception, we do not prescribe or limit the methods to be used by the utilities in reaching a balanced participation in their demonstration programs.

The one exception relates to the role of community organizations. We feel strongly that it would be imprudent for the utilities to attempt to duplicate the person-to-person outreach capabilities of the hundreds of community organizations in their service areas. Service clubs, senior citizen centers, community action agencies, and church groups reach many more people than will be able to participate in the programs. We will know better how the community is reacting to solar water heating when the community itself is involved in the demonstration program.

In addition to the general reliance on community organizations described above, there are two situations which have been brought to our attention in which community organizations must play an essential role. One is the case of determining eligibility for inclusion in the low income utility investment programs. We have determined that eligibility should be based on the same criteria used to determine eligibility in federal utility bill assistance programs. Rather than establish new procedures, utilities should contract with those agencies, including community action agencies, that are administering the federal programs to conduct outreach and screening for the low income investments, reserving the right for this Commission to evaluate the procedures used. The other relates to the unique status of American Indians. We believe that outreach to the Indians will best be conducted through tribal councils.

5. Evaluation

A demonstration program with no monitoring or evaluation would be of little value. In Decision No. 91272, the staff of the Commission was ordered to monitor and assess the progress of the programs and to report to the Commission semi-annually. We reiterate this instruction to the staff and specifically request evaluation of the following matters:

a. Staff's view of the extent to which solar water heating can be relied upon to provide adequate and reliable supplies of energy and to reduce utility costs to consumers.
b. Additional actions that may be necessary to encourage consumer acceptance of solar water heating.
c. The performance of the solar industry in delivering quality equipment in adequate supply at reasonable prices.
d. The quality of service offered by the solar industry.
e. The adequacy and attractiveness of financing offered by conventional institutions in response to utility credits.
f. The need for the utilities to play a more active role in consumer protection.
g. The impact of utility actions pursuant to the order on competition.
h. Economies of scale that could reduce the per unit cost of promotion or administration.
i. Impacts on both participating and non-participating ratepayers.
j. Start up costs that would not be part of an ongoing program.
k. Impacts on different utility financial structures.
l. Differences in consumer acceptance and ratepayer reaction.
m. Differences in means to divide costs and benefits among ratepayers.

Some of the items we have asked the staff to study will require constant review during the demonstration while others may require only periodic or one time study. Some items may require expertise not present on our staff. Thus, we ask the staff to prepare an evaluation plan for submission to the Commission within 60 days after the date of this order. The Evaluation Plan shall describe the types of information gathering necessary and the manner in which the staff proposes to keep the Commission informed. The plan shall also advise the Commission of assistance which the staff will require on a contractual basis.

6. Advisory Committee

Decision No. 91272 also called for the formation of an advisory panel to report on a variety of matters some six months prior to the termination of the demonstration. The advisory panel has been appointed and includes representatives of the solar industry, the regulated utilities, the financial community, consumer and environmental groups, realtors, apartment house owners, contractors, labor, and government agencies at the local, state, and national levels. A list of advisory panel members is included in Appendix F.

It has become apparent that this advisory panel can serve an important purpose in addition to preparation of the report called for in Decision No. 91272. The balanced composition of the panel creates an ideal forum for the different interests concerned with the demonstration to meet and discuss specific problems that arise during the demonstration. Recommendations of the panel can be very helpful to the Commission in resolving the multitude of detail problems certain to arise in this large pioneering undertaking. The panel cannot make decisions for the Commission or bind the Commission with its recommendations, yet the balanced recommendations of the panel can pave the road for the Commission in resolving unforseen problems.

Although the panel is not a formally constituted government body, it is important that it conduct all of its deliberations in public, provide adequate notice to the public of its meetings, and seek the broadest involvement of the public. This will assure the most thorough consideration of all aspects of specific problems.

To avoid duplication of administrative personnel, we have asked the Executive Office of theSolarCal Council to administer the advisory panel on behalf of the Commission. We intend to enter into an inter-agency agreement with the Council which will

establish a budget for the panel and clarify the mutual respon-responsibilities of the Commission and the Council. The budget for the panel shall not exceed $20,000 a year for the duration of the demonstration. Each of the respondent utilities shall include in its application for rate adjustment for the demonstration program a prorata share of such a budget. Each utility's share shall be based on the number of installations it will assist in financing compared to the number of installations to be assisted statewide. Pending final resolution of the inter-agency agreement and final decision on the applications for rate adjustment, each respondent utility shall make available to the SolarCal Council, for the account of the advisory panel, $1,000 for the initial organization of the panel.

FINDINGS OF FACT

1. All findings of fact in Decision No. 91272 should be and are incorporated by reference into this decision.

2. There is a vital state and national interest in promoting energy conservation and the development of alternative energy resources, including solar energy.

3. The adequacy and reliability of energy supplies depends largely on the ability of the utilities to reduce their dependence on foreign oil and to increase the rate at which energy supplies can be augmented in the short term.

4. Many questions of fundamental importance regarding the role and viability of solar water heating as an energy source cannot be answered on the basis of the information currently available.

5. The information gained from the demonstration programs ordered herein will enable the Commission to make properly informed decisions regarding the reasonableness of rates or the reasonableness and adequacy of equipment, facilities, and service of the utilities.

6. It is in the best interests of the ratepayers to assist in financing demonstrations of energy resources which appear to have a high potential to displace foreign oil and stablize utility costs.

7. The demonstration programs ordered herein are of a scale comparable to demonstration projects for other energy resources and are of appropriate scale to provide reliable information regarding large-scale programs.

8. There is no need at present for statewide uniformity of terms and conditions for loans and financial assistance to purchasers of solar water heaters.

9. It is necessary that standards and procedures relating to energy audits, minimum system standards, minimum installation standards, and inspections be uniform statewide in the demonstration program.

10. No-interest loans, whether fully amortized or with payment deferred until the sale of the home may offer a greater incentive than is necessary in the demonstration program.

11. It is necessary to set aside a portion of the funds to be expended in the demonstration program in order to assure that the low income market is reached.

12. There are substantial differences in the markets for solar retrofits to single-family electric, single-family gas, and multi-family gas water heaters justifying different incentives in each market.

13. There is no persuasive evidence that a substantial number of conventional lending institutions make loans available for solar water heating systems at rates sufficiently attractive to assure rapid implementation of solar water heating.

14. Direct utility lending for solar water heating is necessary to compare consumer response to different incentives and to evaluate the respective cost and administrative complexity of different incentives.

15. To make direct utility loans the primary source of financing during the demonstration could adversely effect the availability of loans from conventional lending institutions for solar water heating after the demonstration program has terminated.

16. It is not necessary to make direct utility loans available in all solar water heating markets to obtain adequate information for purposes of a demonstration program.

17. Demonstration of direct utility lending for solar water heating should be limited to determine whether conventional lending institutions will provide financing at terms which, in conjunction with utility credits, are sufficiently attractive to meet societal objectives for rapid implementation of solar water heating.

18. The availability of direct utility loans would have little impact on the decision of owners of multi-family buildings with gas water heaters to purchase retrofit solar water heaters.

19. Single-family gas water heaters constitute the largest potential market for solar retrofits. It is proper to limit the availability of direct utility loans during the demonstration program to this market in order to obtain information with the widest applicability.

20. While utility incentives for the development of alternative energy resources such as solar water heating should be related to the value of the energy saved, in a demonstration program to compare various inventives, the precise relationship of the cost of the incentives to the value of energy saved is of secondary importance.

21. The incentives adopted herein for use in the demonstration program are and the cost of the demonstration program to ratepayers is reasonable compared to other demonstration projects for energy resources, to the marginal cost of energy and to utility rates generally.

22. The financial situation of the San Diego Gas & Electric Company is such that no direct utility loan program should be implemented by the company for its ratepayers.

23. The utility credits proposed by the Southern California Edison Company, while different in form and amount from those adopted for PG&E and SDG&E, have merit and should be adopted to offer a comparison between two types of credit.

24. It is necessary to limit the size of direct utility loans to avoid creating an incentive for undue price increases for solar water heaters and to control the cost of the demonstration program to the ratepayers.

25. Limits on the size of direct utility loans, either by price limitations or a requirement for three bids, could have a detrimental effect on marketing programs in the solar contracting industry. Only utility credits should be made available for direct contractor sales.

26. Utility loans should be made available only for solar retrofits to single family gas water heaters for which contractors have been referred to the customer by the utility. The amount of the loan should be limited by requiring the customer to obtain three bids with either of the two lowest bids being eligible for financing or by limiting the amount financed by the utility at low interest while permitting the utility to offer additional financing at an interest rate equal to its cost of money. These loan limits will best preserve competition, will be readily understood by customers, are most compatible with the utility referral process, and best recreate market forces as a prior determinant.

27. Financing by utility investment with no repayment required should be utilized solely to reach the low-income market during the demonstration program.

28. Eligibility for utility investment financing should be determined using the same criteria and decision-making agencies that are used to determine eligibility for federal energy grants to low-income people.

29. During the demonstration solar financing program, security for repayment is necessary where loans have been provided to customers by a utility with ratepayers assistance.

30. The solar financing demonstration program should be conducted in a manner consistent with the State Plan for a Residential Conservation Service.

31. Energy audits emphasize cost as a primary basis for a decision to install energy conservation or solar measures. There are many other factors that may properly influence such decisions. To require energy audits as a condition of participation in the demonstration program could distort the information from the program.

32. There are no widely accepted standards for complete solar water heating systems. Such standards could obviate the need to adopt minimum quality, performance, or sizing criteria.

33. Post installation inspections are the best method to protect the interests of ratepayers in providing financial assistance for the demonstration program and to develop reliable information for use in evaluating the demonstration program.

34. A combination of contractor self-inspections and utility inspections is the most prudent method of obtaining adequate inspections.

35. A standardized inspection checklist is necessary to avoid widespread confusion in the solar industry.

36. Progress payments to contractors consitute the best method to assure both prompt payment to contractors and protection of consumer and ratepayer interests.

37. Utility maintenance of solar water heaters should be limited to avoid substantial harm to the growth of the solar industry.

38. Extended warranties offer the best assurance of system reliability and durability in the absence of prescriptive standards for system design.

39. Warranties in excess of those required to obtain the state solar tax credit are warranted given the additional incentives offered by the ratepayers in the demonstration program.

40. The demonstration solar financing programs ordered herein are not inconsistent with programs created by the recently enacted Energy Security Act, S. 932. Each of the programs can proceed simultaneously and thereby provide further information regarding the relative merits of different incentives for solar water heating.

41. It would be imprudent to permit ratepayer funds to be expended to encourage the use of heat pump water heaters given the dearth of practical experience with the technology.

42. Conventional financing institutions have expressed little interest in or concern about a demonstration solar financing program by utilities.

43. The programs ordered herein will stimulate competition among lenders offering loans for solar water heaters.

44. Rate issues have not been thoroughly considered in this proceeding.

45. If preparatory work to implement this order were not to begin until conclusion of the rate proceedings, there could be substantial delays which would be contrary to the purpose of this order. Preparatory work should commence immediately.

46. Preparatory costs should not exceed $500,000 for any utility.

47. Questions related to administrative structure and procedure are intimately related to rate treatment.

48. Liability of the utilities for service, maintenance, and damage claims flowing from solar water heaters installed pursuant to this program should be minimized to reduce the cost of the program and to assure the solar industry assumes responsibility for its products.

49. Utility ownership of solar systems installed pursuant to this order would create problems inconsistent with the purpose of this order.

50. The demonstration programs ordered herein should not preclude the implementation of various solar programs by municipal utilities or municipal solar utilities.

51. To adopt interim standards different from standards for eligibility for the state solar tax credit would be a disservice to those who have purchased solar systems since January 29, 1980 in reliance on Decision No. 91272.

52. Utility inspection of installations made after January 29, 1980 is necessary to assure interim standards are met by these installations.

CONCLUSIONS OF LAW

1. This Commission has a responsibility to ratepayers to assure adequate and reliable supplies of energy at the lowest reasonable rates.

2. The program adopted herein will result in no unreasonable anticompetitive impacts on the markets for solar water heaters and home improvement loans. Any incidental impacts on competition are within the public interest to promote technologies which will displace the use of fossil fuels.

3. To continue to fulfill its responsibility to the ratepayers, this Commission must determine the extent to which solar water heating can be relied upon to provide adequate and reliable supplies of energy and to reduce utility costs to consumers.

4. The information gained from the demonstration programs ordered herein will enable the Commission to make properly informed decisions regarding the reasonableness of rates or the reasonableness and adequacy of equipment, facilities, and service of the utilities.

5. It is premature for the Commission to take action at this time on the proposal for the creation of Sunnymac.

6. The provision of direct loans at subsidized interest rates by utilities to customers for the installation of energy conservation and solar energy measures need not unduly restrict competition among or with other lending institutions.

7. There is no restriction of competition in the loan market where the utilities offer direct loans to consumers at subsidized rates for solar water heaters and also provide comparable incentives to those who purchase solar systems for cash or with loans from conventional lending institutions. The programs ordered herein promote competition by making loans from any conventional lending institution significantly more attractive with utility credits and by increasing the number of lenders in the market with direct utility loans.

8. Comparable incentives need not be precisely equal in dollar amount. In a demonstration program, it is necessary and proper to test incentives of different dollar amounts to determine if a lesser cash incentive given in a shorter period of time is more attractive than a larger interest incentive given over a longer period of time.

9. Requirements that no utility loans be made available for sales consummated directly by contractors, that three bids be obtained as a condition of receiving a direct loan from a utility and limiting the amount which utilities will lend at low interest are reasonable measures to avoid undue interference with the development of the solar contracting industry, to maintain price competition, to remove any incentive to unduly increased prices during the demonstration, and to remove any incentive to reduce quality under price pressure.

10. The measures adopted herein to assure a wide distribution of installations throughout the state and in multi-family and low income residences are reasonable and necessary to provide all ratepayers an opportunity to participate in the demonstration program and to provide balance for purposes of evaluation.

11. The State Plan for a Residential Conservation Service (RCS) should be and is incorporated by reference into the order herein and shall be binding on the demonstration programs herein except to the extent specific provisions of this order are at variance as strictly necessary to conduct a reasonable demonstration.

12. A requirement that an energy conservation audit or a renewable resources audit be conducted or that specific energy conservation measures by installed as a condition of participation in the demonstration programs would infringe on the purposes of the demonstration and could restrict the growth of the solar industry and the solar market.

13. Any contractor eligible to be included in a referral list pursuant to the State RCS Plan should be eligible to participate in the demonstration programs.

14. In the absence of other consumer protection measures, minimum durability standards for solar water heaters are necessary to protect the solar industry and the investment of the ratepayers. The extended warranty measures adopted herein provide a reasonable and proper standard for the demonstration programs.

15. In the absence of other suitable inspection procedures, the self-inspection and utility inspection requirements ordered herein are necessary and proper to assure compliance with adopted quality standards and to provide necessary information for the evaluation of the demonstration.

16. Energy audits are not required by law to be and should not be required by this Commission as a prerequisite to obtaining utility financing assistance for solar systems during the demonstration program.

17. Standards for contractor eligibility to participate in the demonstration program should be the same as those adopted in the State RCS Plan for eligibility to be included on referral lists.

18. Minimum system and installation standards should be adopted for the demonstration program which will offer reasonable protection to consumers while not stifling innovation.

19. A minimum sizing methodology should be adopted to prevent consistent undersizing of solar systems and to prevent unfair competition.

20. Each installation of each participating contractor should be inspected at the outset of the demonstration but consideration should be given to random sample inspections once there has been sufficient experience in the field.

21. Utility inspections are reasonable and necessary to assure compliance with system standards and should be required as a condition of participation in the demonstration program.

22. Extended warranties assure system reliability and durability and do not unreasonably discriminate against innovative technologies.

23. Recent federal legislation has removed prohibitions against utility financial assistance for solar water heating.

24. The demonstration solar financing programs adopted herein comply with minimum federal standards for utility financing programs in that they employ reasonable rate and reasonable terms and conditions, have no substantial adverse effect upon competition, and do not involve any unfair, deceptive or anticompetitive acts or practices.

25. Creation of the Solar Energy and Energy Conservation Bank by federal legislation neither precludes nor preempts nor is inconsistent with the demonstration solar financing programs adopted herein.

26. It is reasonable and proper to temporarily exclude an entirely new and different technology such as the heat pump water heater from a demonstration solar financing program at least until such time as there has been adequate testing and experience with the technology in practical applications so as to permit a prudent decision on the viability of the technology.

27. Rate issues should be reserved for subsequent rate proceedings.

28. Questions relating to administrative structures and procedures should be reserved for subsequent rate proceedings.

29. Questions relating to legal or de facto liability of the utilities for service, maintenance, or damage flowing from

any installation pursuant to this program should be deferred to the subsequent rate proceedings.

30. To retroactively impose standards other than those for eligibility for the state solar tax credit would prejudice consumers who purchased solar water heaters after January 29, 1980 in reliance on Decision No. 91272.

31. Direct sales made by solar contractors during PG&E and SoCal Gas trial periods, in areas outside of the trial areas, should be treated as interim sales.

32. Success in creating broad community access to the demonstration programs should be one of the factors on which utility performance should be evaluated.

33. It would be imprudent for the utilities to attempt to duplicate the person-to-person outreach capabilities of the hundreds of community organizations in their service areas.

34. Eligibility for the utility investment financing option should be based on the same criteria used to determine eligibility in federal utility bill assistance programs.

O R D E R

IT IS ORDERED that:

1. The Pacific Gas and Electric Co., San Diego Gas and Electric Co., Southern California Edison Co., and Southern California Gas Co. shall implement demonstration solar financing programs on the terms and conditions and subject to the limitations described herein and in Appendices B, C, and D.

2. Each respondent utility shall, at least 10 days prior to hearing, modify its application for rate adjustment for the demonstration program to conform to this decision.

3. Each utility shall begin preparatory work on the demonstration program effective the date of this order.

4. Expenditures for preparatory work shall be accumulated in separate accounts and shall not exceed $500,000 for each utility.

5. The following matters are deferred to subsequent rate proceedings:

a. Utility administrative structures and procedures
b. Utility liability
c. Rate treatment
d. Other matters so deferred in this decision

6. In the subsequent rate proceedings, each utility, the staff, and any interested party shall offer specific proposals on the proper limits of utility responsibility for installations made pursuant to this program and the means by which such limits can be established, including the content of any written disclaimers to be used. Each utility, the staff, and any interested party shall also fully brief the relevant law of implied obligations as it may apply to transactions in the demonstration program.

7. No utility shall take or hold title to any solar water heater installed during the demonstration programs regardless of the type of utility financial assistance provided.

8. Each utility shall cooperate with those municipal utilities and municipal solar utilities which are developing programs that could have an effect on the program ordered herein.

9. Eligibility standards for the state solar tax credit shall be the standards for eligibility for financing for any installation for which a contract was executed between January 29, 1980 and January 15, 1981.

10. Each utility shall commence certification of interim installations no later than 45 days after the date of this order. Utilities shall commence payment of the first quarterly credits for certified interim installation 90 days after certification is granted for an installation.

11. PG&E and SoCal Gas may implement their programs on a phased basis as proposed, provided that credits are made available for direct contractor sales outside the trial areas on the same basis as for interim sales.

12. Modifications in the demonstration programs shall be made as found necessary or proper by and as ordered by the Commission.

13. Each utility shall contract with those agencies, including community action agencies, that are administering the federal utility bill assistance programs to conduct outreach and screening for the low income investments.

14. The advisory panel shall conduct all of its deliberations in public, shall provide adequate notice to the public of its meetings, and shall seek the broadest involvement of the public.

15. The Executive Director shall enter into an interagency agreement as described herein with the Executive Office of the Solar Cal Council to administer the advisory panel on behalf of the Commission.

16. Each utility shall include in its application for rate adjustment a prorata share of the budget of the advisory panel as described and shall make available to the SolarCal Council, on an interim basis, $1,000 for the initial organization of the panel.

17. No utility shall alter an approved program or any part thereof without approval of the Commission.

18. All programs shall be implemented by each utility throughout its entire service area after conclusion of the authorized trial periods.

19. The numbers of residential units to be served by the program as stated in Table III, Page 14c, shall be construed as ceilings. No utility shall provide financial assistance for installations beyond the numbers of units to be served in each category as stated in Table III.

20. OII 42 remains open.

The effective date of this order is the date hereof.
Dated SEP 16 1980, at San Francisco, California.

President

Commissioners

Appendix A

SAN DIEGO GAS & ELECTRIC CO.
ESTIMATED COSTS AND SAVINGS

Year	Gross Revenue Requirement	Savings	Net Revenue Requirement
1	$ 823	$ 62	$ 761
2	3,258	265	2,993
3	5,944	619	5,325
4	5,702	903	4,799
5	3,138	1,055	2,083
6	2,021	1,230	791
7		1,368	(1,368)
8		1,518	(1,518)
9		1,787	(1,787)
10		1,872	(1,872)
11		2,050	(2,050)
12		2,313	(2,313)
13		2,574	(2,574)
14		2,863	(2,863)
15		3,186	(3,186)
16		3,490	(3,490)
17		3,952	(3,952)
18		4,402	(4,402)
19		4,910	(4,910)
20		5,475	(5,475)
21		5,664	(5,664)
22		4,440	(4,440)
23		1,526	(1,526)
	$20,886	$57,524	$(36,638)

Pacific Gas and Electric Company

ESTIMATED COSTS AND SAVINGS

Year	Gross Revenue Requirement	Savings	Net Revenue Requirement
1	$ 2,488	$ 139	$ 2,349
2	7,736	812	6,924
3	18,792	2,662	16,130
4	22,224	4,444	17,780
5	13,571	5,198	8,373
6	8,860	6,091	2,769
7	940	6,767	(5,827)
8	760	7,523	(6,763)
9	640	8,368	(7,728)
10	540	9,310	(8,770)
11	460	10,362	(9,902)
12	393	11,204	(10,811)
13	333	12,849	(12,516)
14	280	14,318	(14,038)
15	230	15,961	(15,731)
16	185	17,803	(17,618)
17	145	19,862	(19,717)
18	110	22,169	(22,059)
19	80	24,759	(24,679)
20	55	27,660	(27,605)
21	37	29,370	(29,333)
22	30	24,913	(24,883)
23	0	11,602	(11,602)
	$78,889	$294,146	$(215,257)

Southern California Gas

ESTIMATED COSTS AND SAVINGS

Year	Gross Revenue Requirement	Savings	Net Revenue Requirement
1	$ 3,118	$ 65	$ 3,053
2	8,123	287	7,836
3	15,454	735	14,719
4	17,053	1,194	15,859
5	12,775	1,491	11,284
6	6,143	1,865	4,278
7	933	2,143	(1,210)
8	776	2,466	(1,690)
9	675	2,835	(2,160)
10	595	3,261	(2,666)
11	529	3,750	(3,221)
12	472	4,312	(3,840)
13	427	4,959	(4,532)
14	385	5,079	(4,694)
15	346	5,701	(5,355)
16	310	6,559	(6,249)
17	279	7,541	(7,262)
18	250	8,673	(8,423)
19	222	9,976	(9,754)
20	20	11,471	(11,451)
21	6	13,191	(13,185)
22	0	13,566	(13,566)
23	0	10,884	(10,884)
	$68,891	$122,004	$(53,113)

SOUTHERN CALIFORNIA EDISON
ESTIMATED COSTS AND SAVINGS

Year	Gross Revenue Requirements	Savings	Net Revenue Requirement
1	798	$ 82	$ 716
2	2171	470	1,701
3	3795	1,516	2,279
4	3445	2,492	953
5	1498	2,865	(1,367)
6	1289	3,295	(2,006)
7	656	3,624	(2,968)
8		3,986	(3,986)
9		4,385	(4,385)
10		4,823	(4,823)
11		5,306	(5,306)
12		5,837	(5,837)
13		6,419	(6,419)
14		7,062	(7,062)
15		7,768	(7,768)
16		8,545	(8,545)
17		9,399	(9,399)
18		10,338	(10,338)
19		11,374	(11,374)
20		12,511	(12,511)
21		13,074	(13,074)
22		11,354	(11,354)
23		4,995	(4,995)
	$13652	$141,520	$(127,868)

Appendix B

SOLAR DOMESTIC WATER HEATING SYSTEM UTILITY DEMONSTRATION PROGRAM SYSTEM AND INSTALLATION REQUIREMENTS FOR FINANCING ELIGIBILITY

A. General Requirements

1. Utility inspections and surveys, common to all utilities, shall be used to monitor system installation and components. Utility inspectors shall record the brand names and models of system components during the system inspection process. Marketing research conducted by the utilities at various times during the three-year program will be used to monitor the level of consumer satisfaction and the types of maintenance problems which are occuring.

2. In order to reduce utility inspection time for single family home installations each utility should urge its listed contractors to provide one or more typical system designs or package installations for reference.

3. Contractors are encouraged to cooperate with utilities to insure that installations for all multi-family systems for four or more units meet sizing guidelines.

4. All RCS-listed solar energy contractors will be notified promptly of all changes to qualifications and requirements.

5. Any installation made on or after January 15, 1981 shall comply with all provisions of Appendices B, C, and D.

B. System Specifications

1. Valving must be provided to isolate the solar portion of the water heating system so that hot water interruption does not occur due to solar system malfunctions.

2. Valving must be supplied to isolate and manually drain the collector loop.

3. The system must meet all qualifications for the State and Federal tax credits on the date completed.

4. Back-flow prevention is required for potable water piping supplying water to nonpotable water systems. See Uniform Plumbing Code, Chapter 10.

5. Flat plate glazed collectors without storage tanks do not require additional rafter support if the wet weight is less than 10 pounds per square foot.

6. The structural integrity of roof or attic-mounted storage tanks must be approved by a registered structural engineer for a given generic system through a report on record with the utility.

7. All collectors must be securely anchored to the support structure.

8. A minimum roof clearance of one inch must be supplied between the collector and the roof unless the collectors are integrated into the roof and the collector support must not inhibit the free flow of roof drainage.

9. In accordance with California Public Utilities Commission Decision No. 89592, natural gas should be utilized as the auxiliary energy source for solar systems when available at the customer's location.

10. One indicating temperature device must be installed in the upper portion of the storage tank.

C. Component Qualifications

1. The collector must be rated and accepted under the CEC TIPSE or other rating program judged equally stringent by the utility. Unglazed swimming pool collectors are not acceptable for domestic hot water applications. Collector glazing must be readily replacable.

2. Insulation and organic materials must be protected from accelerated degradation from heat or exposure to sunlight. Collectors must be certified by a recognized laboratory equipped for stagnation testing that outgassing of insulation does not significantly impair performance.

3. A single wall heat exchanger can be utilized if the collector loop contains potable water. A visible warning sign must be posted near the fill port for the collector loop to prevent the use of toxic fluids. (Check local building codes for applicability of this provision).

4. Double wall heat exchangers are required when a toxic fluid is used. A visible sign must warn that toxic fluid is being utilized.

5. All electrical components must meet UL approval.

6. All electrical wiring must meet National Electrical Code ("NEC") requirements.

7. All outdoor electrical components, including the collector roof sensor wire, must have weatherproof circuitry per NEC requirements.

8. All pipe insulation must meet the Cal. Adm. Code Title 24 Residential Energy Conservation Standards.

9. All pipe insulation must be bonded with the proper adhesive according to manufacturer's instructions.

10. Temperature and pressure relief valve must be supplied on all individual pressurized systems. See Uniform Plumbing Code, Chapter 10.

11. A separate pressure relief valve is required on closed collector loops.

12. Factory built storage tanks must meet UPC requirements and be accepted by IAPMO or UL.

13. Insulation on storage tanks must meet the State Tax Credit requirements of a R-12 value.

14. The solar system piping must be at least three-quarter inch Type "L" copper pipe or CPVC or PVDF plastic tubing where permitted by local codes.

15. All joints and connections must meet or exceed Chapter 5 of the USEC and Chapter 8 of the UPC.

16. The roofing sealant shall be approved sealant.

17. All flashing must be constructed of a corrosive resistant metal and meet the SMACNA Solar Installations Standards.

18. Fasteners must be compatible with the material being fastened.

19. Auxiliary backup energy use must be minimized by use of freeze protection other than heat and by provision of a timeclock control on electric water heater elements which can be set by the customer to qualify for any solar electric backup preferential rates which may be available or may become available from the serving utility.

20. The customer instructions provided should include information on eliminating all backup energy use during the summer months by either (1) turning off the circuit breaker to an electric water heater or (2) turning off the pilot to a gas water heater.

21. All system components in the potable water circuit shall be manufactured of National Sanitation Foundation (NSF) approved materials.

D. Installation Qualifications

1. The completed system must be neat and as orderly as physically possible and should be integrated into the present structure where possible.

2. All collector racks must be structurally safe and the general design must be approved by a registered structural engineer through a report on record with the utility. "Do-It-Yourself" installers are exempt from this provision, but the rack will undergo a careful examination during system inspection.

3. All potable and nonpotable hot water pipes must be insulated. All cold water pipes must be insulated a distance of two linear feet from connection to hot water sources.

4. Controller sensor must be located within one inch of the storage tank or collectors. Storage tank sensors must be located near bottom of tank and differential high temperature sensor near the outlet of the collectors. Manufacturer's specifications must be followed if different from this provision.

5. The collectors must be manifolded in a reverse return, parallel manner to minimize pressure drop and optimize collector performance.

6. Collector installation must conform with Chapter 7 of USEC.

7. The system relief valves on tanks must be discharged to an outside drain in a direction to eliminate any possible scalding to property or persons.

8. A dielectric isolation union, or equivalent, shall be used on each pipe connection wherever dissimilar metal contact is possible (i.e., between piping and storage tanks).

9. The fluid flow through the collector shall be designed to be 15 $lb/hr\text{-}ft^2$ or meet collector manufacturer recommendations.

10. Flashing, or an approved roof jack, must be installed to prevent water leakage under and around the collector piping penetration in the roof.

11. Adequate sealing and reroofing is required to eliminate potential leaks where roof penetrations are made.

12. The entire solar piping system, including the solar collector if it carries line pressure potable water, shall be hydrostatically tested using water to a pressure of 125 psig and held for 15 minutes.

The contractor must document this test and provide the documentation to the owner. During the pressure test, the remaining potable water system must be isolated from the pressurized solar system. The tie-in connections shall be tested to line pressure.

13. All testing shall be performed in accordance with Section 309, Part 2 of the Uniform Solar Energy Code.

14. The solar collectors shall be pressure tested in accordance with Items 12 and 13 above, prior to installation. The test can be waived on the collectors if the manufacturers' test is documented and meets the above criteria.

15. Closed loop collector systems must be hydrostatically tested to one and one-half times their normal working pressure and held for 15 minutes.

16. All pipe runs, vertical and horizontal, must be adequately supported by fasteners at no greater than five-foot intervals.

17. The installation must comply with other applicable points included in the HUD Installation Guidelines Checklist. (Appendix D)

18. For purposes of both daily protective draining if so designed, and for periodic maintenance, all pipe runs in all systems shall slope continuously from the highest point to fill and empty valves and to the drainback tank if any.

E. Supplementary Codes and Solar Energy Tax Credit Requirements

All requirements of the following codes and tax credits will also apply. In case of conflict the more stringent requirement shall apply. Current editions shall be used.

ANSI	-	American National Standards Institute, Inc.
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society of Testing and Materials
	-	California State Solar Energy Tax Credits
	-	Federal Solar Energy Tax Credits
IAPMO	-	International Association of Plumbing and Mechanical Officials
NEC	-	National Electric Code
SMACNA	-	Sheet Metal and Air Conditioning Contractors' National Association, Inc., Solar Installation Standards
TTPSE or equal	-	California Testing and Inspection Program for Solar Equipment
Title 24	-	California Administrative Code, Residential Energy Conservation Standards
UBC	-	Uniform Building Code
UL	-	Underwriters Laboratories, Inc.
UPC	-	Uniform Plumbing Code
USEC	-	Uniform Solar Energy Code
NSF	-	National Sanitation Foundation

APPENDIX C

SIZING METHOD

Appendix C

FLAT PLATE COLLECTOR SIZING METHOD FOR SOLAR WATER HEATERS

SITE OWNER _____ SITE ADDRESS _____

Assumptions for use
1. Flat plate ORIENTATION and TILT are tabulated in the CEC California Solar Data Manual.
2. The collector efficiency by make and model is reported in CEC TIPSE results or in those of a comparable testing program.
3. Collectors are free from shading throughout the day and year.

Step 1 Hot Water Usage —

	Gal/Day per Person		No. of Fixtures		
Clothes Washer	4.5 gal/day	x	_____	=	_____
Dishwasher	3.5 gal/day	x	_____	=	_____
Shower/Bathtub	4.5 gal/day	x	_____	=	_____
Kitchen Sink	5.0 gal.day	x	_____	=	_____
Hand Sink	1.0 gal/day	x	_____	=	_____

Total _____ gal/day per person

2 Number of Bedrooms — _____

a. (Single or Multi-Family except as in b.) x 1.5 _____ persons

b. (Single Family) 1 Bedroom - Use 2 persons
2 Bedroom - Use 4 persons
3 Bedroom - Use 5 persons
_____ persons
(Enter the larger of a. or b.)

3 Water Temperature —

Delivery at 135°F less Supply at _____°F = _____°F rise

4 Energy Required —

_____ (Step 1) x _____ (Step 2) x _____ (Step 3) x 3 = _____ kBtu/yr

5 Gross Solar Energy Available —

a. Circle best fit ORIENTATION using a map or compass — E SE S SW W

b. Circle best fit TILT —

Collector Slope	Angle
Flat	0
3.3 : 12	15
7 : 12	30
12 : 12	45
21 : 12	60
-	75
Vertical	90

Step

5 c. Use California Solar Data Manual —

Select appropriate Solar Zone from Map of California on p. 17 and turn to Solar Zone page indicated.

Select nearest Solar Station and turn to Solar Data section indicated — Name _____

Locate the table in that section titled, "Total Radiation on a Tilted Surface - Engineering Units"

Enter the table at the orientation from Step 5.a. above and the angle in degrees from Step 5.b. above. Read across to the "Annual" figure — _____ $kBtu/ft^2$

		Trial #1	Trial #2	
6	Use TIPSE Results to select the collector —			
	a. Manufacturer (from Column 1)			
	b. Model No. (from Column 2)			
	c. Efficiency (from Column 8 use decimal)	0.	0.	
	d. Area (from Column 11)			ft^2
7	Heat Exchanger Efficiency — Select one and enter as a decimal —	0.	0.	

Type	Efficiency
None	100%
Single wall	90%
Double wall	80%

8	Usable Fraction of Gross Solar Energy —	(Step 6.c.)		0.	0.
		(Step 7)	x	0.	0.
			x	0.68	0.68
			=	0.	0.
9	Net Solar Energy Available	(Step 5.c.)			
		(Step 8.)	x		$\left(\frac{kBtu}{ft^2\text{-yr}}\right)$
			=		
10	Collector Area Needed — $\frac{\text{(Step 4.)}}{\text{(Step 9.)}}$	( )	=		ft^2
11	Number of Collectors — $\frac{\text{(Step 10.)}}{\text{(Step 6.d)}}$	( )	=		
12	Use —				collectors

APPENDIX C

FLAT PLATE COLLECTOR SIZING METHOD FOR SOLAR WATER HEATERS

SITE OWNER EXAMPLE 1 SITE ADDRESS SAN RAFAEL

Assumptions for use
1. Flat plate ORIENTATION and TILT are tabulated in the CEC California Solar Data Manual.
2. The collector efficiency by make and model is reported in CEC TIPSE results or in those of a comparable testing program.
3. Collectors are free from shading throughout the day and year.

Step 1 Hot Water Usage --

			No. of Fixtures		Gal/Day per Person
Clothes Washer	4.5 gal/day	x	1	=	4.5
Dishwasher	3.5 gal/day	x	0	=	0
Shower/Bathtub	4.5 gal/day	x	1	=	4.5
Kitchen Sink	5.0 gal.day	x	1	=	5.0
Hand Sink	1.0 gal/day	x	2	=	2.0
				Total	16.0 gal/day per person

2 Number of Bedrooms -- 2

a. (Single or Multi-Family except as in b.) x 1.5 = 3 persons

b. (Single family) 1 Bedroom - Use 2 persons; (2 Bedroom) - Use 4 persons; 3 Bedroom - Use 5 persons

4 persons

(Enter the larger of a. or b.)

3 Water Temperature --

Delivery at 135°F less Supply at 65 °F = 70 °F rise

4 Energy Required --

16.0 (Step 1) x 4 (Step 2) x 70 (Step 3) x 3 = 13,441 kBtu/yr

5 Gross Solar Energy Available --

a. Circle best fit ORIENTATION using a map or compass -- E SE (S) SW W

b. Circle best fit TILT --

Collector Slope	Angle
Flat	0
3'3 : 12	15
7 : 12	(30)
12 : 12	45
21 : 12	60
-	75
Vertical	90

Step

5 c. Use California Solar Data Manual --

Select appropriate Solar Zone from Map of California on p. 17 and turn to Solar Zone page indicated.

Select nearest Solar Station and turn to Solar Data section indicated -- Name SAN RAFAEL

Locate the table in that section titled, "Total Radiation on a Tilted Surface - Engineering Units"

Enter the table at the orientation from Step 5.a. above and the angle in degrees from Step 5.b. above. Read across to the "Annual" figure -- 626 kBtu/ft^2

			Trial #1	Trial #2	
6	Use TYPSE Results to select the collector --				
	a. Manufacturer (from Column 1)		ARCHER	GRUMMAN	
	b. Model No. (from Column 2)		JH 101	121	
	c. Efficiency (from Column 8 use decimal)		0.44	0.51	
	d. Area (from Column 11)		24.06	21.99	ft^2
7	Heat Exchanger Efficiency -- Select one and enter as a decimal --		0.90	0.90	
8	Usable Fraction of Gross Solar Energy --	(Step 6.c.)	0.44	0.51	
		(Step 7) x	0.90	0.90	
		x	0.68	0.68	
		=	0.27	0.31	
9	Net Solar Energy Available	(Step 5.c.)	626	626	
		(Step 8.) x	.27	.31	
		=	169	194	kBtu/ft^2-yr
10	Collector Area Needed -- (Step 4.)/(Step 9.)	= (13,441)/(169) =	80	69	ft^2
11	Number of Collectors -- (Step 10.)/(Step 6.d)	= (80)/(24.06) =	3.3	3.1	
12	Use --		3	3	collector

Type	Efficiency
None	100%
Single wall	90%
Double wall	80%

APPENDIX C

FLAT PLATE COLLECTOR SIZING METHOD FOR SOLAR WATER HEATERS

SITE OWNER EXAMPLE 2 SITE ADDRESS APPLE VALLEY

Assumptions for use
1. Flat plate ORIENTATION and TILT are tabulated in the CEC California Solar Data Manual.
2. The collector efficiency by make and model is reported in CEC TIPSE results or in those of a comparable testing program.
3. Collectors are free from shading throughout the day and year.

Step 1 Hot Water Usage —

			No. of Fixtures		Gal/Day per Person
Clothes Washer	4.5 gal/day	x	1	=	4.5
Dishwasher	3.5 g-l/day	x	0	=	0
Shower/Bathtub	4.5 gal/day	x	1	=	4.5
Kitchen Sink	5.0 gal.day	x	1	=	5.0
Hand Sink	1.0 gal/day	x	2	=	2.0
				Total	16.0 gal/day per person

2 Number of Bedrooms -- 2

a. (Single or Multi-Family except as in b.) x 1.5 = 3 persons

b. (Single family) 1 Bedroom - Use 2 persons
(2 Bedroom) - Use 4 persons
3 Bedroom - Use 5 persons

4 persons (Enter the larger of a. or b.)

3 Water Temperature --

Delivery at 135°F less Supply at 65 °F = 70 °F rise

4 Energy Required --

16.0 (Step 1) x 4 (Step 2) x 70 (Step 3) x 3 = 13,44 kBtu/yr

5 Gross Solar Energy Available --

a. Circle best fit ORIENTATION using a map or compass -- E SE (S) SW W

b. Circle best fit TILT --

Collector Slope	Angle
Flat	0
3'3 : 12	15
7 : 12	(30)
12 : 12	45
21 : 12	60
-	75
Vertical	90

Step

5 c. Use California Solar Data Manual —

Select appropriate Solar Zone from Map of California on p. 17 and turn to Solar Zone page indicated.

Select nearest Solar Station and turn to Solar Data section indicated -- Name: CHINA LAKE/INYOKERN

Locate the table in that section titled, "Total Radiation on a Tilted Surface - Engineering Units"

Enter the table at the orientation from Step 5.a. above and the angle in degrees from Step 5.b. above. Read across to the "Annual" figure — 740 kBtu/ft²

		Trial #1	Trial #2	
6	Use TYPSE Results to select the collector —			
	a. Manufacturer (from Column 1)	ARCHER	GRUMMAN	
	b. Model No. (from Column 2)	JH101	121	
	c. Efficiency (from Column 8 use decimal)	0.44	0.51	
	d. Area (from Column 11)	24.06	21.99	ft²
7	Heat Exchanger Efficiency — Select one and enter as a decimal —	0.90	0.90	
8	Usable Fraction of Gross Solar Energy — (Step 6.c.)	0.44	0.51	
	(Step 7) x	0.90	0.90	
	x	0.68	0.68	
	=	0.27	0.31	
9	Net Solar Energy Available (Step 5.c.)	740	740	
	(Step 8.) x	.27	.31	
	=	199	229	kBtu/ft²-yr
10	Collector Area Needed -- (Step 4.)/(Step 9.) = (13,441)/(199) =	68	59	ft²
11	Number of Collectors -- (Step 10.)/(Step 6.d) = (68)/(24.06) =	2.8	2.7	
12	Use --	3	3	collectors

Type	Efficiency
None	100%
Single wall	90%
Double wall	80%

CALIFORNIA SOLAR DATA MANUAL

MARCH 1978

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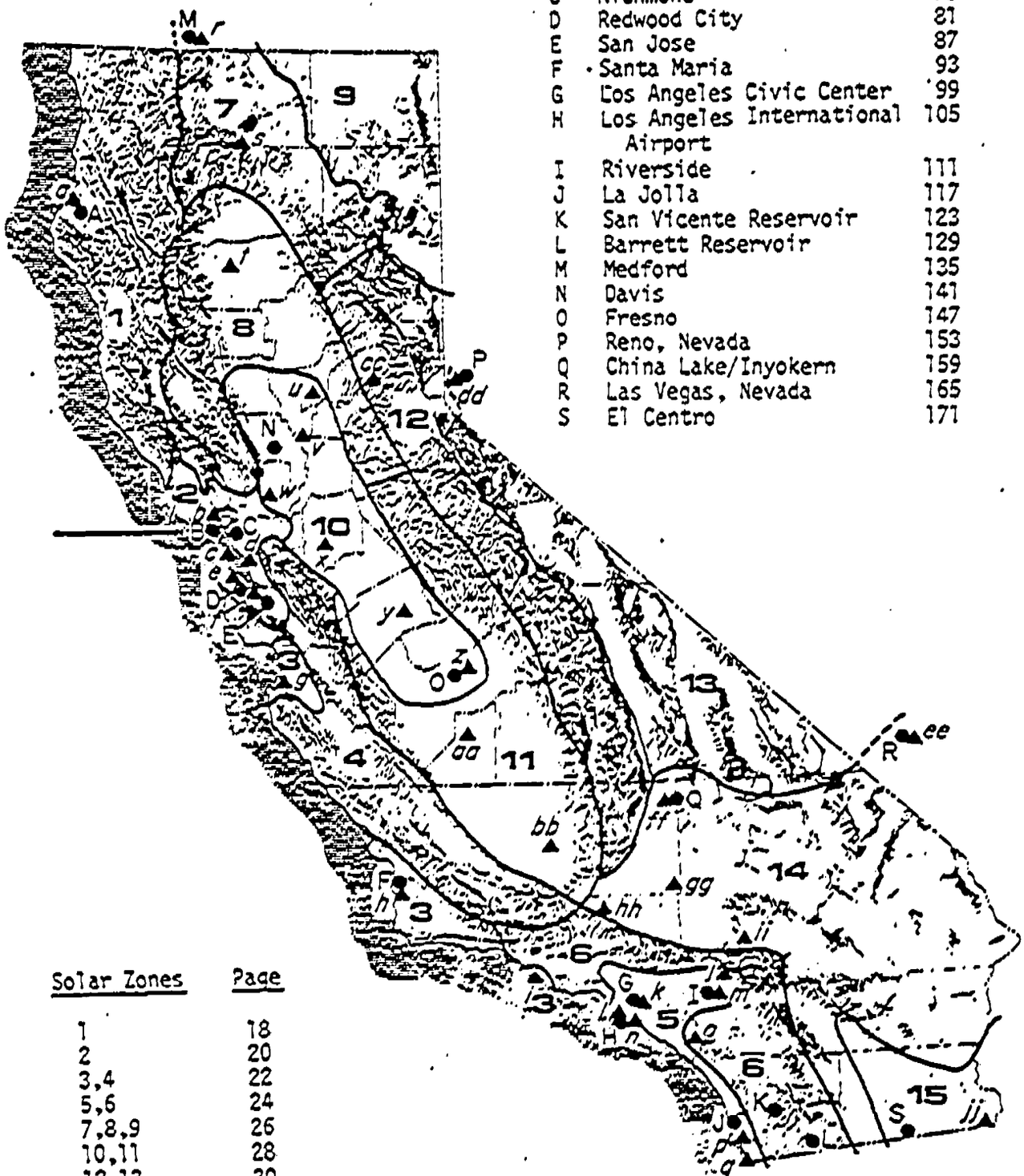

● Solar Data Stations		Page
A	Butler Valley Ranch	63
B	San Rafael	69
C	Richmond	75
D	Redwood City	81
E	San Jose	87
F	Santa Maria	93
G	Los Angeles Civic Center	99
H	Los Angeles International Airport	105
I	Riverside	111
J	La Jolla	117
K	San Vicente Reservoir	123
L	Barrett Reservoir	129
M	Medford	135
N	Davis	141
O	Fresno	147
P	Reno, Nevada	153
Q	China Lake/Inyokern	159
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Solar Zones	Page
1	18
2	20
3,4	22
5,6	24
7,8,9	26
10,11	28
12,13	30
14	32
15	34

Total Radiation on a Tilted Surface (Calculated Values)
Metric Units (kWh/m²)
San Rafael

SURFACE ORIENTATION	ANGLE OF TILT (DEGREES FROM HORIZONTAL)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
DIRECT BEAM + DIFFUSE (GROUND REFLECTION EXCLUDED)														
SOUTH	15	89	108	158	205	225	231	240	226	187	136	89	70	1955
SOUTH	30	98	120	166	203	213	213	223	220	192	148	96	82	1974
SOUTH	45	106	125	165	190	188	189	199	200	186	151	102	89	1880
SOUTH	60	107	123	154	165	154	145	155	169	169	146	102	91	1679
SOUTH	75	102	113	133	131	112	100	109	128	142	131	96	87	1386
SOUTH	90	91	97	106	90	67	54	61	82	106	109	85	79	1026
SE,SW	15	78	102	152	201	224	232	240	223	181	129	79	65	1906
SE,SW	30	86	109	156	198	213	217	226	216	182	135	86	72	1897
SE,SW	45	90	110	151	185	193	193	202	199	175	125	88	75	1796
SE,SW	60	88	105	139	164	165	162	171	173	159	127	85	74	1612
SE,SW	75	81	99	121	135	131	126	134	141	135	112	78	69	1358
SE,SW	90	70	79	97	103	95	89	95	105	106	92	66	60	1057
E,W	15	64	88	137	190	220	231	237	214	166	113	66	53	1780
E,W	30	62	84	130	179	206	216	222	201	157	108	64	51	1680
E,W	45	58	78	120	163	186	195	200	183	144	100	59	48	1534
E,W	60	52	70	107	143	162	169	174	160	127	89	52	43	1350
E,W	75	45	60	91	120	135	140	144	134	108	76	44	38	1136
E,W	90	37	49	73	95	106	109	112	105	86	62	38	31	903
GROUND REFLECTION FOR REFLECTIVITY = .2 (MULTIPLY BY RHO/.2 FOR REFLECTIVITY = RHO)														
ANY	15	0	0	0	1	1	1	1	1	1	0	0	0	4
ANY	30	1	1	2	3	3	3	3	3	2	2	1	1	24
ANY	45	2	3	4	6	7	7	7	6	5	3	2	2	53
ANY	60	3	4	7	10	11	12	12	11	8	6	3	3	91
ANY	75	5	7	10	14	17	18	18	16	13	9	5	4	135
ANY	90	7	9	14	19	23	24	24	22	17	12	7	5	182

Total Radiation on a Tilted Surface (Calculated Values)
Engineering Units (kBtu/ft²)
San Rafael

SURFACE ORIENTATION	ANGLE OF TILT (DEGREES FROM HORIZONTAL)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
DIRECT BEAM + DIFFUSE (GROUND REFLECTION EXCLUDED)														
SOUTH	15	27	34	50	65	71	73	76	72	59	43	27	22	619
SOUTH	30	31	38	53	64	67	68	71	70	61	47	30	26	624
SOUTH	45	33	40	52	60	60	58	62	63	59	46	32	28	595
SOUTH	60	34	39	49	52	49	46	49	53	54	46	32	29	532
SOUTH	75	32	36	42	41	36	32	35	41	45	42	31	28	439
SOUTH	90	29	31	33	28	21	17	19	26	34	35	27	25	325
SE,SW	15	25	32	48	64	71	73	76	71	57	41	25	21	604
SE,SW	30	27	35	49	63	68	69	72	69	58	43	27	22	601
SE,SW	45	28	35	48	59	61	61	64	63	55	43	28	24	569
SE,SW	60	28	33	44	52	52	51	54	55	50	40	27	24	511
SE,SW	75	26	30	38	43	42	40	42	45	43	34	25	22	430
SE,SW	90	22	25	31	33	30	28	30	33	34	29	21	17	335
E,W	15	20	28	44	60	70	73	75	68	53	36	21	17	564
E,W	30	20	27	41	57	65	68	70	64	50	34	20	16	532
E,W	45	18	25	38	52	59	62	63	58	46	32	19	15	486
E,W	60	17	22	34	45	51	53	55	51	40	28	17	14	428
E,W	75	14	19	29	38	43	44	46	42	34	24	15	12	360
E,W	90	12	15	23	30	34	34	36	33	27	20	12	10	286
GROUND REFLECTION FOR REFLECTIVITY = .2 (MULTIPLY BY RHO/.2 FOR REFLECTIVITY = RHO)														
ANY	15	0	0	0	0	0	0	0	0	0	0	0	0	2
ANY	30	0	0	1	1	1	1	1	1	1	0	0	0	8
ANY	45	1	1	1	2	2	2	2	2	2	1	1	1	17
ANY	60	1	1	2	3	4	4	4	3	3	2	1	1	29
ANY	75	2	2	3	5	5	6	6	5	4	3	2	1	43
ANY	90	2	3	4	6	7	8	8	7	5	4	2	2	58

INITIAL RESULTS OF THE CALIFORNIA TESTING AND INSPECTION PROGRAM FOR SOLAR EQUIPMENT (TIPSE)

CALIFORNIA ENERGY COMMISSION

AUGUST 1979

C-10

500-79-011

INITIAL RESULTS
Testing and Inspection Program for Solar Equipment

Manufacturer (Alphabetically for Each Category) (Address & Telephone #)	Model #	Single or Double Glazing	Cover Plate	Absorb Coating	Thermal Performance: Swimming Pool — Thermal Efficiency %	Swimming Pool — Btu/hr/ft²	Domestic Hot Water/Space Heating — Thermal Efficiency %	Domestic Hot Water/Space Heating — Btu/hr/ft²	Heat Loss Rate (Slope)	Gross Area (ft²)	Dry Wt. (lbs)	Fluid Cap (Gal)	Max Flow Rate (GPM)	Max Oper Press (Psi)	Max No Flow Temp (°F)	Max Live Load lbs/ft²	Use Restrictions
Copper Tube & Absorber																	
Aratek, Inc. 1525 Pollaski Road England, PA 18936 (215) 441-0770	D-189 * D-202 * D-212 * D-213 * D-220 * D-221 *	Single	Glass	Selective	72	182	48	121	-.848	25.63	155	.6	2.6	40			Thermal Performance Based on Model D-189
	D-189C D-229 D-222	Single	Glass	Selective	74	181	66	137	-.636	26.63	155	.6	2.5	40			Thermal Performance Based on Model D-189C
					74	181	66	137	-.636	26.15	160	.6	2.5	60			
American Home Solar Energy Systems 888 Catalina Laguna Beach, CA 92651 (714) 631-9756	9120-2	Single	Fluorocarbon Film	Black Paint	66	158	35	83	-1.085	32.74	135	.96	8	80			
American Solar King Corporation 6201 New McGregor Hwy. Waco, TX 76710	DG16	Double	Glass	Selective	69	141	38	93	-.707	23.64	190	.6	.5	45			
Archer Industries 359 Ercal Street Escondido, CA 92026 (714) 653-6104	JH101	Single	Glass	Black Paint	77	185	44	106	-1.169	24.06	116	.8	1	90			Do Not Exceed Recommended Flow Rate
B & W Refrigeration Co. 1410 3rd Avenue Yuma, AZ 85364 (602) 726-4564	CSSPY30	Single	Glass	Black Paint	70	173	38	94	-1.12	31.44	200	1.6	8	100			
	CSSPH30	Single	Glass	Black Paint	70	173	38	94	-1.12	31.46	200	1.6	8	100			Thermal performance based on model CSSPY30
	CSSPY15	Single	Glass	Black Paint	70	173	38	94	-1.12	18.0	106	.8	8	100			Thermal performance based on model CSSPY30
	CSSPH15	Single	Glass	Black Paint	70	173	38	94	-1.12	18.0	106	.8	8	100			Thermal performance based on model CSSPY30
General Energy Devices P. O. Box 5439 Clearwater, Florida (813) 566-3565	*16-41D	Single	Reinforced Plastic	Black Paint	57	134	23.6	65	-1.179	22.1	92	.9	4	160			Thermal Performance Based on Model 16-41P
	16-41PDT *16-41P	Single	Reinforced Plastic	Black Paint	57	134	23.6	66	-1.179	22.1	101.6	.9	4	160			
Grumman Energy Systems, Inc. 4175 Veterans Memorial Highway Ronkonkoma, New York (516) 737-3741	100-2 *	Single	Glass	Selective	81	189	57	140	-.845	23.43	169	.72	.6	128			

* Grandfathered In Data

APPENDIX D

INSTAL-LATION CHECKLIST

NOTE: Although it is mandatory standard procedure to consult the installation, operations, and maintenance instructions supplied by the manufacturer for each approved system, the following general checklist will serve as a useful guide for installing a typical solar DHW system. For more detailed information, consult HUD's Intermediate Minimum Property Standards for Solar Heating and Domestic Hot Water Systems, Volume 5 (4930.2).

YES NO

1. SITING AND ORIENTATION

_____ _____ 1-1. Are collectors oriented in a proper southerly direction?
DISCUSSION: Most manufacturers recommend true (not magnetic) south plus or minus 15°. Variations outside these limits reduce the efficiency of the system.

_____ _____ 1-2. Do solar collectors have an unobstructed view in a southerly direction between 9:00 A.M. and 3:00 P.M.?
DISCUSSION: While shading problems are possible all year, low winter sun angles may cast shadows of distant obstructions across the collectors that would not be a problem in summer. Remember that trees which shed leaves in the fall are less prone to create such problems than evergreens.

_____ _____ 1-3. Are collectors tilted within acceptable limits?
DISCUSSION: Most manufacturers recommend latitude plus up to 10° for domestic hot water installations. Variations outside these limits may reduce the efficiency of the system. Increasing the tilt favors winter energy collection, decreasing it favors summer collection.

		YES	NO
1-4.	Are system components located in such a manner as to harmonize with surroundings, to minimize vandalism and obstruction to pedestrian or vehicular traffic, and to facilitate emergency access?		
DISCUSSION:	Solar energy system components may include elements which are large and visually dominant when viewed from off-site. If not carefully designed and located, such elements can produce a detrimental effect on the overall appearance of a residential area. The potential hazard and nuisance of collector reflections should not be ignored when planning system locations. Also, solar hot water systems should not block exits, roads, or walkways and, since they might be said to constitute an "attractive nuisance" (like an unfenced swimming pool), should be fenced off to prevent unauthorized access.		
1-5.	Are system components located in such a manner as to allow easy access for cleaning, adjusting, servicing, examination, replacement or repair, especially without trespassing on adjoining property?		
DISCUSSION:	Components should not be located in places which are difficult to reach. Storage tanks may need periodic inspection, maintenance, and possible replacement. Care must be taken that installers do not damage existing roofing or flashing.		
1-6.	Is there safe and easy access to gutters, downspouts, flashing, and caulked joints to allow minor repairs and preventative maintenance?		
1-7.	Are collectors located to minimize heat losses?		
DISCUSSION:	In order to avoid heat losses, the location of the solar collector should be planned to avoid low spots where freezing ground fog can collect or unprotected ridges where winds can be more extreme.		
1-8.	If ground-mounted, are collectors located to minimize interference from drifting snow, leaves, and debris?		
DISCUSSION:	Collector surfaces are often smooth and slippery, warmer than their surroundings, and located in elevated positions at steep angles. Adequate space should be provided for melting snow to slide off collectors. Poorly placed ground-mounted collectors and components may encounter snow cover and drifting problems beyond the capabilities of collectors to clean themselves. Collectors should be a minimum of 18 inches above ground level at their lowest point to reduce drift coverage and mud splashing.		
1-9.	If roof-mounted, are existing roof structures capable of supporting the additional load imposed by the collectors?		

YES NO

2. COLLECTOR MOUNTING

2-1. Is the framework constructed to support collectors under anticipated extreme weather conditions (wind loading up to 100 MPH, ice, rain, etc.)?

DISCUSSION: A tilted collector array can markedly increase the wind loading (both positive and negative) imposed on a roof.

2-2. Has the framework been treated to resist corrosion?

2-3. Are joints between the framework and the rest of the building caulked and/or flashed to prevent water leakage and are collectors installed so as not to contribute to moisture build-up, rotting, or deterioration of the roof or wall of the building?

DISCUSSION: All holes in the roof should be flashed and sealed according to the National Roofing Contractors Association Manual of Roofing Practices, 1970.

2-4. Are collectors installed so that water flowing off warm collector surfaces cannot freeze in cold weather areas and damage roof or wall surfaces?

DISCUSSION: Keep collectors several feet from eaves to prevent ice dams from forming and backing water up under shingles. In the case of ground-mounted systems, a gutter and downspout might be necessary to prevent excessive erosion around the footings.

2-5. Have collectors been mounted with weep holes (if provided) at the lowest end of the collector?

DISCUSSION: Proper provision for runoff of condensation within the collectors minimizes the problem of fogging of the inside of the collector glazing. Holes should be blocked with glass fiber to prevent entry of dirt.

2-6. In areas that have snow loads over 20 pounds per square foot or greater, have provisions been made to deflect snow or ice that may slide off roof-mounted components and endanger vehicles or pedestrians?

3. PIPING AND VALVES

3-1. Have the required building, plumbing, and electrical permits (if necessary) been obtained prior to the start of installation?

DISCUSSION: In some localities it may be necessary to supply background information on the operation of solar domestic hot water systems to the local building inspector.

		YES	NO
DISCUSSION:	Installers frequently underestimate the time required to complete their first few installations. Special order equipment should be received before installation begins.		
3-4.	Is all piping properly insulated to maintain system efficiency?	_____	_____
DISCUSSION:	All piping should be insulated to at least R-4. The first 5-10 feet of pipe coming from the conventional water heater tank also should be insulated.		
3-5.	Is all exposed insulation protected from weather damage?	_____	_____
DISCUSSION:	Fiberglass, rigid pipe insulation should be wrapped with weather-protective material. Neoprene insulation must be painted with a flexible finish or wrapped to prevent ultraviolet degradation. It is important to seal all joints, because water seepage will damage insulation and reduce system efficiency.		
3-6.	Are sufficient pipe hangers, supports, and expansion devices provided to compensate for thermal effects?	_____	_____
DISCUSSION:	Insulation should not be interrupted for pipe hangers or supports. Pipes should be insulated as completely as possible. Straight pipe runs of 100 feet or more call for an expansion joint and anchors to avoid pipe or equipment damage.		
3-7.	In ground mounted systems in cold weather areas, are insulated pipes to and from collector buried below the frost lines?	_____	_____
DISCUSSION:	Not only do ur .ed pipes present a poor appearance, but inadequately buried pipes may be subjected to abnormal stresses due to frost heaving (insulation can absorb some stress). Because buried pipe insulation is subject to absorption of ground water, use only thoroughly waterproofed closed-cell foam insulation. Local codes may prohibit normal 95-5 or 50-50 soldered joints underground. Use 45 percent silver solder, brazing alloys, or whatever local codes require. Take care when backfilling the ditch that rocks and construction debris do not touch pipes and create stress points.		
3-8.	Is piping for draindown systems properly pitched to facilitate draining of fluid from the collectors?	_____	_____
DISCUSSION:	Draindown systems with piping not buried below the frost line are vulnerable to frost heaving, changes in the piping pitch, air lock, and subsequent incomplete draindown resulting in frozen pipes, and collector damage. Closed loop systems should also be pitched to facilitate draining, filling, and venting.		
3-9.	If ground-mounted collectors are used, is the run of pipe to storage and back reduced to the absolute minimum?	_____	_____
DISCUSSION:	Long pipe runs between collectors and storage tanks reduce the efficiency of the system by increasing heat losses and		

YES NO

pressure drops. If the run from collectors to storage and back is greater than 100 feet, use thicker insulation and consult standard plumbing tables for pipe size required. Provisions must be made for expansion.

3-10. Have isolation valves been provided so that major components of the system (pumps, heat exchangers, storage tank) can be serviced without system draindown?

3-11. Have air bleed valves been provided at high points in the system so that air can be removed from the liquid circulation loop during both filling and normal operation?

3-12. Have suitable connections been supplied for filling, flushing, and draining both the collector loop and the potable water piping of the system?

3-13. Has piping been leak tested to 1½ times system design pressure for at least 1 hour at constant temperature (with collectors covered) prior to backfilling and insulating?

3-14. Has corrosion between dissimilar metals been avoided by the use of suitable inhibitors in the system as well as dielectric washers in the mounting?

3-15. Has care been taken not to short out the insulating effect of dielectric washers between dissimilar metals by pipe hangers, control systems connections, etc.?

3-16. Will heat transfer fluids be safe and stable at both stagnation temperature and normal running temperatures?

DISCUSSION: Glycol heat transfer fluids should not be subjected to more than 250°F, because this will shorten service life. The flash point of any oil should be compared with the maximum collector stagnation temperature, particularly if the collector manifold is inside the building envelope.

3-17. If a system using antifreeze is used, have a fill valve and a drain (for sampling) been provided in the collector loop?

DISCUSSION: An extra gate valve and drain may have to be installed to blow out the system with compressed air if it is not pitched to drain properly. Make sure that the fill port is upstream of the check valve to prevent air being trapped in the system when filling the collector loop with antifreeze.

3-18. Has a tempering valve or other temperature limiting device been installed to limit exit temperature of the hot water to a safe level?

		YES	NO
DISCUSSION:	Reducing the output water temperature prevents scalding, saves energy, and may be required by law for unregulated DHW water heaters.		
3-19.	If a system containing antifreeze is used, have threaded joints been taped with tightly drawn Teflon® tape?	_____	_____
DISCUSSION:	Antifreeze solutions will often leak through joints that normally will contain water. Therefore, special attention should be paid to joint leakage.		
3-20.	Are all systems, subsystems, and components clearly labeled with appropriate flow direction, fill weight, pressure, temperature, and other information useful for servicing or routine maintenance?	_____	_____
3-21.	Are there vacuum relief valves in the system to prevent the collapse of storage or expansion tanks?	_____	_____
3-22.	Has care been taken to install the circulator pumps so that fluid is flowing in the proper direction?	_____	_____
DISCUSSION:	Improper pump installation is a common problem. Check to see that the small paper gasket in a Bell and Gossett® pump (if used) is still intact after rotating the pump for proper flow direction. Pumps manufactured by other firms will indicate flow direction by another method. Isolate pump vibration from structural members.		
3-23.	Has the expansion tank been located on the suction side of the pump?	_____	_____
3-24.	Has a check valve been installed in the collector loop to prevent reverse circulation by thermosiphoning at night?	_____	_____
DISCUSSION:	Such reverse circulation causes system inefficiency and heat losses.		
3-25.	Are vacuum relief valves protected from freezing?	_____	_____
4. STORAGE TANK			
4-1.	Is the storage tank and conventional water heater insulated to at least R-11?	_____	_____
4-2.	Are the piping connections to the tank located to promote thermal stratification?	_____	_____
DISCUSSION:	The cold city water inlet should be at the bottom of the storage tank, as should the pickup for the cold water to be supplied to the heat exchanger or collector. Hot fluid returning from the heat exchanger or collector should be introduced at the top of the tank. Do not block the top of a gas heater or the entrance of combustion air at its base.		
4-3.	If a storage tank is installed on a roof or in an attic, is it provided with a drip pan and an outlet to an adequate drain?	_____	_____

YES	NO		
		4-4.	Is the storage tank properly connected to the conventional water heater?
		DISCUSSION:	To maximize system efficiency, the collector loop must be permitted to operate independently of the hot water demand. A separate tank, in addition to the conventional heater tank, will provide greatest system efficiency. The higher end of the solar storage tank, through which the collector loop circulates, may be connected to the low end of the conventional hot water tank so that cold city water goes into the solar tank and forces the preheated water from the top of the solar tank into the conventional tank.
		4-5.	Are buried storage tanks anchored to prevent flotation in case of high groundwater levels?

5. SYSTEM SAFETY

		5-1.	Are all surfaces with running temperatures at 120°F. or higher isolated from pedestrian traffic in order to prevent burns?
		5-2.	Are temperature and/or pressure relief valves installed so that pedestrians or equipment are not exposed to effects of venting valves?
		5-3.	Are temperature and/or pressure relief valves installed so as to prevent system pressures from rising above working pressure and temperatures?
		5-4.	When toxic or flammable fluids are used in the system, will fluids overflow or discharge into sewers or storage in a manner acceptable to the local applicable codes?
		DISCUSSION:	As an added safety precaution, the end of the pipe draining the toxic or flammable heat transfer fluid should NOT BE THREADED to prevent any type of hose hookups for any accidental use.
		5-5.	If supplied water pressure is in excess of 80 pounds per square inch or the working pressure rating of any system components, has an approved pressure regulator preceded by an adequate strainer been installed?
		DISCUSSION:	Pressure should be reduced below 80 psig or system working pressure. Each regulator and strainer should be located and isolated by valves so that the strainer is readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping.
		5-6.	Has the system been designed so that any direct connection between wastes from the system and potable water is impossible?

		YES	NO
5-7.	Is there an approved backflow preventer at the cold water supply inlet if required?		
DISCUSSION:	When a backflow preventer is installed, an expansion tank may be required for the hot water system.		
5-8.	Is there a double-walled heat exchanger in the system or another approved method of separating nonpotable heat transfer fluids from potable water?		
DISCUSSION:	HUD's Intermediate Minimum Property Standards notes that single-walled heat exchanger designs that rely solely on potable water pressure or extra thick walls to prevent contamination are not acceptable.		
5-9.	Have all outlets and faucets on the nonpotable fluid and water lines of the system that might be used by mistake for drinking or domestic uses been marked "DANGER—WATER NOT DRINKABLE"?		
DISCUSSION:	It is suggested that valve handles be removed or tool-operated valves be added if the system is accessible to children too young to read.		
5-10.	If hazardous fluids are used in the system, have proper procedures for their use, including first-aid, handling, and safe disposal been supplied to the owner?		
DISCUSSION:	Nonpotable heat transfer fluids should be colored as a safety precaution.		
5-11.	Is adequate drainage available in the collector piping array for leaks in collectors and discharges from pressure relief valves?		
DISCUSSION:	Suitable high-temperature weather-resistant piping should be utilized. Because some oils are corrosive to asphalt shingles, take special care when oils are used in the collector loop and collectors are roof-mounted.		

6. ELECTRICAL SYSTEM

6-1.	Does field electrical wiring comply with all applicable local codes and equipment manufacturer's recommendations?		
6-2.	Is there a properly grounded and protected power outlet for the system controls?		
6-3.	Has control circuit wiring been color-coded or otherwise labeled so that wires are readily traceable?		
6-4.	Are the sensors for collectors and storage tank attached tightly for the best possible thermal transfer and located per equipment manufacturer's instructions?		

YES	NO		
_____	_____	6-5.	Is the collector temperature sensor located in a collector or near the exit from the collector array?

7. CHECKOUT AND START-UP OF SYSTEM

_____	_____	7-1.	Has a person qualified in both solar and conventional hot water systems put the system through at least one start-up and shutdown cycle, including putting the system through all modes of operation?

DISCUSSION: Installation labor should include time allotted to balance the system for proper flow. Temperature differences under known conditions can be used in lieu of a flow meter.

_____	_____	7-2.	Has the owner been instructed in the proper start-up and shutdown procedures, including the operation of emergency shutdown devices, and fully instructed in the importance of routine maintenance of the system, including cleaning collector glazing and other components, draining and refilling the system, air venting, corrosion control, and other procedures?

DISCUSSION: A clear understanding between installer and owner as to what task could or should be undertaken by each party is a valuable tool for increasing solar business. Some owners may be interested in doing some or all of their system's routine maintenance. Others will gladly enter a service contract arrangement when the full extent of the routine maintenance tasks is clearly understood. While you might be more interested in an installation—rather than maintenance—based business, remember that regular service calls give the owner an opportunity to have a system "tuned" to greatest efficiency.

_____	_____	7-3.	Do operating instructions include provisions for the system if the owner leaves for a vacation and hot water use is nil?
_____	_____	7-4.	Has the system been designed so that both solar and conventional systems can operate independently of each other?

APPENDIX E

ENERGY SECURITY ACT (S932)
CONSERVATION AND SOLAR ENERGY DEVELOPMENT
SUMMARY OF RELEVANT PROVISIONS

TITLE 5 - SOLAR ENERGY AND ENERGY CONSERVATION

A. Solar Energy and Energy Conservation Bank

In Section 504, "Residential Energy Conservation Improvements", are defined to include most conservation measures for a residential or multifamily residential building, except for solar energy devices. "Commercial Energy Conserving Improvements" are defined in a similar manner.

"Solar Energy System" is defined to refer to any type of building and to include any addition, alteration, or improvement, which is designed to utilize wind energy, energy produced by a wood-burning appliance, or solar energy (either active or passive). This definition includes some types of earth-sheltered buildings and fireplaces.

Section 505 establishes a Solar Energy and Energy Conservation Bank (to be a part of HUD). The Bank shall not exist after September 30, 1987.

Section 506 establishes a board of directors for the Bank, including the secretaries of HUD, DOE, Treasury, Agriculture and Commerce.

Section 507, the President is to appoint a president of the Bank with the consent of the Senate.

Section 508, the Energy Conservation Advisory Committee and the Solar Advisory Committee are to be established, each with five members, none of whom can be employees of any government.

Section 509 states that the Bank may make payments to financial institutions (defined to include any nonprofit agency and any state or local governmental agency as well as any other lender as designated by the Board of Directors) in the following forms:

1. Deductions of loan principle for loans made to owners and tenants of existing residential, multifamily, commercial and agricultural buildings for the purchase and installation of energy conserving improvements; and for

loans to owners of existing buildings of the same type for the purchase and installation of solar energy systems, to builders of new or substantially rehabilitated residential buildings for solar energy systems and to purchasers of newly constructed buildings of each type which have solar energy systems.

2. Prepayments of interest otherwise due for the above types of loans.

3. Grants to owners and tenants in existing residential buildings and to tenants in existing multifamily buildings for the purchase and installation of energy conserving improvements.

Under Section 509(b), financing assistance is limited to expenditures made after January 1, 1980. The amount of any financial assistance provided is not to be included in the gross income of any person for income tax purposes.

Section 511 establishes a complicated formula for determining the maximum amount of financial assistance to be provided for the installation of energy conserving improvements in residential buildings.

Section 512 sets up similar limits for the amount of financial assistance for solar energy devices. The amount of financing and financial assistance which can be offered is limited by both the cost of the improvement and the income of the consumer. For instance, an owner or tenant of a single family dwelling whose income is between 100 percent and 120 percent of the median area income could receive an amount equal to 30 percent of the cost of the residential energy conservation improvement not to exceed $750. Similarly, the owner or purchaser of a single family dwelling whose income is between 80 and 160 percent of the median area income could receive an amount equal to 50 percent of the cost of the solar energy system not to exceed $5,000.

Sections 513 through 517 contain a series of conditions and limitations on the availability of financial assistance. In the case of solar systems only, utilities may receive no more than 10 percent of the amount of funds appropriated in a given fiscal year (Section 517(a)). Payments to utilities may consume as much as 20 percent of the funds at the discretion of the Board of Directors. Payments to utilities must be distributed regionally among utilities throughout the United States in a reasonable

manner. This limitation is not placed on any of the other fund allocations. The Board of Directors is to report to Congress within two years on the limitation on the amount of financial assistance provided by the utilities, including recommendations as to the continuation of the limitation and the level of such limitation (Section 519(b)).

The Bank is instructed to seek the advice and assistance of the Freddie Mac and Fannie Mae Programs in coordinating the Bank's programs with the secondary market for loans used to finance conservation and solar energy purchases (Section 518(b)).

The Bank is to undergo an extensive promotional effort to inform financial institutions, builders, and consumers of the benefits of this program and to actively seek their participation.

The Board must report to the President and Congress annually (Section 519(a)).

The Board must issue final rules and regulations for residential, financial assistance within 180 days and for all other aid (multi-family, commercial or agricultural) within 270 days.

Funding for this program as set forth in Section 522 for residential and commercial energy conserving improvements are set at the following limits for the indicated fiscal years: 1981--$200 million (not more than $10 million for promotion); 1982--$629 million (not more than $7,500,000 for promotion); 1984--$875 million (not more than $7,500,000 for promotion).

The following sums are authorized for the purchase and installation of solar energy systems:

1981	-	$100 million (not more than $10 million for promotion)
1982	-	$200 million (not more than $7,500,000 for promotion)
1983	-	$225 million (not more than $7,500,000 for promotion)

Appropriated funds are to remain available until expended.

B. SECONDARY FINANCING

Under prior existing law, the Secretary of HUD was authorized to direct the Government National Mortgage Association (GINNIE MAE) to purchase loans made for the purchase and installation of

residential conservation improvements. Section 581 of this act deletes this provision and instead directs the Bank to purchase such loans as well as loans for solar energy systems unless the Board finds such a step unnecessary in order to advance a national program of energy conservation in residential buildings.

Section 534 goes further to permit the Federal Home and Loan Mortgage Corporation (Freddie Mac) to purchase residential mortgages from any public utility making such a loan for the purpose of financing the installation of residential conserving improvements or solar energy systems. Further, the Federal National Mortgage Association (Fannie Mae) is permitted to purchase loans or advances made by any public utility for the purpose of financing the installation of conservation or solar energy systems.

Section 545 provides that a subsidy provided to customers under this program should not be treated as income for tax purposes. The Conference Report, at page 294 also contains the following language:

> "The conferees intend that any financial assistance which is provided to a customer by a utility for residential energy conservation measures and which does not include Federal, State or local governmental financial assistance (such as assistance from the Solar Energy and Energy Conservation Bank) shall not be considered subsidized energy financing for the purposes of the Internal Revenue Code, it shall not therefore disqualify a customer from receiving development tax credits for expeditures so financed."

C. NATIONAL ENERGY CONSERVATION POLICY ACT REVISIONS

Only portions of the NECPA revisions included in this act are discussed herein.

Section 546 revises Section 216 of NECPA by deleting the prohibition on the financing of energy conservation measures (defined to include solar energy devices) by public utilities. This Section also alters the prohibition on the supply or installation of such measures by public utilities. The prohibition no longer applies to measures supplied or installed by public utilities through contracts with independent suppliers or contractors if:

(1) the supplier or contractor is on the list provided by the utility through the Residential Conservation Service (RCS).

(2) the supplier or contractor is not an affiliate or subsidiary of such utility;

(3) the supplier or contractor is selected in a manner that does not involve unfair methods of competition;

(4) the program will not have substantial adverse effect on competition nor provide the suppliers or contractors with an unreasonably large share of contracts;

(5) that any financing provided by the utility will be available for measures sold or installed by any contractor or supplier on RCS lists; and

(6) that to the extent practicable within these other restraints, the program shall be designed to minimize cost to the customers.

Utility financing programs must seek funds from financial institutions located throughout the area covered by the lending program. Any utility must notify the Secretary of Energy when commencing a program for supply installation or financing of any conservation measures.

Under Section 547 the Secretary of Energy, in consultation with the Federal Trade Commission, is given expanded authority to monitor financing, supply, and installation activities of public utilities. DOE is to file an annual report of such activities to Congress. DOE is further empowered, after notice and opportunity for public hearing and after consultation with the Federal Trade Commission, to stop any utility supply, installation or financing program after determining that: (1) that the program utilized unreasonable rates or unreasonable terms and conditions, or (2) that the program has a substantial adverse affect upon competition or involves the use of unfair, deceptive, or anticompetitive acts or practices.

The Secretary of Energy was given 120 days to promulgate rules amending the regulations adopted to implement the National Energy Conservation Policy Act.

APPENDIX F

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