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A PLAN FOR THE PERFORMANCE
MONITORING OF SOLAR SYSTEMS
INSTALLED BY THE SUEDE* PROGRAM:
NCAT/SUEDE INTERACTION

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FOR:

U.S. DEPARTMENT OF ENERGY
Office of Training,
Information and Education

* SUEDE - Solar Utilization, Economic Development and Employment

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I. INTRODUCTION

The following report, "A Plan for the Performance Monitoring of Solar Systems Installed by the SUEDE Program: NCAT/SUEDE Interaction," has been prepared to fulfill the Task 1 requirements of the SUEDE Technical Assistance Program (Grant #DE-FG01-7930277) for a Technical Assistance Plan.

The purpose of this report is to identify the means by which the National Center for Appropriate Technology (NCAT) can provide the necessary technical assistance for the successful monitoring of performance of selected SUEDE Grantee-installed solar systems. This has been accomplished through (1) a review of the SUEDE Grantee solar system installation programs to determine the type, number and quality of Grantee-installed solar systems available for monitoring consideration, and (2) preparation of an NCAT Performance Monitoring Plan which identifies the services and technical assistance that NCAT will need to provide based on the Grantee review.

II. BACKGROUND INFORMATION

The Solar Utilization, Economic Development and Employment (SUEDE) concept originated in the minds of three federal departments in the physical form of Claire Lipscomb, Office of Planning and Evaluation, U.S. Department of Labor; Miriam Charnow, Energy Program Project Manager, Community Services Administration; and Lawnie Taylor, Acting Branch Chief, Training, Information and Education, U.S. Department of Energy, in the winter/spring of 1978.

The idea involved intra-agency cooperation to utilize the solar energy program demonstrations of CSA, the disadvantaged labor pool supported by the Department of Labor's CETA Program, and the financial and technical capabilities of the Department of Energy. These three resources were combined to develop a program involving the training of CETA participants in solar technologies through the hands-on construction and installation of solar systems on low-income housing. The program was designed to stimulate the creation of community-based solar energy businesses and job placements resulting from participant skill development, primarily in the construction industry.

In the spring of 1978, an intra-agency agreement was signed between CSA, DOL and DOE to cooperatively develop the SUEDE Program. The summer of 1978 saw the conceptualization, planning and development of a Request for Proposals (RFP) outlining the program's parameters. The RFP was distributed to all Department of Labor CETA prime sponsors in August of 1978.

On August 3, 1978 over 90 RFP respondents gathered in Washington, D.C. to participate in a pre-proposal workshop. Hopeful grantees prepared proposals during the month of August, the proposals being due by September 1st. The month of September saw the evaluation of proposals, with the final funding decisions being announced in late September, 1978.

The successful SUEDE Grantees are listed in Appendix 1.

The National Center for Appropriate Technology's (NCAT) involvement in the SUEDE Program has moved through three phases. Originally, NCAT's involve-

ment was limited to an observational role during the planning phase. During this phase, plans were developed for NCAT to provide technical evaluation in the proposal review process. During the month of September, 1978, technical staff members from NCAT joined personnel from the Solar Energy Research Institute, Design Alternatives, George Washington University, CSA, DOL and DOE in reviewing and evaluating submitted proposals.

At this point, except for the maintenance of existing relationships with SUEDE Grantees, NCAT's formal involvement in the project was minimal, until the first SUEDE Project Directors' meeting during March of 1979 at SERI in Golden, Colorado. During this workshop, the need for appropriate instrumentation and analysis of installed systems was expressed by program grantees. The Department of Energy suggested that the performance monitoring of the SUEDE systems would be an activity the Department would be interested in funding. A majority of the Grantees expressed a desire to have NCAT perform this function.

During April, 1979 NCAT submitted a proposal to the Department of Energy to provide technical assistance to the SUEDE Program in performance monitoring. In June NCAT hosted a Performance Monitoring/SUEDE Conference at NCAT in Butte, Montana. During this workshop, grantees presented slides of the technical aspects of their programs, and NCAT and the grantees reviewed the concepts of instrumentation, datalogging and performance analysis.

In late October, 1979 NCAT received a Program Grant Notification from the Department of Energy and formally began program operation on December 1, 1979.

During the past several months, NCAT has assembled Grantee information notebooks, conducted a needs assessment, researched instrumentation, produced an instrumentation resource list, performed eight (8) site visits, hired an instrumentation consultant, handled grantee requests and problems, and prepared this report.

III. SUEDE GRANTEE STATUS/REVIEW

This review covers fourteen (14) of the fifteen (15) SUEDE Grantees originally funded. The Tarrant County, Texas project was unable to complete their program because of local employment conditions. A brief historical description of each Grantee is provided, followed by information on the Grantee-installed solar systems.

A. SOUTHERN NEW HAMPSHIRE SERVICES

This project, located in Southern New Hampshire and in Massachusetts, is organized as a consortium of groups. Total Environmental Action Foundation (TEAF) provides training and support for three groups, Southern New Hampshire Services, University of Massachusetts Extension Service, and the Center for Ecological Technology.

The program involved the extensive training of staff in each operational unit, the design of the basic systems which each group would install, and follow-up training seminars for participants by the staff of the TEA Foundation.

Three (3) basic systems were installed by this program: 23 solar attached greenhouses, 45 thermosiphoning air wall panels, and 22 reconstructions of the south wall of homes to provide more direct gain glazing. Most systems were glazed in thermopane patio door glass. Observations of installed systems during a site visit to New England revealed well-crafted units in good operational condition.

The TEA project is currently approximately 90% complete with over 90 installations, and a number of TEA project personnel have been recruited for employment with the Tennessee Valley Authority (TVA) Solar Project.

TEA is currently developing a client solarization evaluation format. This format will allow TEA to survey clients whose homes were solarized to determine the subjective response of their clients.

B. CITY OF NEW YORK

This project, operated by the New York City-based Energy Task Force, trains unemployed minorities in NYC to retrofit low-income tenements with domestic solar hot water systems. The project operates out of a workspace on lower 5th Avenue in Manhattan. Crews install an ETF-designed domestic solar hot water system; solar hot water collectors are purchased from a minority-operated manufacturing firm in the Bronx. The system's design involves spanning structural steel collector array supports between tenement parapet walls. Pre-insulated collector piping is run to basement storage through ventilation shafts. Modular, wooden 1000-gallon water storage tanks are assembled in basement spaces with hand-built, finned, heat exchange coils suspended in the tank to provide the heat exchange loops for both the collector loop and potable water line. The tanks are filled with water as the heat exchange medium, and hand-insulated. The system represents an innovative solar hot water retrofit technology for high density urban buildings. Workmanship is of excellent quality.

In addition to the hot water installations, ETF has recently received funding to construct a large greenhouse atop a city tenement. This project will be constructed by SUEDE-trained personnel.

C. LEHIGH VALLEY MANPOWER CONSORTIUM

The project was operated directly by the CETA prime sponsor. The project, which drew participants from the Greater Allentown, Pennsylvania area, was but one part of a larger manpower training program involving weatherization, woodstove installation, furnace installation and repair, construction and solarization skills. Participants were trained in the installation of Reynolds Aluminum domestic solar hot water systems. Participants installed various woodstoves in client homes and constructed a solar attached greenhouse. The project was able to maintain a high production-to-trainee-installation ratio, installing over 40 systems during last year's construction season.

The Lehigh Valley Project has been monitoring 4 systems for the past year. The project has forwarded to NCAT data on these systems; additionally, a concept paper was developed on performance monitoring for solar attached greenhouses.

The Lehigh Valley Project is currently installing solar systems and has not hired a monitoring staff person, although data from previously instrumented systems is being gathered on a weekly basis.

D. MEMPHIS-SHELBY COUNTY CONSORTIUM

The South Memphis Development Corporation trains CETA participants in the installation of a silicone fluid, external double loop heat exchange domestic solar hot water system manufactured by Solar Unlimited Incorporated of Huntsville, Alabama. The program uses a training manual which details installation procedures and has recently developed a proposal to establish an energy conservation and solar training center in Memphis. The Memphis Project was designed to train disadvantaged CETA labor in solar installation skills with the hope of placing trainees with the Memphis 1000 Program, the Tennessee Valley Authority's solar hot water installation program in Memphis.

The Memphis Project is currently installing units, having completed 16 installations to date. The project expects to complete 35-40 units by the close of the program.

Monitoring activities are currently underway with the purchasing of instrumentation. The Consortium has also prepared a performance monitoring paper on solar hot water systems.

E. BALANCE OF STATE WISCONSIN

This SUEDE Project, operated by WEST-CAP, a Community Action Agency, is located in West Central, Wisconsin. The project is a rural solarization program based on the conceptual extension of WEST-CAP's successful weatherization program.

During the past year, WEST-CAP has trained CETA participants in solar design and construction skills. The project has installed 21 thermosiphon air panels, 19 solar attached greenhouses, and 21 commercial solar hot water systems on area low-income homes.

The project has been completed, with several participants obtaining solar industry employment in the private sector.

WEST-CAP has been monitoring a solar hot water system during the past year and has ordered and received instrumentation to monitor 5 additional hot water systems. The project is performing low-level monitoring of several solar attached greenhouses following the recommended NCAT procedure.

F. TARRANT COUNTY, TEXAS

This project, because of local employment conditions in the prosperous Fort Worth area, was unable to execute their grant. No NCAT monitoring is planned for this Grantee.

G. KANSAS CITY (MO) CONSORTIUM

The Midland Energy Institute provided training, system design and technical assistance to four local community-based organizations in the Greater Kansas City area. The Economic Opportunity Corporation of Greater St. Joseph, the Missouri Valley Human Resource Development Corporation, the West Central Missouri Rural Development Corporation, and the Kansas City Black Economic Union acted as local program operators. The project involved the hand-building and installation of solar air heating systems on low-income housing.

Project solar systems were built in a workshop environment using locally-available materials. The systems are wood-framed, fiberglass-glazed, back-pass active solar wall panels. Systems vary in size from approximately

50 square feet to 100 square feet. System-to-structure interface is accomplished by ducting air from the panel directly into an adjoining room. The system utilizes squirrel-cage blowers which are thermostatically activated.

The Kansas City Program is ongoing, having installed 120 systems to date. The Midland Energy Institute is acting as the local CSA monitoring grantee and has developed an instrumentation plan which includes fuel bill documentation, installed systems performance instrumentation and a newly-constructed test stand facility. Equipment required for these tasks has been ordered.

H. THE CHIPPEWA-CREE ROCKY BOY RESERVATION

This project, known as the Rocky Boy Project, is actively involved in an effort to increase the self-reliance of the Chippewa-Cree American Indians in Northern Montana. Unemployed tribal youth are being trained in construction and solarization skills through the efforts of this project.

The project approaches solarization in two general areas. One is the construction of a large community greenhouse, which will be used by the tribe to increase vegetable production in this severe climate. The project also retrofitted tribal homes at the Rocky Boy Reservation with site-built solar attached greenhouses and air panel systems, of which 11 units were installed. Additionally, the project constructed a 1000-square foot solar attached greenhouse on their workshop area, which, during last spring, was used to begin plant starts that tribal members then transplanted to backyard gardens as the winter broke in late May.

The Rocky Boy Project currently is organizing a Montana Indian Peoples' Solar Conference, which will be held in late May, 1980 in Havre, Montana at Northern Montana College. This project will begin to transfer solarization skills, developed on the Rocky Boy Reservation through the SUEDE Program, to other Indian people in Montana. The Rocky Boy Project is currently constructing additional solar units and putting the finishing touches on

their community greenhouse.

The American Indian Development Corporation (AIDA) is assisting Rocky Boy in the installation of its solar systems. This organization has developed dataloggers with strip chart recorders and temperature sensors which have been installed in several units at the Rocky Boy Reservation. Data is currently being obtained by use of this equipment.

I. HUMBOLDT COUNTY, CALIFORNIA

This project is located in rural northern California, which has been hard hit by the instability of the redwood logging industry. The Redwood Community Development Council has undertaken this project along with Net Energy, a non-profit community-based solar group, to train 16 CETA participants in solar design and construction skills. The project installed 17 solar units on low-income housing in the Arcata, California region. Construction options included passive air panels, solar hot water systems, sunspaces and greenhouses. These systems were designed by CETA personnel, using solar theory and design skills obtained through the program.

The project has been completed and the monitoring effort is just beginning with the ordering of solar hot water monitoring equipment and the low-technology instrumentation for solar-heated greenhouses.

J. MID-WILLAMETTE VALLEY MANPOWER CONSORTIUM

The Mid-Willamette Valley Program is operated by the Mid-Willamette Community Action Agency which is located in Salem, Oregon. This program employs CETA workers in a solar program designed to teach the construction of hand-built solar devices. Technical assistance to the project was provided by Ecotope, a Washington State based appropriate technology organization.

During the project, participants constructed both solar attached greenhouses and several solar hot water designs. Nine (9) solar hot water systems were constructed which were later removed because of code problems. These

problems related to Oregon codes, the same systems being legal in other states. The Mid-Willamette Program met on numerous occasions with state and local officials to solve this problem and the program was able to develop alternative hot water systems of which twelve (12) were installed. The program also built three (3) solar attached greenhouses. All systems were hand-built, allowing for participants to obtain a wide level of skill development. The program is completed, with ten (10) participants finishing the course, six (6) of whom have obtained solar-related jobs. Two businesses have developed out of the program, one a minority business in California with over a million dollars in business at present.

The Mid-Willamette Project has begun a monitoring effort. The project is ordering solar hot water monitoring equipment which will be installed on various units to obtain performance data.

K. COMMITTEE ON EMPLOYMENT AND TRAINING

This project, operated by the Stamford Committee on Employment and Training in Stamford, Connecticut, is designed to train CETA participants in the installation of Revere Hot Water Systems. Stamford is a bedroom community for New York City and is in general a prosperous area, but with very serious areas of urban poverty. Participants were drawn from the disadvantaged labor pool and given training in basic work habits and skill development, along with solar utilization skills.

The Stamford Project was able to secure, from the City of Stamford, a large rundown warehouse for their program operation and have spent extensive time retrofitting the building for their use. The retrofitting has included replacement of windows, insulation, stud wall construction, installation of an attached solar greenhouse, and retrofitting a former oil furnace to wood fuel.

The project was delayed in getting started, due to local manpower problems. Four (4) Revere systems, in addition to the greenhouse and other

activities, have been installed. The program is on-going.

Monitoring efforts have not begun, as the program operators wish to concentrate on installing solar hot water systems.

L. THE SOLAR PROJECT

The Solar Project is operated by the Community Action Program in Lancaster, Pennsylvania, just a few miles from the Three Mile Island Nuclear Power Station. The project started three years ago, as a CETA Title VI program, which was involved in the retrofitting of local low-income homes with site-built solar systems. The SUEDE Program allowed this project to increase its program activities and impact on the community. CETA participants were involved in the construction of passive and active air wall panels, passive and active solar hot water systems and solar-heated greenhouses and sunspace retrofits. The project has developed a retrofit technique of constructing large solar sunspaces (200 to 400 square feet of glazing), which are designed to impact significantly on the space heating needs of the homes. The project has recently received funding from the City Housing Community Development Program to install solar hot water systems on low-income public housing in the city, and County Housing and Community Development funds to assist a local development corporation in an energy conservation home remodeling program.

The Solar Project participated in Act '79, an appropriate technology fair held on the Mall in Washington, D.C. in May of 1979, by constructing a large solar display emphasizing hand-built solar devices. The group has conducted numerous workshops for community residents on site-built solar options.

M. BERGEN COUNTY COMMUNITY ACTION PROGRAM

The Bergen County SUEDE Program is located in an urban and industrial setting in South Hackensack, New Jersey, just across the river from New York

City. The Bergen County Community Action Program has been retrofitting low-income homes with solar devices for several years. The SUEDE Program funding has allowed the program to increase its scope of activities by offering increased training opportunities to disadvantaged urban youth.

This program has dealt with retrofitting houses in an area which is densely populated. The outcome of this effort has been a decision to develop roof-top active air heating and storage systems which will allow for the utilization of exposed roofing in this densely populated area, and it is hoped that this will significantly impact on the heating needs of Bergen County's low-income population.

The program has employed 25 CETA participants in the installation of five (5) different commercial solar hot water systems. The project installed 25 hot water systems. Additionally, the project provided training to participants in the construction of two active air space heating systems with storage, 24 thermosiphoning air panels and three solar attached greenhouses, for a total of 50 retrofitted low-income homes. The Bergen County Program is completed and the program is working with a local university, the Stevens Institute of Technology, which is installing and evaluating the Bergen County's thermosiphoning air panel in a test cell format. The Bergen County Program is involved in researching solar hot water installation in addition to their air panel work.

N. DEPARTMENT OF ECONOMIC AFFAIRS OF OKLAHOMA

This program is managed by the Little Dixie Community Action Agency in Antlers, Oklahoma. The SUEDE Project is a result of several years of effort designing and installing a Little Dixie-manufactured hot water system. This system involves the construction of hydronic collectors which are interfaced with hand-built external heat exchange coil jacketed hot water tanks. The system was previously installed in Little Dixie-constructed HUD housing and the SUEDE Project has allowed Little Dixie to greatly expand its operation in terms of production and participants' training. The Little

Dixie Program has installed 27 hot water systems to date and the project is on-going.

Monitoring efforts have begun with the assistance of the University of Tulsa Solar Laboratory. Little Dixie has, for some time, been monitoring a solar hot water system, located in their workshop, which operates alongside a standard hot water system. Water is drawn out of both systems on a regular schedule and electricity usage is compared in each system. Little Dixie has sent their hydronic collector to NCAT for testing.

0. INDIAN DEVELOPMENT DISTRICT OF ARIZONA, INC.

The Indian Development District of Arizona, a non-profit group founded and funded by Arizona Indian Tribes, organized a program which trained young Indian people in the installation of an Indian-manufactured solar hot water system. The system, an air-to-water heat exchange solar hot water system, is named the Shandiin Solar System and is manufactured by the Birdsprings Solar Corporation, a Navajo solar enterprise.

Seventeen (17) young Indian people were trained by the project. These participants were drawn from several tribes in Arizona and installed systems on various reservations. The training program involved 12 weeks of orientation to solar and related fields and training in the installation of the Shandiin Solar System. This group was featured in a news report in August of 1979 on the Today Show, which filmed the project using helicopters to transport solar collectors to installation sites in the Grand Canyon.

The Arizona Project has currently been completed, with several systems installed on low-income reservation homes. The CSA monitoring contract is just beginning and no systems have been monitored to date.

IV. NCAT PERFORMANCE MONITORING PLAN

A. SUEDE RETROFIT SYSTEMS

SUEDE Program activities have resulted in the installation of, at least, five (5) basic solar retrofit options (See Appendix 2 for overview):

- * Domestic Solar Hot Water Systems
- * Solar Attached Greenhouses and Sunspaces
- * Passive Air Wall Panels
- * Active Air Wall Panels
- * Additional Direct Gain Glazing

NCAT will provide technical assistance to SUEDE Grantees to instrument and analyze selected types of these systems in as many locations as are economically and programmatically possible.

Domestic Hot Water Systems

The instrumenting of these systems is currently taking place at various SUEDE locations. These systems can be instrumented without the use of datalogging equipment. NCAT is in the process of preparing a technical paper for the Grantees on instrumentation and analysis procedures for obtaining performance monitoring data on the systems. In most cases, Grantees have sufficient funds from their CSA monitoring contracts to instrument these systems, and personnel on site will be able to install the equipment and retrieve the data.

Solar Attached Greenhouses

NCAT initially recommends the use of low-level instrumentation, as outlined in the NCAT Solar Greenhouse Instrumentation Packages which have been distributed to the SUEDE Grantees. This package involves the hand-documentation of daily interior and exterior maximum/minimum temperatures, soil temperature, storage temperature, percent of sunshine and crop production. The package also includes a written

description of each greenhouse. This technique will allow the client and the Grantee to better understand how their greenhouse reacts to the environment and will document the crop production during the spring/summer/fall.

During the fall/winter/spring of 1980-81, NCAT will assist Grantees in a detailed instrumentation of the thermal properties of their greenhouses through the use of NCAT-purchased dataloggers, data processing and analysis. NCAT will supply technical assistance/site visit to each Grantee involved in collecting detailed performance data on installed greenhouses.

Passive Air Wall Panels, Active Air Wall Panels, Additional Direct Gain Glazing

NCAT will assist grantees in instrumenting selected retrofit systems by the use of a datalogger in the fall/winter/spring of 1980-81. A technical assistance site visit will be made to each location to assist in the installation of the equipment.

B. SYSTEM DESCRIPTION AND DATA

NCAT will prepare standardized formats for both the description of the installed solar systems and instrumentation package, and the listing of needed data.

NCAT has established individual Grantee notebooks, which are used to organize Grantee information. All documents forwarded to NCAT will be organized into appropriate Grantee notebooks. Each system monitored will be fully recorded. This will assist NCAT in the analysis of the various systems. The success of this project will be highly dependent on the conscientious completion of the data monitoring formats by the Grantee-funded monitor and the forwarding of the documents to NCAT.

C. DATA PROCESSING AND ANALYSIS

As raw data are received from the field, whether in the form of hand-

documented performance factors or cassette tapes from dataloggers, NCAT will analyze the information.

NCAT will develop computer programs to reduce the data for each type of instrumented system. Inter-systems comparisons will be made. Data received from Grantees will be input into the appropriate program and a printout detailing the system's performance will be produced. These printouts will be placed in the Grantee's NCAT notebook and a copy will be forwarded to the Grantee. Once all data is received and processed, a report outlining the system's performance will be developed. These reports will relate to the cost effectiveness of these retrofit approaches and will discuss pros and cons of the system as well as analyzing any problem areas.

D. GRANTEE MONITORING CONTRACTS

In July of 1979, after the SUEDE monitoring meeting in Butte, but before the awarding of a contract to NCAT by DOE, the CSA SUEDE Project Manager allocated monies to individual grantees for the purpose of performing individual Grantee monitoring activities (see Appendix 3 for CSA Grantee Monitoring Contracts).

The CSA Monitoring Contracts allow each Grantee to hire an instrumentation staff person for one year and purchase equipment and consultant time in order to instrument Grantee-installed systems. Many Grantees have begun work on this phase of the project. Activities range from monitoring fuel bill and consumption data, to developing a client solarization evaluation format, to instrumenting solar hot water systems with temperature, insolation and KWHr meters, to the development of hand-built dataloggers.

Personnel hired for the monitoring positions are primarily former CETA or project staff, or technical assistance providers associated with the SUEDE Program. All CSA monitoring staff have been contacted by NCAT and working relationships exist. It is the intention of NCAT to utilize these CSA-funded monitoring personnel to instrument the various solar systems

and to collect the necessary data. This information will then be sent to NCAT for analysis.

Several of the SUEDE Grantees have arranged individual contracts with local consultant and educational institutions for technical assistance.

E. REFERRAL SERVICES

During the course of the NCAT/SUEDE monitoring grant, NCAT will provide referral services to SUEDE Grantees in order to encourage inter-program resource access and assistance in problem solving. SUEDE Grantees are encouraged to use the SUEDE Project Manager as a referral source to solve problems. Grantees who request assistance will be referred to other SUEDE programs who have been dealing with similar problems and may have technical ideas which the Grantee will be able to use. If problems are original in nature, the Project Manager will attempt to locate other organizations or in-house NCAT staff who may be able to help with solving a given problem. This technique will allow the Project Manager to better understand the range of Grantee problems and, over a period of time, should assist in developing interprogram contact and resource development.

F. PROGRAM DOCUMENTATION

NCAT has established individual Grantee notebooks in which all documents forwarded to NCAT are organized and stored. Additionally, a search of other SUEDE-related documents is in process and information concerning the origin and operation of SUEDE from a Federal and programmatic level is being documented. This documentation will allow NCAT to possess a full range of information on SUEDE Grantees which will assist NCAT as it develops program status reports and the final report. This documentation will serve as a permanent and organized record of the SUEDE Program for future use by Grantees and funding sources. Program descriptions will be compiled by NCAT for informational use by organizations or people who have an interest in the program.

G. INFORMATION DISSEMINATION

Over the past several years of operation, NCAT has established a wide range of technical information, both in the NCAT library and individual research files. The Project Manager will, on an on-going basis, attempt to identify pertinent technical papers and other information and forward these reports to SUEDE Grantees. This information will relate to instrumentation, performance monitoring and solar design research (see Appendix 4 for Instrumentation Resource List).

H. SOLAR HOT WATER COLLECTOR TESTING

As part of NCAT's Solar Program, a hydronic solar panel testing unit has been constructed and is operating at NCAT. Grantees who are interested in performance testing of their water panels should contact the Project Manager. NCAT will run performance tests on these panels. Grantees will be responsible for providing the panel to be tested and for transportation costs.

I. PERFORMANCE MONITORING OF SOLAR HOT WATER SYSTEMS

As a result of the NCAT site visits to SUEDE Grantees who are monitoring solar hot water systems under the CSA monitoring contract, NCAT is preparing a report on the instrumentation and performance analysis of these systems. This report will outline recommendations concerning data collection, instrumentation and formulas for calculating system performance. The report will also include standardized formats for describing systems and recording data (see Appendix 4 for format example).

J. THIRD SUEDE CONFERENCE

The Third SUEDE Conference will be held in mid-May in New York City. NCAT is working with the Energy Task Force, the SUEDE Grantee in New York City, to organize this three-day conference.

Although this activity is in the early planning stages, it is anticipated that the conference would include a day of Grantees reviewing their past work and status, a day of instrumentation workshops and discussion, and the final day to include site visits to Energy Task Force, Stamford, Connecticut and Bergen County, New Jersey solar installations.

APPENDIX 1
SITES SELECTED FOR SOLAR HEAT DEMONSTRATION

<u>PROGRAM</u>	<u>REGION</u>	<u>SITE DESCRIPTION</u>	Proposed Funding TOTAL SPONSOR BUDGETS AS SUBMITTED (1,000's)	
			<u>TOTAL DOL</u>	<u>CSA/DOE</u>
1	1	Southern New Hampshire Services, Epping, N.H., with the cooperation of Massachusetts Balance of State sponsor	396.0	186.1
2	2	City of New York Department of Employment	196.0	253.1
3	3	Lehigh Valley Manpower Program, Allentown, Pa.	207.7	90.0
4	4	Memphis-Shelby County Consortium, Memphis, Tenn.	104.7	142.7
5	5	Wisconsin Balance of State, Madison, Wis.	237.9	166.5
6	6	Tarrant County Employment and Training, Fort Worth, Texas	DID NOT EXECUTE PROGRAM	
7	7	Kansas City Area, Mo., Employment and Training Consortium, with the cooperation of Missouri Balance of State	231.7	320.8
8	8	Chippewa-Cree Tribe, Rocky Boy, Mont.	290.0	167.3
9	9	Humbolt County, Eureka, California	155.7	69.6
10	10	Mid-Willamette Valley Manpower Consortium, Salem, Oregon	117.2	132.7
11	1	Community Training and Employment, Stamford, Conn.	96.8	153.3
12	2	Bergen County Community Action Program, Inc., Hackensack, NJ	184.6	113.3
13	3	Community Action Program of Lancaster, Lancaster, PA	65.4	90.5
14	6	Department of Economic Community Affairs, Oklahoma City, OK	60.9	122.6
15	9	Indian Development District of Arizona	<u>365.8</u>	<u>250.3</u>
TOTALS:			2,764.3	2,310.1

SUEDE GRANTEES	MONITORING CONTRACTS	PRODUCTION STATUS	MONITORING STATUS	SOLAR HOT WATER	SOLAR AIR PANELS	SUN SPACES/ GREENHOUSES	DIREC GAIN
TOTAL ENVIRONMENTAL ACTION FOUNDATION CHURCH HILL HARRISVILLE, NEW HAMPSHIRE 03450	PROG. MGR-BILL FRYE MONITOR-NED NISSON SAME ADDRESS (603) 827-3374	90 UNITS INSTALLED 90% COMPLETE	STARTED DEVELOP- ING CLIENT SURVEY	0	45	23	22
ENERGY TASK FORCE 156 FIFTH AVENUE NEW YORK, NEW YORK 10010	PROG. MGR-STEVE MINDEN MONITOR-MAURICE SELF SAME ADDRESS (212) 675-1920	4 SINGLE FAMILY & 2 MULTI FAMILY DIRECT SOLAR HOT WATER SYSTEMS 24 FAMILIES TOTAL 60% COMPLETE	STARTED INSTALL- ING BTU METERS	6	0	0	0
LEHIGH VALLEY MANPOWER PROGRAM ABE ADMINISTRATION BLDG. ALLEMTOWN, PENNSYLVANIA 18103	PROG. MGR-JOHN PULLI MONITOR-NOT HIRED SAME ADDRESS (215) 867-9711	45 SYSTEMS INSTALL- ED 75% COMPLETE	4 HOT WATER HEAT- ERS INSTRUMENTED DATA IS BEING COLLECTED	45	0	1	0
MEMPHIS/SHELBY COUNTY CONSORTIUM 215 MADISON AVENUE MEMPHIS, TENNESSEE 38103	PROG. MGR-TYRONE MOORE MONITOR-BLAIR POLLOCK SAME ADDRESS (901) 522-9238	16 SYSTEMS INSTALL- ED 40% COMPLETED	MONITORING EQUIP- MENT IS ORDERED	16	0	0	0
WESTCAP, INC. 525 SECOND STREET GLENWOOD CITY, WISCONSIN 54013	PROG. MGR-DAVE HEWITT MONITOR-GARY TITUS SAME ADDRESS (715) 265-4271	61 SYSTEMS INSTALL- ED 100% COMPLETE	MONITORING START- ED 5 SYSTEMS INSTRU- MENTED	21	21 PASSIVE	19	0
MIDLAND ENERGY INSTITUTE 1221 BALTIMORE STREET SUITE 1100 KANSAS CITY, MISSOURI 64105	PROG. MGR-JOHN SLOTE MONITOR-JIRAIR GHARAK- HANIAN SAME ADDRESS (816) 842-2459	120 SYSTEMS IN- STALLED 75% COMPLETE	MONITORING START- ED EQUIPMENT ORDERED	0	120 ACTIVE	0	0
ROCKY BOY RESERVATION LOCAL INDIAN FUEL TECHNOLOGY OFFICE ROCKY BOY ROUTE BOX ELDER, MONTANA 59521 (406) 395-4321	PROG. MGR-DARYL WRIGHT MONITOR-RICHARD HAARD AMERICAN INDIAN DEV. ASSOC. BOX 2793 BELLINGHAM, WA. 98225 (206) 733-1336	13 UNITS CONSTRUC- TED-1 5000 SQ. FT. GREENHOUSE 60% COMPLETE	MONITORING START- ED INSTRUMENTED 3 INSTALLATIONS	0	0	13	0
NET ENERGY, INC. 930 NINTH STREET ARCATA, CALIFORNIA 95521	PROG. MGR-KIT MANN MONITOR-NOT HIRED SAME ADDRESS (707) 822-5926	15 SYSTEMS INSTALL- ED 100% COMPLETE	MONITORING START- ED ORDERED BTU METERS	8	1 PASSIVE	5	0
MID-WILLAMETTE VALLEY C.A.A. 2035 DAVCON STREET SALEM, OREGON 97302	PROG. MGR-PAUL SANSONE MONITOR-PAUL SANSONE STAR ROUTE 38 GALES CREEK, OREGON 97116 (503) 357-5774	15 SYSTEMS INSTALL- ED 100% COMPLETE	MONITORING START- ED EQUIPMENT BEING ORDERED	12	0	3	0
COMMITTEE ON TRAINING & EMPLOYMENT 433 ATLANTIC STREET STAMFORD, CONNECTICUT 06901	PROG. MGR-RON CYR MONITOR-NOT HIRED SAME ADDRESS (203) 357-1733	4 UNITS INSTALLED 50% COMPLETE	MONITORING HAS NOT STARTED	3	0	1	0
THE SOLAR PROJECT LANCASTER C.A.P. 630 ROCKLAND STREET LANCASTER, PENNSYLVANIA 17602	PROG. MGR-STEVE STEIN- BACHER MONITOR-JIM SHEARER SAME ADDRESS (717) 291-1051	26 UNITS INSTALLED 90% COMPLETE	MONITORING START- ED FUEL CONSUMPTION DATA BEING COLL- ECTED	6	5 ACTIVE 4 PASSIVE	11	0
BERGEN COUNTY C.A.P. 8 ROMANELLI AVENUE SOUTH HACKENSACK, NEW JERSEY 07606	PROG. MGR-GEORGE TUCKEL MONITOR-NOT HIRED SAME ADDRESS (201) 487-3400	54 UNITS INSTALLED 100% COMPLETE	MONITORING START- ED ON AIR PANELS	0	2 ACTIVE 24 PASSIVE	3	0
LITTLE DIXIE C.A.A. 207 EAST JACKSON STREET HUGO, OKLAHOMA 74743	PROG. MGR-CLAUDE LAWREN- CE MONITOR-DONNY DAY SAME ADDRESS (405) 298-5507	27 SYSTEMS INSTALL- ED 50% COMPLETE	MONITORING START- ED EQUIPMENT ORDERED PRELIMINARY DATA COLLECTED	27	0	0	0
INDIAN DEVELOPMENT DISTRICT OF ARIZ. SUITE A-108 1777 CAMELBACK PHOENIX, ARIZONA 85015	PROG. MGR-MIKE PETERSON MONITOR-NOT HIRED SAME ADDRESS (602) 448-2881	40 SYSTEMS INSTALL- ED 100% COMPLETE	MONITORING HAS NOT STARTED	40	0	0	0
TOTALS				184	222	79	22

APPENDIX 3.
CSA/SUEDE INDIVIDUAL
GRANTEE MONITORING CONTRACTS

Grantee	Grantee Monitor Salary	Monitoring Equipment	Additional Consulting
1. Lehigh Valley	\$ 10,000	\$ 6,000	--
2. West-Cap	9,000	2,300	\$ 500
3. Arizona Indians	12,000	5,000	2,200
4. Memphis	10,400	3,000	300
5. Kansas City	10,600	2,500	1,450
6. Rocky Boy	10,000	4,000	3,000
7. Net Energy	9,000	4,200	--
8. Energy Task Force	12,500	3,500	--
9. Bergen County CAP	10,000	3,500	3,582
10. Mid-Willamette	--	5,000	11,430 (9 mos)
11. Stamford, Connecticut	12,000	3,000	--
12. Little Dixie	8,320	5,011	2,200
13. Total Environmental Action	8,800	5,000	700
TOTALS	\$122,020	\$52,011	\$25,362

14. Lancaster - Monitoring costs are included in separate funding package. No equipment costs included.
15. Fort Worth - Has dropped out of the SUEDE Program.

INSTRUMENT SOURCE LISTACUREX CORPORATION

485 Clyde Avenue
Mountainview, California 94042
(415) 964-3200
weather instruments

ALNOR INSTRUMENT COMPANY

7301 N. Caldwell Avenue
Niles, Illinois 60648
(312) 647-7806
thermal anemometers

AMERICAN SOLAR HEAT CORPORATION

7 National Place
Danbury, Connecticut 06810
(203) 792-0077
heat flow sensors

ANALOG DEVICES

P.O. Box 280
Norwood, Massachusetts 02062
(617) 329-4700
transistors

ARIZONA SCIENTIFIC RESEARCH

10121 Catalina Highway
Tucson, Arizona 85715
(602) 749-3954
pyroheliometers

BARNES ENGINEERING COMPANY

30 Commerce Road
Stamford, Connecticut 06804
(203) 348-5381
infrared

BELFORT INSTRUMENT COMPANY

1600 S. Clinton Street
Baltimore, Maryland 21223
(301) 342-2626
weather instruments - anemometers

BENCH SCALE EQUIPMENT COMPANY

P.O. Box 1123
Dayton, Ohio 45401
(513) 253-7111
temp. baths

BENDIX ENVIRONMENTAL SCIENCE

1400 Taylor Avenue
Baltimore, Maryland 21204
instruments, measuring equipment

BROOKLYN THERMOMETER COMPANY, INC.

10T Verdi Street
Farmingdale, New York 11735
(516) 694-7610
liq., mech., elect.

THE C-V INSTRUMENT COMPANY

1260-T Old Colony Road
Wallingford, Connecticut 06492
(203) 237-6649
wire, conns.

CALIFORNIA MEASUREMENTS

150 E. Montecito
Sierra Madre, California 91024
(213) 355-3713
weather instruments

CAMPBELL SCIENTIFIC, INC.

P.O. Box 551
Logan, Utah 84321
(801) 753-2342
dataloggers

CGS/THERMODYNAMICS

Thermo Row
Southampton, Pennsylvania 18966
(215) 355-9953
wire, etc.

CHEMALLEY ELECTRONICS CORPORATION

Box 10
Santee, California 92071
(714) 448-5715
spectral sensors

CLAUDE S. GORDON COMPANY

5710 Kenosha Street
Richmond, Illinois 60071
(815) 678-2211
wire, etc.

CLIMATRONICS CORPORATION
1324-T Motor Parkway
Hauppauge, New York 11787
(516) 234-2272
met. supplies

CONKLING LABORATORIES
5432 Merrick Road
Massapequa, New York
(516) 541-1323
weather instruments

CONSERDYNE CORPORATION
4437 San Fernando Road
Glendale, California 91204
(213) 246-8408
BTU meters

W.H. COOKE & COMPANY
P.O. Box 263
Finksburg, Maryland 21048
(301) 833-8200
mech.

DEVICES AND SERVICES COMPANY
3501-A Milton Avenue
Dallas, Texas 75205
(214) 368-5749
heat flow sensors

DODGE PRODUCTS, INC.
Box 19781
Houston, Texas 77024
photoelectric

THE DRAMM COMPANY
Box 528
Manitowoc, Wisconsin 54220
(414) 684-9132
pyranometers

DWYER INSTRUMENTS, INC.
P.O. Box 373
Michigan City, Indiana 46360
(219) 872-9141
manometers, air vel.

EASTERN PROCESS INSTRUMENTS, INC.
600 Summer Street
Lynn, Massachusetts 01905
(617) 599-3030
wire, etc.

EICO ELECTRONIC INSTRUMENT COMPANY
283 Malta Street
Brooklyn, New York 11207
instruments, inverter kits

ELECTROMEDICS, INC.
2000 S. Quebec Street
Denver, Colorado 80231
(303) 750-1753
heat flow sensors

ELMWOOD SENSORS, INC.
1655 Elmwood Avenue
Providence, Rhode Island 02907
(401) 781-6500
heat flow sensors

ENTROPY, LTD.
5735 Arapahoe Avenue
Boulder, Colorado 80303
(303) 443-5103
weather instruments

EPIC INSTRUMENTS
150 Nassau Street
New York, New York 10038

THE EPPLEY LABORATORY, INC.
12 Sheffield Avenue
Newport, Rhode Island 02840
(401) 847-1020
thermal

ERNST GAGE COMPANY
250 S. Livingston Avenue
Livingston, New Jersey 07039
(201) 992-1400
liq. rate

FLO-TECH, INC.
403 S. Washington Blvd.
Cleveland, Ohio 44102
(216) 281-1100
turbine

FLOSCAN INSTRUMENT CO., INC.
3016 N.E. Blakely Street
Seattle, Washington 98105
(206) 524-6625
turbine

FOXBORO CONTROLS

38 Neponset Avenue
Foxboro, Massachusetts 02035
(617) 543-8750

H-B INSTRUMENT COMPANY

4303 N. American Street
Philadelphia, Pennsylvania 19140
(315) 329-9125
liq., mech.

LARRY HALL

Box 771
Morgan, Vermont 84050
(801) 829-3232
low-cost, hand-held wind meter

HELIOTROPE GENERAL

3733 Kenova Drive
Spring Valley, California 92077
(714) 460-3930
spectral sensors

HOLLIS OBSERVATORY

One Pine Street
Nashua, New Hampshire 03060
(603) 882-5017
photoelectric

HY-CAL ENGINEERING

12105-T Los Nientos Road
Santa Fe Springs, California 90670
(213) 698-7785
heat flux plates, etc.

IMC INSTRUMENTS

6659 N. Sidney Place
Milwaukee, Wisconsin 53209
(414) 352-3810
heat flow sensors

INDEPENDENT ENERGY

42 Ladd Street
E. Greenwich, Rhode Island 03818
(401) 884-6990
spectral sensors

INDUSTRONICS, INC.

491 Sullivan Avenue
South Windsor, Connecticut 06074
(203) 289-1558
wire, etc.

KAHL SCIENTIFIC INSTRUMENT CORP.

733 W. Main St.
El Cajon, California 92022
(714) 444-2158
liq., mech., elect.

KENT METER SALES, INC.

7 East Silver Springs Blvd.
Ocala, Florida 32670
(904) 732-4670
liq.

KIPP & ZONEN

390 Central Avenue
Bohemia, New York 11716
(516) 589-2885
net radiometers

KURZ INSTRUMENTS, INC.

P.O. Box 849
Carmel Valley, California 93924
(408) 659-3421
thermal anemometers

LAND INSTRUMENTS, INC.

P.O. Box 1623
Tullytown, Pennsylvania 19007
(215) 943-7882
infrared

LEEDS & NORTHRUP

North Wales, Pennsylvania 19454
(215) 643-2000
Quiktips

LEUPOLD & STEVENS, INC.

Box 688
Beaverton, Oregon 97005
(503) 646-9171
weather instruments

LI-COR, INC.

P.O. Box 4425
Lincoln, Nebraska 68504
(402) 467-3576
photoelectric

MARLIN MANUFACTURING CORP.

12411 Triskett Road
Cleveland, Ohio 44111
(216) 941-6200
wire, etc.

MARSHALLTOWN MFG. CO.
710 South 12th Avenue
Marshalltown, Iowa 50158
(515) 752-4251
liq., mech.

MATRIX, INC.
537 S. 31st St.
Mesa, Arizona 85204
(602) 832-1380
net radiometers, pyranometers

MAXIMUM, INC.
Suite 34, 42 South Avenue
Natick, Massachusetts 01760
(617) 785-0113
met. supplies

MERIAM INSTRUMENTS
10920 Madison Avenue
Cleveland, Ohio 44102
(216) 281-1100
oriface, pitot

METER EQUIPMENT MANUFACTURING
8603 Chardon Road
Kirkland, Ohio 44094
liquid flow meters

METEOROLOGY RESEARCH, INC.
464 W. Woodbury
Altadena, California 91001
(213) 791-1901
anemometers, weather instruments

MIDWEST COMPONENTS, INC.
Box 787
Muskegon, Michigan 49443
(616) 777-2602
sensors, etc.

MIKRON INSTRUMENT CO., INC.
P.O. Box 211-T
Ridgewood, New Jersey 07451
(201) 891-7330
infrared surface

MOLECTRON CORPORATION
177 N. Wolfe Road
Sunnyvale, California 94086
(408) 738-2661
net radiometers

MONITOR LABS
4202 Sorrento Valley Blvd.
San Diego, California 92121
(714) 453-6260
weather instruments

NATURAL POWER, INC.
Francestown Turnpike
New Boston, New Hampshire 03070
(603) 487-5512
wind meas., towers

OHIO SEMITRONICS, INC.
1205 Chesapeake Avenue
Columbus, Ohio 43212
(614) 486-9561
watt transducers

OMEGA ENGINEERING, INC.
P.O. Box 4047
Stamford, Connecticut 06907
(203) 359-1660
wire, etc.

PACIFIC TRANSDUCER CORPORATION
Federal & Tennessee Avenue
Los Angeles, California 90064
(213) 478-1134
mech.

PALMER INSTRUMENTS, INC.
3131 Wasson Road
Cincinnati, Ohio 45209
(513) 871-7800
liq., mech.

PYROMETER INSTRUMENT COMPANY
234 Industrial Parkway
Northvale, New Jersey 07647
(201) 768-2000
optical pyrometers

RAYTEC, INC.
1277-A Terra Bella Avenue
Mountainview, California 94040
(415) 961-1650
infrared

RDF CORPORATION
23 Elm Avenue
Hudson, New Hampshire 03103
(603) 882-5195
heat flow sensors

RFL INDUSTRIES, INC.

6 Powerville Road
Boonton, New Jersey 07005
(201) 334-3100
elect.

RHO SIGMA

11922 Valerio Street
North Hollywood, California 91605
(213) 982-6800
BTU meters

SAINT PAUL SCIENTIFIC

2024 Blairmore Road
Lexington, Kentucky 40502
silicon cell light meters

SCIENCE ASSOCIATES, INC.

203 E. Nassau Street
Princeton, New Jersey 08540
(609) 924-4470
met supplies

SEA DATA CORPORATION

153 California Street
Newton, Massachusetts 02158
(617) 244-3216
weather instruments

SENCENBAUGH WIND ELECTRIC

2235 Old Middlefield Way
Mountain View, California 94040
(415) 954-1593
weather instruments

SIGN X LABORATORIES

Easex, Connecticut 06426
(203) 767-1700
recording wind speed instruments

R.A. SIMERL INSTRUMENT DIVISION

238 West Street
Annapolis, Maryland 21401
(301) 849-8667
anemometers

SIMPSON INSTRUMENTS

853 Dundee Avenue
Elgin, Illinois 60120
electrical flow measuring instruments

SOLAR CONTROL CORPORATION

5721 Arapahoe Road
Boulder, Colorado 80301
(303) 449-9180
thermal sensors

SOLAR KING INTERNATIONAL

8577 Canoga Park
Canoga Park, California 91304
(213) 998-6400
heat flow sensors

SOLAR WORLD INC.

4449 N. 12th Street, Suite 7
Phoenix, Arizona 85014
(602) 266-5686
heat flow sensors

SOLARMETRICS

28 Bridge Street
Manchester, New Hampshire 03101
(603) 668-3216
spectral sensors

SOLARWARE

No. 1 Solar Park
Pawlet, Vermont 05761
(802) 325-3035
globe

SOLID STATE SOLAR CONTROLS

123 Independence Drive
Menlo Park, California 94025
(415) 324-1980
pyranometers

SPECTRAN INSTRUMENTS

Box 891
La Habra, California 90631
(213) 694-3995

SPECTROLAB

12484 Gladstone Avenue
Sylmar, California 91342
(213) 365-4611
pyranometers

M.C. STEWART COMPANY

Ashburnhane, Maine 01430
anemometers

SUN SYSTEMS

Box 155
Eureka, Illinois 61530
(309) 467-3632
BTU meters

SUNBURST SOLAR ENERGY

Box 2799
Menlo Park, California 94025
(415) 327-8022
weather instruments

SUNRISE ENERGY PRODUCTS

996 Makinaw Highway
Pellston, Michigan 49769
(616) 347-7220
pyranometers

TAYLOR INSTRUMENTS

Consumer Products Division
Sybron Corporation
Arden, North Carolina 28704
(704) 684-8111
all

TECNICO ELECTRONICS

53 Carrington Road
Marrickville, New South Wales 2204
Australia
recorder/integrator for measuring solar

TEXAS ELECTRONICS, INC.

P.O. Box 7225
Dallas, Texas 75209
(214) 631-2490
met. supplies

TEXAS INSTRUMENTS

Control Products Division
Box 5012
Dallas, Texas 75222
(214) 238-2992
bi-metal thermostats

THERMO ELECTRIC

Saddle Brook, New Jersey 07662
(201) 843-5800
sensors, etc.

THERMONETICS CORPORATION

Box 9112
San Diego, California 92109
(714) 488-3077
heat flow, anemometers

TSI

Box 43394
St. Paul, Minnesota 55164
(612) 483-0900
anemometers

VWR SCIENTIFIC, INC.

P.O. Box 3200
San Francisco, California 94119
(415) 469-0100
scientific supplies

WEATHER MEASURE CORPORATION

P.O. Box 41257
Sacramento, California 95841
(916) 481-7565
thermocouples, atmospheric meas.

WEATHERTRONICS

P.O. Box 1286
West Sacramento, California 95691
(916) 371-2660
met supplies

WEKSLER INSTRUMENTS

80T Mill Road
Freeport, New York 11520
(516) 623-0100
liq., mech.

WEST INSTRUMENTS, MCS DIVISION

East Greenwich, Rhode Island 02818
(401) 884-6800
weather instruments

WILLIAM WAHL CORPORATION

12908 Panama Street
Los Angeles, California 90066
(213) 822-614?
elect., infrared

WINDWATCH

104 Heimann
San Antonio, Texas 78205
wind speed and direction indicators

R. M. YOUNG COMPANY

2801 Aero-Park Drive
Traverse City, Michigan 49684
(616) 946-3980
wind meas.

Pre-Monitoring Data: A Domestic Solar Hot Water System Description Format:

CLIENT

Name _____	Grantee _____
Address _____	
Phone No. ( ) _____	

SYSTEM OVERVIEW

Solar Hot Water System Manufacturer _____ (Name & Address) _____	
Model No. (Please describe, if necessary) _____	
Please Check if Hand-Built:	☐

NOTE: Please include both a black and white negative and a color slide of the house/collector array and the storage area. The black and white photos will be included in the final report and the slides will be assembled into a slide show which will be made available to SUEDE Grantees and funding sources.

SYSTEM COSTS

<u>Packaged System</u>	
<u>Material Costs</u>	
Packaged System Cost	
Extras for Installation (piping, insulation, etc.)	
Total System Materials Cost	

<u>Labor Man Hours</u>	
Purchasing	
Installation	
Trouble Shooting	
Total Man Hours	

<u>Hand Built</u>	
<u>Material Cost</u>	
Collectors	
Storage	
Pump	
Piping	
Controller	
Extras	
Total Materials Cost	

<u>Labor Man Hours</u>	
Component Ordering	
Assembly	
Installation	
Trouble Shooting	
Extras	
Total Man Hours	

SYSTEM DESCRIPTION:**Collector**

Number of collectors _____

Absorber size per collector _____

Total square feet of collector
(No. of collectors x absorber sq. ft.) _____

Number of glazings _____

Glazing material _____

Inches of insulation in collector housing _____

Insulation material in collector housing _____

Collector housing material _____

Type of absorber (Please describe) _____

_____
_____
_____
_____

Cross section drawing:

Array

Collector array building material _____

Drawing of collector array (or photo):

Collector Piping:

Piping material _____

Piping insulation material _____

Piping insulation thickness _____

(from pipe surface to outside of insulation)

Total length of collector loop piping (supply and return) _____ ft.

interior (inside building)

insulated length _____ ft.

uninsulated length _____ ft.

exterior (outside building)

insulated length _____ ft.

uninsulated length _____ ft.

Pipe size collector loop:

_____ in. (actual outside diameter) or

_____ in. "pipe size" designation

Thermister Locations*Please describe through drawings:*

Collector thermister

Storage tank thermister

High limit thermister

Drawing:

Controller settings

High _____

Low _____

High limit shut off _____

Pump or Blower (Collector loop)

Make and model _____

Firm's Address _____

Pump Size _____

Flow rate _____ 6 p.m.

Highest temperature observed on return loop _____

Transfer fluid (medium) _____

2nd Pump (Some installed systems have a second pump from storage to an external heat exchanger)

Make and Model _____

Firm's Address _____

Pump size _____

Flow rate _____ 6 p.m.

Highest temperature observed on return loop _____

Transfer fluid _____

Pipe size in second loop _____

_____ in. (Actual outside diameter) or

_____ in. "Pipe size" designation

PLEASE DESCRIBE EXTERNAL OR INTERNAL HEAT EXCHANGER IN A LABELED DRAWING.

Solar Storage Tank

Tank make and model _____

Tank size _____ gal.

Tank insulation thickness _____ inches (Existing tank insulation)

Material (F.G. foam, etc.) _____

Additional tank insulation thickness _____ inches

Material (F.G. foam, etc.) _____

Back-up Tank

Tank make and model _____

Address of firm: _____

Tank size _____ gal.

Electric ☐Gas ☐Oil ☐

Heat exchange in boiler (Please describe) _____

_____
_____Potable Water Piping

Pipe size — actual or nominal _____

Material and Thickness _____

Total length of hot water pipe from tank to all outlets _____ ft.

Number of feet:

Insulated _____

Uninsulated _____

Describe Insulation: _____

_____
_____

Gallons/day hot water used: _____

Estimated _____

Measured _____

ADDITIONAL INFORMATION: _____

_____
_____
_____
_____
_____
_____