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**SITE SELECTION AND PRELIMINARY EVALUATION
OF POTENTIAL
SOLAR-INDUSTRIAL-PROCESS-HEAT APPLICATIONS
FOR FEDERAL BUILDINGS IN TEXAS**

FINAL REPORT

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Michael A. Branz

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**A Study Conducted By
SOUTHERN SOLAR ENERGY CENTER**

For

UNITED STATES DEPARTMENT OF ENERGY

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A Study Conducted by
the Southern Solar Energy Center
for the Department of Energy
Written by Michael A. Branz

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SECTION 1.0

INTRODUCTION

The purpose of this report is to assess the potential for solar energy in industrial process heat (IPH) applications for federal buildings in Texas and to identify one site warranting consideration as a possible demonstration project site in conjunction with the solar federal buildings program (SFBP).

A review of sites funded under the first phase of the solar federal buildings program (SFBP) was conducted to determine prior applications considered appropriate. Following a review of those sites selected previously, federal buildings in Texas were surveyed to determine which agencies were actively involved in industrial processes. It was determined by the survey that military installations were the major sites in which the federal government was actively involved in industrial processes. The survey was then ordered to emphasize military installations in the western part of the state since that area receives the greatest amount of incident solar radiation.

Three sites subsequently identified by the survey engage in processes considered representative of those possessing the greatest potential for applying solar energy in low temperature industrial process heat (IPH) applications.

Visits to the sites were made to determine the feasibility of applying solar to these processes. The proposed processes and their respective site locations are described hereafter.

SECTION 2.0

SELECTED SITES

2.1 Reese Air Force Base, Lubbock

An electroplating and descaling facility for aircraft maintenance was visited at this site. Currently electric immersion heating elements are being used in the electroplating and descalings tanks which require the equivalent of 2.2×10^6 Btu/h thermal energy. These requirements exist eight hours per day five days a week. Work scheduled for completion by early 1981 will replace the existing electric heating elements with steam coils and two existing 60 HP boilers located in a building adjacent to the electroplating and descaling shop will be reactivated to supply 15 psia saturated steam @ 213°F (100°C) to the process. Only one boiler will be required for the process with the other unit functioning in a standby capacity.

The electroplating and descaling processes are viewed as having good potential for solar applications since typically 85% of the energy requirements for the average plating plant is in the form of thermal energy.^{1&2} Temperature requirements for the plating and descaling processes are relatively low, 170° to 275°F (76° to 135°C), which favor the use of solar energy in this application.

Recent developments have taken place in the chemical solutions used in these processes which lower the temperatures required for the reactions to proceed; however in speaking with the manager of the facility it was mentioned

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1. Daniel A. Mazzeo and Wiley D. Holcombe, "Opportunities for Harnessing Solar Energy for Use in the Plating Shop," Plating and Surface Finishing: (March 1979): 26-31.
 2. W. D. Holcombe, "Solar Energy Opportunities in the Plating and Surface Finishing Industry", Georgia Tech Engineering Experiment Station, Atlanta, Georgia.

that military specifications define criteria that chemical solutions must meet and at this time no new solutions were being evaluated for this purpose.

Certainly lower temperature requirements would further enhance the potential for solar energy in this application.

2.2 Fort Bliss, El Paso

The laundry facility at this site was investigated to determine the potential for using solar energy to heat water required in the laundry's operation.

Hot water at 160°F (71°C) is used for this process which is ideal for solar applications. Thermal energy requirements for hot water heating at this facility vary between 4×10^6 and 5×10^6 Btu/h, with the laundry operating eight hours per day five days a week.

Energy conservation considerations have spurred developments in the laundry industry similar to those which have taken place in the electroplating and surface finishing industry. Laundry detergents are now available which reduce the temperature of hot water required for the process by approximately 20°F; however 160°F hot water would still be required for sterilization of contaminated laundry from the hospital. Contaminated laundry presently accounts for approximately 50% of the laundry processed at the facility.

2.3 Dyess Air Force Base, Abilene

At this site the use of solar energy to preheat boiler feedwater makeup for the base hospital boiler plant is considered the most appropriate potential application.

Three 175 HP boilers are in use in the hospital boiler plant which generate 75 psia saturated steam @ 308°F (153°C). Each boiler requires approximately 5.3×10^6 Btu/h. The boiler plant is operational twenty-four hours a day seven days a week. Typically one boiler is required at all times

throughout the year and a second one is brought on line during the winter months or times of peak demand. A third boiler is maintained for standby purposes. Steam from the boilers is used in the hospital kitchen and labs as well as for space and hot water heating.

SECTION 3.0

CONCLUSIONS

3.1 Among the many factors contributing to the basis for selection of a proposed solar IPH demonstration site, foremost in consideration is the attainment of goals outlined by the Solar Federal Buildings Program (SFBP). The goals of the SFBP are the encouragement of more rapid commercialization of solar products and systems and increased industry and consumer experience with and confidence in these systems. The federal government hopes to achieve these goals by establishing a leadership role in supporting technologically feasible applications through demonstration projects while gaining experience in the operation and maintenance of these systems.

In addition to the basic objectives set forth by the SFBP specific parameters pertaining to each proposed site must be evaluated. Relevant parameters include the system's energy requirements, operating conditions (i.e., temperatures, pressures, flow rates, etc.), hours of operation, available sunlight and plant personnel.

3.2 On the basis of the criteria outlined above, the most appropriate site for a solar IPH demonstration project is the electroplating and descaling facility at Reese AFB in Lubbock. The process is one which if successfully demonstrated has great potential for application in private industry, especially since process temperature requirements in this sector are generally lower than those encountered at the proposed facility 100° to 250°F (38° to 121°C) versus 170° to 275°F (76° to 135°C). Daily thermal energy requirements are from 7% to 44% of those found at the other sites, thereby reducing the required solar collector array; and the facility's operating hours are 7:30 AM to 4:30 PM, five days a week, which minimizes the need for thermal storage. The engineer

who would be responsible for the project if funded has had formal training in solar energy which would be of benefit. It should be noted that there is a proposal to relocate and upgrade the electroplating and descaling shop in fiscal year 1984, however the existing boiler plant and proposed solar collector array location would not be effected by this.

3.3 An alternate site selection to Reese AFB is the hospital boiler plant at Dyess AFB in Abilene.

Perhaps more appropriate as a commercial application, industrial processes in federal buildings appear limited.

Preheating boiler feedwater makeup was considered preferable to hot water heating at this site because of the seasonal and intermittent demand for hot water, whereas the demand for steam is more constant.

3.4 El Paso receives an average of approximately 10% greater incident solar radiation than either of the other sites. Little interest was expressed at this facility in pursuing solar IPH applications. In an effort to determine the reason for the apparent lack of interest it was stated by the Ft. Bliss Deputy Director of facilities engineering that any interest must be generated at the Army command level for Training and Doctrine Command at Ft. Monroe, Virginia and then emanate from that point to individual Army installations. This attitude was in complete contrast to that taken by personnel at the Air Force bases contacted. Personnel at those installations were very enthusiastic about the possibility of being selected as a potential solar IPH demonstration site, and took the initiative to see that the proper individuals were available for assistance.

Another consideration discounting the selection of the laundry facility at Ft. Bliss was the poorly maintained condition of the laundry boiler plant

which is forty years old. Although a study was conducted two years ago by Ft. Bliss to determine the feasibility of upgrading the boiler plant and implementation of such a program was recommended, no action has been taken to this effect.

It is felt that these indications would jeopardize the successful demonstration of solar energy in the proposed process at this site.

Preliminary Evaluation

A preliminary evaluation of the potential contribution by solar energy to the electroplating facility at Reese AFB is included in the section. By using the computer program "IPHFCHART" it is possible to project for a given solar collector configuration the surface area required to provide a specific percentage of the total thermal energy requirements for the system.

The data below indicate that for a 10,000 ft² array of line focusing collectors with north-south axes tracking east to west approximately 41% of the total annual IPH requirements can be supplied with solar energy.

LUBBOCK

TX 33.65

TIME	PERCENT SOLAR	***THERMAL ANALYSIS***			
		INCIDENT SOLAR (MMBTU)	SYSTEM LOAD (MMBTU)	SOLAR COLLECTED (MMBTU)	AMBIENT TEMP (F)
JAN	14.8	.134E+03	.496E+03	.736E+02	39.2
FEB	27.2	.218E+03	.448E+03	.122E+03	42.8
MAR	42.5	.371E+03	.496E+03	.211E+03	48.2
APR	55.7	.464E+03	.480E+03	.268E+03	60.8
MAY	61.5	.529E+03	.496E+03	.305E+03	68.0
JUN	65.8	.545E+03	.480E+03	.316E+03	77.0
JUL	61.6	.528E+03	.496E+03	.306E+03	80.6
AUG	56.7	.485E+03	.496E+03	.281E+03	78.8
SEP	44.6	.374E+03	.480E+03	.214E+03	71.6
OCT	32.7	.285E+03	.496E+03	.162E+03	60.8
NOV	18.6	.161E+03	.480E+03	.892E+02	48.2
DEC	10.6	.974E+02	.496E+03	.528E+02	41.0
YR	41.1	.419E+04	.584E+04	.240E+04	