SITE PARTICIPATION IN THE SMALL COMMUNITY EXPERIMENT

H. J. Holbeck and M. Fellows
Jet Propulsion Laboratory
Pasadena, California

ABSTRACT

The Small Community Solar Thermal Power Experiment (SCSE) has been planned to test a small, developmental solar thermal power plant in a small community application. The baseline plan is to install a field of parabolic dishes with distributed generation to provide 1 MWe of experimental power. Participation by the site proposer is an integral element of the experiment; the proposer will provide a ten-acre site, a connection to the electrical distributional system serving the small community, and various services. In addition to the primary participant, site study efforts may be pursued at as many as five alternative sites.

In 1980, 44 proposals for site participation in the SCSE, representing 24 states, were received by the U.S. Department of Energy (DOE). The extent and quality of the responses provide a great deal of encouragement regarding public interest in alternative energy in general and particularly in this solar thermal experiment. The 44 proposals represented a wide variety of potential site participants with respect to size, type of community, utility characteristics and geographic distribution. Following evaluation, DOE selected six geographically-dispersed site finalists and completed further evaluation of sites in mid-1980. Site selection by DOE has been delayed pending programmatic considerations.

SITE PARTICIPATION PLANS

Application experiments of parabolic dish solar thermal systems are intended to provide information on the operation of these experimental systems in a realistic field environment. The SCSE has the objective demonstrating the interaction of the experiment with the small community and its utility as well as on the technology itself. Site participation, then, is an important aspect of the experiment, and the site participant will be a partner in the experiment.

The general baseline characteristics of the experiment are for a 1 MWe plant, consisting of approximately 55 parabolic dish collectors, each approximately 12 meters in diameter with power conversion occurring at the focal point of each dish. The combined, rectified panel from these generators is inverted and transformed at the experiment/utility interface. The technical aspects of the SCSE are described in another conference paper and will not be repeated here.

The experiment will be located in a distinct small community, preferably one which has a peak electric load less than 20 MWe. The site participant must

represent the community itself as well as the owner of the local electrical distributional network.

The site participant as a cooperative partner will provide support including:

1. A suitable 10-acre site with appropriate zoning and permits for experimental plant activities.

2. Access roads and utility service to the site.

3. An electrical interface to the participant's distributional network.

4. Various data, maintenance, and operational support services.

The selection of the site participant is based on:

1. Community characterization and support

2. Insolation resource

3. Need for solar energy

4. Utility interface and generation experience

5. Site and permit acquisition

6. Site suitability

7. Site development characteristics

8. Environmental impact

9. Extent of participation

10. Organization and management

The baseline plan called for site participation to begin in July 1980 with construction activities beginning in October 1981 and experimental operation commencing in April 1983. Due to programmatic consideration, this schedule is now delayed at least one year. Six of the 44 site participation proposers have been selected by the DOE as site finalists. One of these finalists will be designated for the prime site. Up to five of the remaining sites may be designated for study activities which will involve, among other things, the deployment of field data systems. The purpose of these systems is to assess the site-specific insolation and system performance-related weather characteristics. These data will be used to examine a number of environmental variables that directly impact plant operation. The insolation data will enable system designers to characterize the solar resource of each site and to examine the frequency and effect of power dropouts due to clouding. Used in conjunction with temperature data, estimates of system performance can also be derived. The wind speed data can also be used to determine how often the system will have to be stowed due to high winds.

Each of the data systems will employ the following instruments:

1. Tracking pyroheliometer (direct normal insolation)
2. Pyranometer (total insolation on a horizontal surface)
3. Wind speed indicator
4. Ambient temperature

The flow of site data is described in Figure 1.

The instrument package is sampled by the data logger which converts the data signal from the analog to the digital form and stores the value with the corresponding time of sample. The values are accumulated throughout the day in electronic storage, on a five-minute basis; each evening the central unit transmits the data to the central site via telephone. The capability also exists to access the intermediate computation registers and obtain short-term data. These data can be transmitted to the central system in parallel to the site operation. The data are edited and stored in engineering unit form on floppy diskettes. A standardized report will then be generated from the data.

GENERAL DESCRIPTION OF THE PROPOSERS' SITE CHARACTERISTICS

A high degree of diversity among the proposers was manifest by the varying demographic characteristics of the communities and by the range of proposal combinations of utility types coupled with small communities. These proposer characteristics reflected an interest in the application of the technology over a wide range of supply and demand situations. This diversity is illustrated in Table 1.

In Figure 2, the locations of all proposal sites are identified. The six finalist sites selected by DOE are noted by stars, while the remaining 38 sites are shown by dots. The 24 represented states extend from the far western location in Hawaii to New Jersey in the northeast; South Carolina on the east coast; Washington, North Dakota and Minnesota as northern boundaries and Florida as the most southern location. Almost two-thirds of these locations may be considered to lie outside the sunbelt.

Utility ownership is particularly diverse as shown in Table I, with municipal utilities representing the largest number of proposers. 16 of these municipals have some degree of self-generation and 12 municipals rely entirely on purchase power. Eight of the total utilities are investor-owned, six small community proposers have combined with rural electric cooperatives and two proposers are teamed with irrigation districts. In addition to utility combinations with small communities, two of the above utilities (one municipal, one investor-owned) are teamed with academic institutions.

The average customer cost of electricity reported for a residential usage of 500 KWh per month at 1979 rates varied among utilities by a factor of five. Similarly, a wide range of values appeared for peak demand, even though the median peak value of 6.25 MWe reflected the stated preferred peak electrical power requirement of less than 20 MWe. The resulting peak values thus ranged from a low of 1 MWe to a high of 68.4 MWe.

These 44 small community proposers continue to show interest and confidence in solar thermal dish applications. Based on their varied generational experience and other characteristics as discussed here, solar thermal electric power uses by small communities offer a broad spectrum of opportunities.

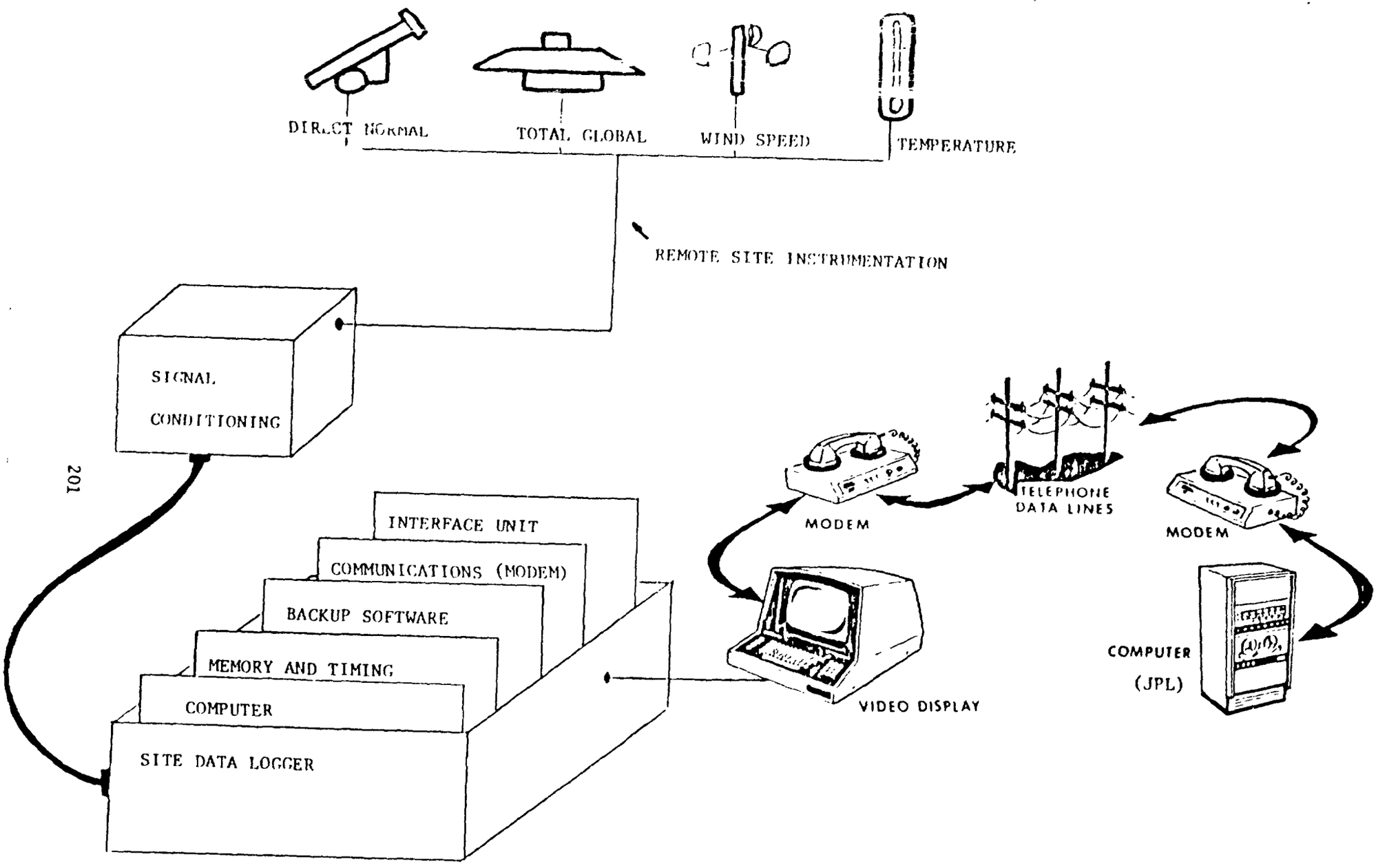

Figure 1. Small Community Instrumentation and Data Aquisition System.

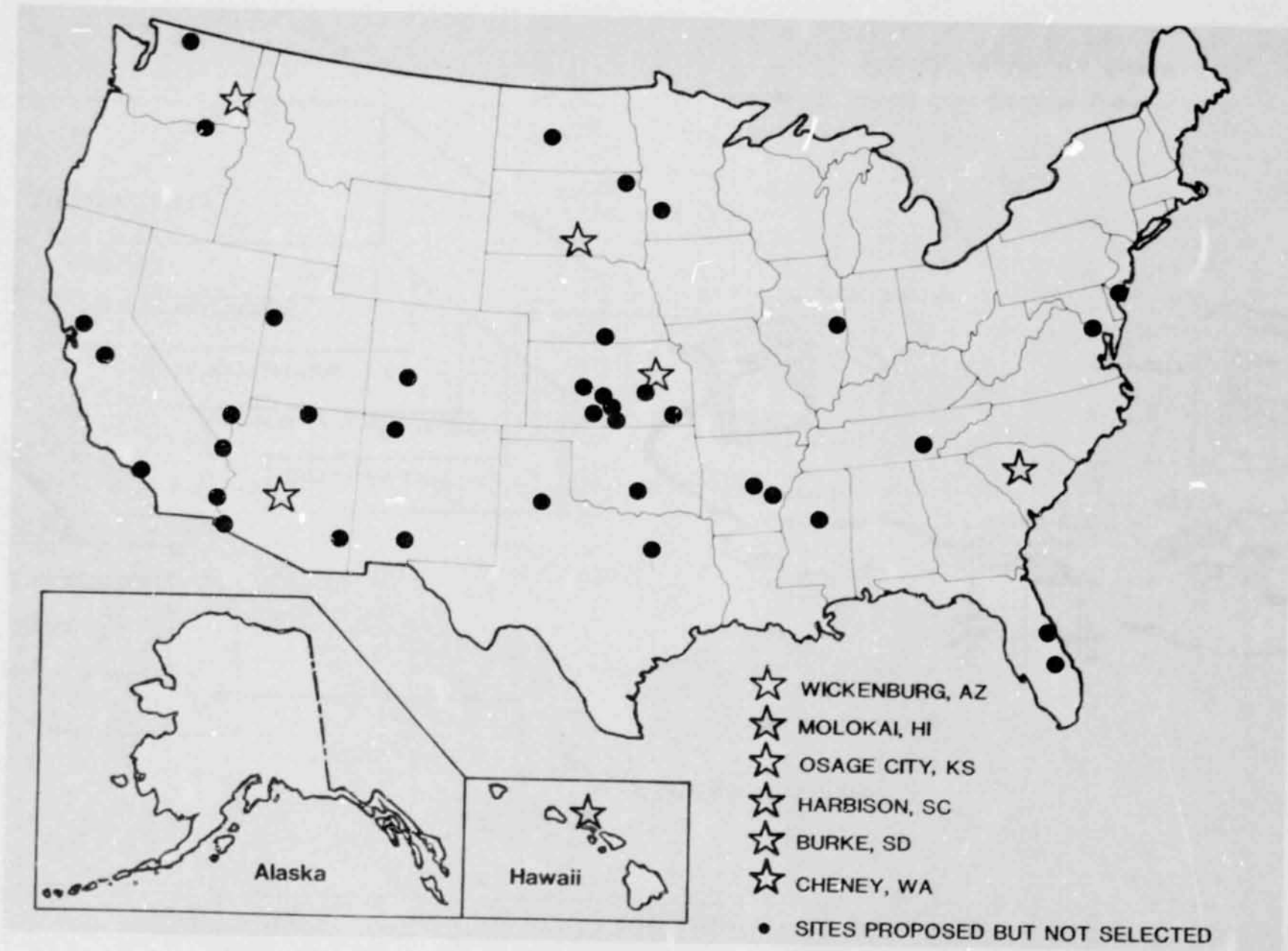

Figure 2. Finalists in SCSE Site Selection

Table I

Generic Summary of the 44 Site/Respondents

Utility Ownership*:	28 Municipal 16 Municipals with self-generation 12 Municipals with purchase only
	8 Investor-Owned
	6 Rural Electric Cooperatives
	2 Irrigation Districts
Median Peak Demand**:	6.25 MWe
Mean Peak Demand**:	15 MWe
Mean Electricity Cost: (Mean 1979 Customer Cost)	5¢/KWh

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* Two academic institutions submitted proposals, one in conjunction with a municipal, one in conjunction with an investor-owned utility.

** Figures available for only 40 sites.