

ORIGINAL

Decision 82 03 009 MAR 2 - 1982

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Application of SUNMASTER CORPORA-)	
TION for eligibility to)	
participate in the Demonstration)	Application 60938
Utility Solar Financing Program)	(Filed September 28, 1981;
of OII-42, Decisions 92251, 92501,)	Petition for Modification
and 92769.)	filed December 3, 1981)

ORDER MODIFYING D.93689

Sunmaster Corporation (Sunmaster), filed Application (A.) 60938 on September 28, 1981, seeking eligibility for its solar water heating equipment under this Commission's Solar Demonstration Financing Program in Order Instituting Investigation 42 (OII 42).

On November 3, 1981, the Commission issued Decision (D.) 93689 granting Sunmaster the eligibility sought. A minimum collector area and storage tank volume were among the several conditions attached.

On December 3, 1981, Sunmaster petitioned this Commission for lower minimum sizing conditions than those received by it. It submitted new technical data supporting its request. On January 7, 1982, an amendment with additional supporting data was also filed.

The issues which Sunmaster formally appealed do not deal with basic certification. Eligibility was granted. They deal with the performance rating and system sizing aspects appearing on page 8 of D.93689, as follows:

<u>Number of Bedrooms</u>	<u>Area of Collector (Sq. Ft.)</u>	<u>Number of Panels</u>	<u>Solar Storage (Gallons)</u>
1-2	42	3	66
3	56	4	82
4	84	6	82
5	98	7	120

The sizing requirements requested by Sunmaster on page 6 of its petition are as follows:

<u>Number of Bedrooms</u>	<u>Area of Collector (Sq. Ft.)</u>	<u>Number of Panels</u>	<u>Solar Storage (Gallons)</u>
1-2	28	2	42
3	42	3	66
4	56	4	82
5	70	5	120

The area of collector and number of panels shown above are based on a net area of 14 sq. ft. per panel.

The collector performance test results submitted to the Commission are based on the gross area as per the test (ASHRAE-93) guidelines. The collector area requirements in gross, based on 17.2 sq. ft. per panel, adopted by this decision are not fixed as before but vary with location in California.

A Sizing Chart Handbook containing 16 climate zones was adopted for the OII 42 program. Sunmaster collector requirements are now based on the Handbook as are other systems eligible for the program. For example, the sizing requirements for Zones 6 (Los Angeles) or 12 (Sacramento) are as follows:

<u>Number of Bedrooms</u>	<u>Area of Collector (Sq. Ft.)</u>	<u>Number of Panels</u>	<u>Solar Storage (Gallons)</u>
1-2	34	2	66
3	51	3	82
4	67	4	120
5	84	5	120

Collector sizing varies both above and below these levels depending on location. The tank sizes are based on the Handbook with credit given for the small additional tank provided as standard equipment to accommodate Sunmaster's drainback method of freeze protection. Sunmaster also disagreed with a technical statement made in the decision which is being revised per Finding 3.

Collector Sizing

Energy Conservation Branch (ECB) staff in D.93689, proposed, in the absence of baseline performance data, minimum numbers of Sunmaster collectors and storage tank volumes for each number of bedrooms, from one through five, to be served in a single-family installation. These minimums were similar to those

granted to General Electric for its generically similar collectors. Both use concentric clear glass evacuated tubes permitting solar energy to enter while trapping the heat within by a thermos bottle effect.

Sunmaster petitioned that the reflectors which are used to increase the sunlight collected by the tubes are significantly different in shape among the evacuated tube collectors on the market, with Sunmaster's reflector producing performance superior to that for which the decision gave it credit in specifying minimum sizing.

ECB staff requested from Sunmaster the results of a Testing and Inspection Program for Solar Equipment (TIPSE) test on its DEC-8A collector. A Lockheed Research Laboratory report dated January 14, 1982 was provided, containing collector performance results (known as ASHRAE 93 Intercept and Slope data). These data permit Sunmaster's collectors to be sized with the Sizing Chart Handbook now used in the OII 42 program for flat plate collectors, when the Handbook is used with the method explained below. The Charts permit sizing to be more flexible because some installations cannot be made at the optimum tilt and southerly orientation. In such cases, the appropriate added amount of collector area is indicated.

The Handbook Charts cover a wide range of slope and intercept data, but not wide enough to cover the Sunmaster collector without reasonable extension. ECB staff made such extensions on each of the 16 Charts to cover the superior low heat loss characteristic of the Sunmaster collector.

In order to permit the use of the Charts in the field without reprinting them, however, ECB staff needed to specify the result of its work in terms of material already appearing on the charts. Artificial values of 0.5 each were then arbitrarily chosen for Slope and Intercept values, which actually are 0.15 and 0.39 based on gross area in the Lockheed test report. Used in conjunction with the appropriate System Type line on the charts, a multiplier of 0.89 on the indicated area yields the same collector area that would be indicated if the actual Slope and Intercept data could be entered.

A further simplification was made because the Charts are difficult to read for the case of a one-wall heat exchanger as used by Sunmaster. Since the No-heat-exchanger line may be read relatively easily, that line should be used and the result simply multiplied by 1.1, which is the constant ratio between the two heat-exchanger conditions.

When the factor of 0.89 previously derived is multiplied by the factor of 1.1, the net multiplier to be used becomes 0.98.

Incident Angle Modifier

The original decision is now improved in two ways; one, by incorporating objective TIPSE data, and two, by permitting flexibility through use of the Charts.

The incident angle modifier effects emphasized by Sunmaster were studied by ECB staff. Data was taken both from the Lockheed test report, and from a study of four evacuated tube collectors done at Argonne National Laboratories including the Sunmaster collector.

The two sources were consistent. They clearly demonstrated the superior optical characteristics of the Sunmaster configuration when compared with a typical flat plate collector at incident angles of radiation in the range from about 20 to 60 degrees.

Sunmaster's advantage over flat plate collectors in this respect must be weighed against the flat plate's advantages over Sunmaster in another respect. When the relative disadvantages of zero concentration and higher heat loss in flat plates are separated for analysis, flat plates typically are observed to absorb a greater fraction of incident radiation due to both geometry and surface type. This factor is best represented for the scope of this study by the Intercept (efficiency) result of TIPSE testing.

When the efficiency at a mid-point fluid parameter is combined with the incident angle modifier and the cosine reduction for off-normal radiation, no net optical advantage is found for Sunmaster over a typical flat plate collector. This Commission, however, in no way denies the existence of a possible net advantage for Sunmaster systems in any specific installation. The decision which was petitioned already states that such an advantage does in fact generally exist in certain applications and climates discussed. If an advantage appears for domestic water heating applications in California after this demonstration affecting about 2% of the California market, then this fact will be borne out and made public through the monitoring program described in D.93689.

Tank Sizing

Sunmaster also requested revised tank sizing. It emphasized the presence of drainback tank volume which is provided as standard equipment on Sunmaster systems.

ECB staff concludes that a consistent, conservative position on tank sizing should be maintained for all manufacturers in the face of remaining uncertainties as to the effect on metered energy use of reducing solar storage volume. Sunmaster is being asked to do nothing more than its competitors. Sunmaster retains some advantage in that the solar energy present in the collectors

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and manifolding is largely conserved rather than lost each day when the circulation pump shuts down. The authorized tank sizes appear in Table 1.

TABLE 1
Authorized Nominal Tank Sizes - Gallons

All Zones

<u>No. of Bedrooms</u>	<u>D.93689 11/3/81</u>	<u>Summaster Petition Appendix G 12/3/81</u>	<u>One-Tank</u>			<u>Two-Tanks</u>		
			<u>Solar with Backup</u>	<u>Drain- back</u>	<u>Total with Backup</u>	<u>Solar Only</u>	<u>Drain- back</u>	<u>Total without Backup</u>
1	66	42	66	15	81	42	15	57
2	66	66	66	15	81	66	15	81
3	82	66	82	15	97	66	15	81
4	82	80	120	20	140	82	20	102
5	120	120	120	20	140	120	20	140

Findings of Fact

1. Sunmaster systems benefit from the vacuum insulation of collected solar heat under conditions of high ambient-to-water temperature differences or of low incident radiation.

2. The Sunmaster incident angle modifier exceeds unity in a portion of the plane perpendicular to the longitudinal axis of the collector.

3. Sunmaster has completed and provided TIPSE test results to quantify Finding 1 and 2.

Conclusions of Law

1. Sunmaster systems should now be sized for eligibility in the OII 42 Program by using the Sizing Chart Handbook with the method described to accommodate the Model DEC-8A collector characteristics.

2. D.93689 should remain in effect except as revised.

3. The following order should be effective on the date of signature in order to allow Sunmaster to participate in the Program at the earliest time under the conditions authorized herein.

IT IS ORDERED that:

1. D.93689 is modified in that Sunmaster systems incorporating its Model DEC-8A collectors are eligible for utility rebates only when:

- (a) In compliance with all currently effective Commission directives, and
- (b) Collectors are sized in accordance with the Sizing Chart Handbook using artificial values of Slope of 0.5, Intercept of 0.5, System Type lines A, B or C as appropriate, and no heat exchanger, and
- (c) The resulting minimum areas are multiplied by 0.98, and
- (d) The number of collectors is based on 17.2 square feet of area per collector rounded to the nearest whole number, and
- (e) Tanks are sized in accordance with Table 1.

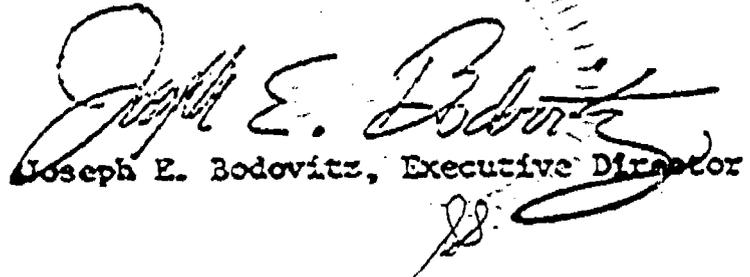
2. In all other respects, D.93689 remains in full force and effect .

This order is effective today.

Dated MAR 2 1982, at San Francisco, California.

JOHN E. BRYSON
President
RICHARD D. GRAVELLE
LEONARD M. GRIMES, JR.
VICTOR CALVO
PRISCILLA C. CREW
Commissioners

I CERTIFY THAT THIS DECISION
WAS APPROVED BY THE ABOVE
COMMISSIONERS TODAY.


Joseph E. Bodovitz, Executive Director