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## United States Department of Energy

# Announcement of Scientific and Technical Information ( STI )

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## Part I: STI PRODUCT DESCRIPTION

### STI PRODUCT IDENTIFIERS *(Separate multiples with ; space)*

**\*Report/Product Number(s)** : DOE/GO/14281-F

**\*DOE Award/Contract Number(s)** : DE - FG36-04GO14281 (XXXX-XXXXXXXXXX)

**Other Identifying Number(s)** :

### **\*RECIPIENT/CONTRACTOR (ORGANIZATION)** :

Solar Rating and Certification Corp.

### **\*STI PRODUCT TITLE** :

Development & Maintenance of Testing Standards for Solar Energy Systems - Final Report

### **\*AUTHOR(S)** : *(Separate multiples with ; space)*

Jim Huggins; Les Nelson; Stephen Still

### **Authors E-Mail Addresses** : *(Separate multiples with ; space)*

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**\*STI PRODUCT TYPE** : Technical Report

Technical Report Type:  Final  Other (specify):

**\*PUBLICATION/ISSUE DATE** : 09/09/2009 (MM/DD/YYYY)

**STI PRODUCT OR TECHNICAL REPORTING PERIOD** : *(mm/dd/yyyy)*: 06/01/2004 thru 05/31/2009

### **SPONSORING DOE PROGRAM OFFICE**

[Select Primary First]

USDOE Office of Solar Thermal, Biomass Power, and Hydrogen Technologies (EE-13)

### **SUBJECT CATEGORIES** :

[Select Primary First]

14 SOLAR ENERGY

### **Keywords**:

solar; certification; water heating; solar collector

### **DESCRIPTION/ABSTRACT**:

This is the final report covering a June 2004 through May 2009 grant to support the certification of solar thermal collectors and systems. The Solar Rating and Certification Corporation (SRCC) has developed and maintained minimum standards and performance tests for solar water heating components and

## Part II: STI PRODUCT MEDIA / FORMAT AND TRANSMISSION

Ensure the STI product/final technical report does not contain protected Personally Identifiable Information (PII) before you upload the document. See Media/Format Information instructions for definition.

### MEDIA / FORMAT INFORMATION

\*Medium of this STI product is:

Size of STI Product:

### \*TRANSMISSION INFORMATION (required for Electronic Document only)

\*STI Product is Being Transmitted Electronically Via E-Link:

Full-Text File Upload:

Specify File Format of Electronic Document:  Searchable PDF

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### LOCATION

Digital Object Identifier (DOI) Number: ( **10.NNNNN** /XXXXXXXXXXXXXXXXXXXX)



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Last Updated: 09/08/2009

## **Final Report**

**Project Title:** Development & Maintenance of Testing Standards for Solar Energy Systems

**Covering Period:** June 1, 2004 to May 31, 2009

**Date of Report:** September 4, 2009

**Recipient:** Solar Rating and Certification Corp.

**Award Number:** DE-FG36-04GO14281

**Contact:** Jim Huggins  
Phone: 321-638-1503  
Fax: 321-638-1010  
Email: [jhuggins@solar-rating.org](mailto:jhuggins@solar-rating.org)

**DOE Project Team:** DOE Field Contracting Officer - Beth Dwyer / D. Denise Riggi  
DOE Field Project Officer - Glenn Doyle / Rob Martinez  
Project Engineer - Pat Saito

**Project Objective:** The objective of this project was to continue the SRCC certification program and implement enhancements to the standards and test methods used to determine product durability and calculate performance ratings. This objective was met by supporting the operation of the certification programs (Task 1) and by performing five additional technical tasks that addressed specific areas that were identified for enhancement.

**Background:** The Solar Rating and Certification Corporation (SRCC) has developed and maintained minimum standards and performance tests for solar water heating components and systems since 1980. SRCC certification is used by a wide variety of organizations as criteria for the installation of, or payment of incentives for, solar water heating systems. The existing guidelines must be maintained and new ones developed. The certification program based on these guidelines must be operated nationwide. Technical issues must be addressed as they arise.

Operation of the certification programs was addressed as Task 1. Five additional technical tasks that addressed specific areas were identified for enhancement:

2. Examination of installed solar water heating systems to determine whether they are being installed properly and whether the components and materials are performing as expected.
3. Work with utilities, state and federal agencies, building code jurisdictions, and trade organizations to provide education and training in the capabilities and advantages of solar water heating.
4. Monitor the progress of new and international standards and test methods that deal with solar water heating components and systems. As new materials and components are introduced, the test methods used by SRCC must adapt to

- ensure that all of the necessary information is collected to properly evaluate the performance (both durability and thermal output) of solar collectors and systems. Changes to existing SRCC standards and test methods will be made as needed.
5. System certification is currently limited to residential size systems. There has been a growing desire on the part of organizations offering incentives to be able to require SRCC certification of larger commercial sized systems. Expansion of the OG-300 certification to larger systems will be studied to determine how to certify and rate commercial systems.
  6. Adoption of SRCC certification by code bodies has been hampered by lack of accreditation of SRCC standards. While achieving accreditation is beyond the funding available to this project, SRCC will continue working to bring its programs in compliance with accreditation requirements.

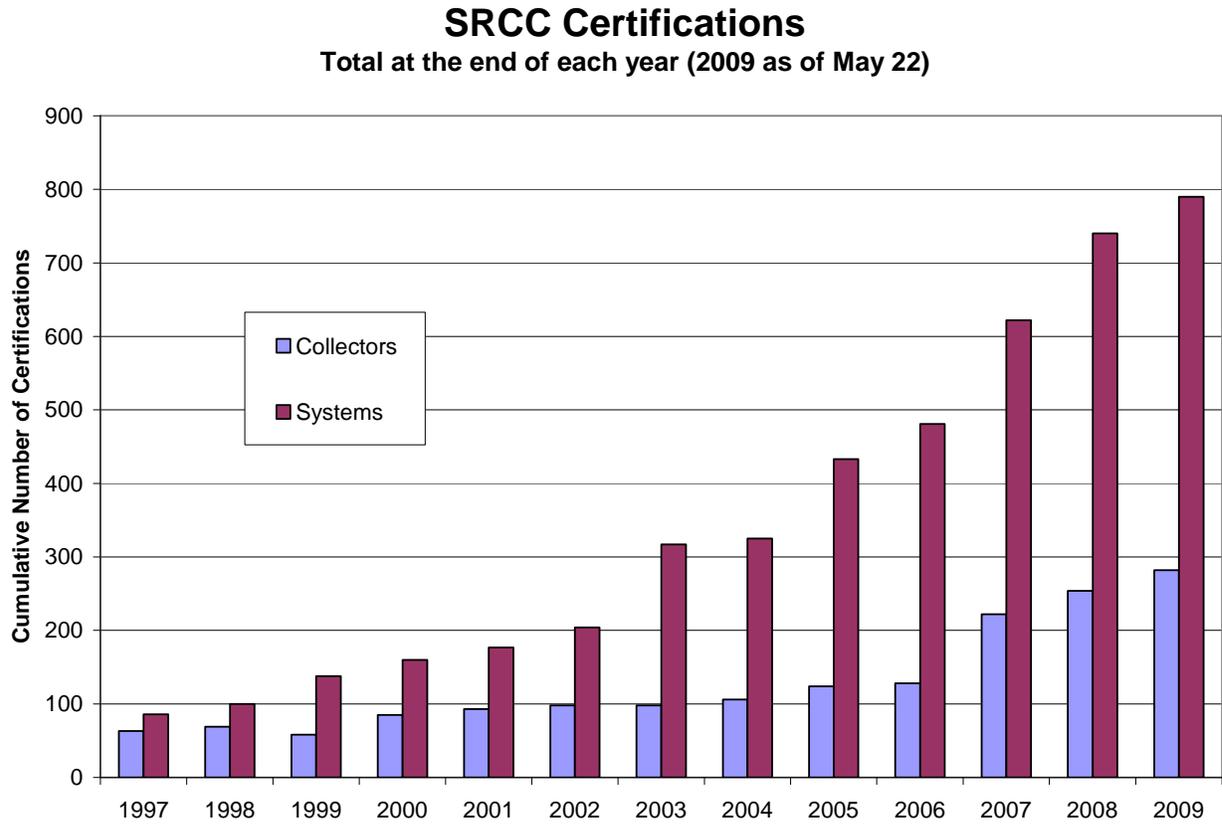
**Results:**

Task 1: Certification Program Maintenance (ongoing)

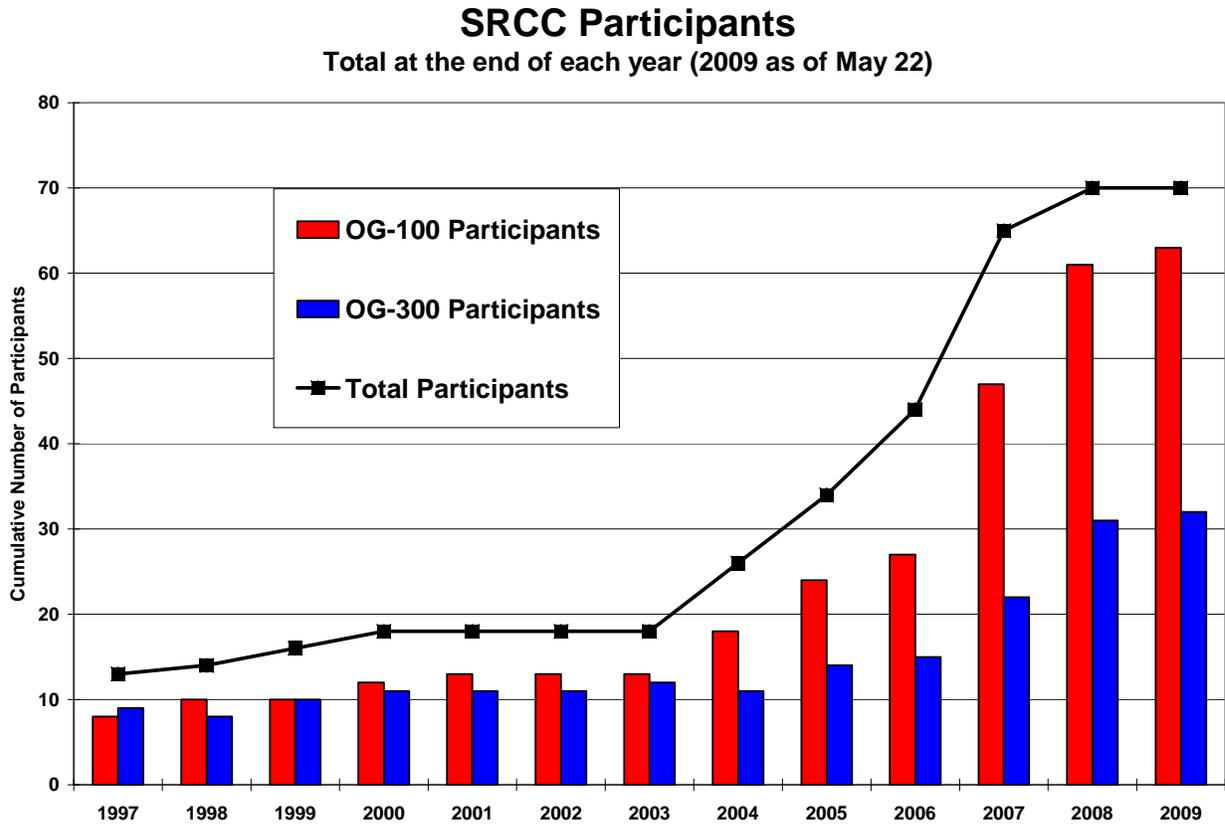
Activities in this task included:

- Certification Application Processing: During the 5-year period the following applications were approved:
  - o 184 OG-100 collector certifications
  - o 473 OG-300 system certifications

The following chart shows the number of certifications issued by SRCC.



The following chart shows the number of companies holding SRCC certification.



- Certification Data Base Maintenance:

A database was used to organize all information for the rating directories. Directory pages, labels, licenses, and certificates were prepared for each collector and system when it was certified. These new certifications were added to the Directories, Summary, and annual performance documents that were made available through the web site. During the last year of this project, work was begun to transfer the database from Access to Oracle.

- Directory Updates

The collector and system directories, the summary document and the annual booklets documents were updated and placed on the web site (PDF) as needed when new collectors or systems were certified.

- Document Revisions and Maintenance

All of SRCC's documents were reviewed and many were changed during the project. The latest version was always available on the web site. These documents include:

- o OG-100, "Operating Guidelines for Certifying Solar Collectors"
- o Standard 100, "Test Methods and Minimum Standards for Certifying Solar Collectors"
- o RM-1, "Methodology for Determining the Thermal Performance Rating for Solar Collectors"
- o OG-300, "Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems"
- o TM-1, "Solar Domestic Hot Water System and Component Test Protocols"
- o CS-1, "Operating Guidelines Governing Component Substitution in the SRCC Solar Collector and Solar Water Heating System Certification and Rating Program "

One new document was developed. Standard 150, "Test Methods and Minimum Standards for Certifying Innovative Solar Collectors" defines the requirements for certifying a solar collector based on tests conducted by the manufacturer rather than by a laboratory with an SRCC accredited testing program.

In addition, work was begun on these new documents:

- o OG-500, "Operating Guidelines and Minimum Standards for Certifying Solar Combi Systems"
- o OG-600, "Operating Guidelines for Certifying Concentrating Solar Collectors"
- o Standard 600, "Standard for Certifying Solar Concentrating Collectors"

- Renewal Notices and Maintenance Fee Invoices

All certification agreements are renewed annually. Renewal dates fall in every month of the year, based on when a company was first awarded certification. Maintenance fee invoices are issued four times a year, in January, April, July, and October.

- Compliance Enforcement

Compliance with SRCC standards was enforced through review of applications submitted for certification.

- Board of Directors Support

This primarily included scheduling, preparing documents, conducting meetings, and transcribing minutes for the Board of Directors meetings. These meetings were held monthly via conference call and one annual in-person meeting.

- Contract Administration

These activities included preparing quarterly reports, submitting deliverables, and processing ASAP submittals.

- General Administrative Overhead Functions

This included: liaison with other organizations, groups, and agencies; overseeing the corporation's financial affairs (tax returns, reimbursements, invoice payments, and maintenance of bank accounts); responding to individual inquiries from Suppliers, users, and the public; maintaining an office infrastructure in Cocoa, FL (business licenses, articles of incorporation, logo registration, office supplies, and regular updating of the corporation's mailing data base, documents, and files); and maintaining the web site ([www.solar-rating.org](http://www.solar-rating.org)). The web site was expanded as issues arose that SRCC needed to communicate to its constituents. The webmaster is at FSEC so changes were made as needed.

- Committee Support

Support was provided to SRCC's standing committees: Standards, Lab Accreditation, Technical Compliance, Combi-systems, Concentrating Collector certification, Finance, and Nominating. This support included making meeting arrangements, preparing minutes, mailings, staff recommendations, assisting the Chair in conducting meetings, researching issues, preparing reports, etc.

#### Task 2: Installed Systems Analysis (completed in 2005)

NREL provided 8,000 records of repairs that had been conducted on solar water heating systems in California. SRCC entered information from these records into a database for analysis. Approximately 1500 of the records were reviewed and cleaned to the point where an analysis could be done. Since a better set of records became available from Hawaii, the decision was made to suspend activity on this task. A final report was prepared on the records that were analyzed.

#### Task 3: Outreach, Education, and Marketing (ongoing)

This task involved contact with a number of organizations. The annual performance booklets were used as the basis of several incentive programs. Discussions were held with participants of USH<sub>2</sub>O, and NABCEP. SRCC participated in reviewing the solar thermal task analysis prepared by NABCEP. We worked extensively with the California Center for Sustainable Energy and their solar water heating incentive program. Also, information was provided to DOE to assist in its development of Energy Star criteria for residential water heaters.

Several workshops were conducted to provide information on the proper way to install a solar water heating system certified in accordance with OG-300.

Finally, contributions were made to the development of a new task on solar thermal standards being proposed to the International Energy Agency.

#### Task 4: Standards and Technical Compliance Committee Support (ongoing)

The Standards Committee met monthly via conference call. The major topics of discussion were:

- maintenance fees
- time limit on test data that will be accepted for certification
- acceptance of test data on tanks and heat exchangers
- conversion from ASHRAE to ISO standards for collector testing
- revision of the component substitution document
- revision of the product inspection document
- inclusion of additional water heating loads in the OG-300 savings estimates
- polymer collector and system test requirements
- simplified ratings
- interim certification
- certification of commercial size solar water heating systems
- draw profile for estimating annual savings
- calculating ratings for similar collectors sized differently from the tested one
- rating conditions for unglazed collectors
- acceptance of SRCC certification by IAPMO
- waivers for various test procedures
- pipe insulation requirements in OG-300
- reliability of solar water heating systems
- field monitoring to validate ratings
- system freezing and overheating
- test flow rate for air-heating collectors
- testing unglazed air-heating collectors
- heat transfer fluids
- intercomparison of test data from various laboratories
- alternate methods for conduction random selection
- use of PEX piping in the collector loop
- harmonization with certification programs world wide
- need for more laboratories with SRCC accredited testing programs
- precision of published ratings

- federal income tax credit
- use of combustible materials inside a collector
- indoor vs outdoor collector testing
- addition of a parts list to OG-300 manuals
- climate appropriateness of systems
- OG-300 installation guidelines
- rating label content and posting location
- testing and certification of innovative equipment
- posting collector measurements on the web site
- quality of the air coming from air-heating collectors
- test procedures for separable thermosiphon systems

The Technical Compliance Committee met as needed to address petitions regarding certification. They addressed the following topics:

- test process for a specific collector under Standard 150
- use of old test data while the collector is being retested
- absorber plate construction

The following topics are still under consideration:

- absorber plate construction
- absorber coating interchangeability
- solar loop piping

The Standards Committee also established a number of subcommittees. Some were ad-hoc and met only briefly. Some were created to address specific, and often complex, tasks. Each subcommittee met (and, as indicated below, continues to meet) approximately monthly. The major subcommittees of the Standards Committee were:

- Concentrating Collector Subcommittee – develop a new certification program for concentrating solar collectors. Draft documents OG-600 and Standard 600 were developed. The subcommittee continues to work.
- Waiver Subcommittee – address requests for waiving selected qualification tests on specific collectors. Subcommittee decided that no waivers should be allowed on any collectors.
- Combi Systems Subcommittee – develop a new certification program for combination space and water heating solar systems. The subcommittee began work, but faltered due to lack of participation. It is currently being restructured to try to restart work.

- TRNSYS Deck Release Subcommittee – develop policy for releasing TRNSYS computer models. The subcommittee developed a draft plan and is currently conducting a trial release.
- San Diego Pilot Program Subcommittee – provide technical assistance to the San Diego Pilot Program. The subcommittee provided assistance until the pilot program became a state-wide program. It was then reconstituted as the Code Integration Subcommittee.
- Code Integration Subcommittee – provide technical assistance to municipal and code organizations nationwide, but primarily and initially in California. The subcommittee continues to work.
- Commercial System Certification Subcommittee – develop a certification program for commercial size systems. The Subcommittee investigated numerous approaches for a new certification program, but finally decided there is too much variation in commercial systems to be covered by a standardized certification. Instead of a certification program, the subcommittee acquired permission to post an out-of-print ASHRAE document on commercial system design on the SRCC web site. This provides guidelines rather than certification.
- Interim Collector Certification Subcommittee – develop a new certification program to award temporary collector certification faster than the full certification. Full certification was delayed because of backlogs at the testing laboratories. The interim certification will be awarded after qualification tests (relatively quick to complete) are complete, but before the efficiency test (slow to complete) is conducted. The collector will still be required to obtain full certification eventually. The subcommittee developed draft documents and interim certification is expected to be implemented by July 2009.

#### Task 5: Commercial System Certification (completed in 2007)

The Commercial System Certification Subcommittee recommended that the ASHRAE design guide be made available on the SRCC web site. Since commercial systems are all different and there is no current requirement for certification of these systems, it was decided not to pursue a formal certification program at this time. This issue can be reopened in the future if need for large system certification arises. Problems to be considered are the diversity of designs used in large systems, extent of the certification (collectors, schematic, component sizes, etc.), publication of certification, liability, etc.

#### Task 6: Accreditation Coordination (ongoing)

ANSI accreditation of SRCC was discussed extensively in the Board of Director's meetings. In general, the Board feels that ANSI accreditation is important and should be pursued. Most program participants feel that this certification will not help them very much so it should not be pursued unless it can be done at no to very low cost. SRCC took the first step toward applying for accreditation by submitting a letter of interest. However, no further

action was taken because of the difference of opinion and the lack of staff time to pursue accreditation. The SRCC Board is still interested in ANSI accreditation and may pursue it further when funding for staff time becomes available.

**Publications / Presentations / Travel:**

Web Site: The results of SRCC certification are listed on the web site at [www.solar-rating.org](http://www.solar-rating.org). The web site also includes general information on SRCC certification, all of the standards for certification, a list of companies with certified products, general educational materials, application forms, and a list of laboratories with SRCC accredited testing programs.

**Presentations:**

- SRCC presented a workshop on installing solar water heating systems at every ASES conference, at most of the Solar Electric Power Association / Solar Power International conferences, and to several selected small groups. This 4-hour workshop stressed the details of properly installing solar water heating systems to meet the requirements of OG-300.
- SRCC had an exhibit booth at every ASES conference and at most of the Solar Electric Power Association / Solar Power International conferences
- The SRCC Executive Director made numerous presentations on SRCC's certification programs

Travel: Most of the SRCC Board and Committee meetings are held monthly via conference call. The Board did meet in person once a year. Travel expenses were limited to two staff members and the few Board members who did not have support from their company to attend.

### PATENT CERTIFICATION

Solar Rating and Certification Corp. \_\_\_\_\_

Interim Certification

Contractor

x Final Certification

DE-FG36-04GO14281 \_\_\_\_\_

DOE Prime and/or Subcontract Nos.

Contractor hereby certifies that:

1. All procedures for identifying and disclosing subject inventions as required by the patent clause of the contract have been followed throughout the reporting period.
2. There were no subcontracts or purchase orders involving research, development, and demonstration except as follows: [State none when applicable.]
3. No inventions or discoveries were made or conceived in the course of or under this contract other than the following  
(Certification includes  , does not include  all subordinates):  
[State none when applicable.]

<u>TITLE</u>	<u>INVENTOR</u>	<u>DATE REPORTED</u>	<u>DOE "S" NO.*</u>
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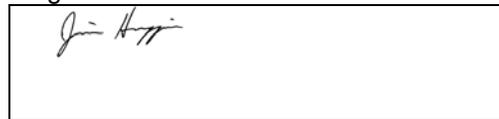
4. The completion date of this contract is as follows: May 31, 2009

5. The following period is covered by this certification:

<u>June</u>	<u>1</u>	<u>2004</u>	to	<u>May</u>	<u>31</u>	<u>2009</u>
Month	Day	Year		Month	Day	Year

Contractor  
Solar Rating and Certification Corp.

Signature



Address  
1679 Clearlake Road  
Cocoa, FL 32922

Date of Certification August 31, 2009

\* Also include Subcontract No. If available

FINANCIAL STATUS REPORT

(Long Form)

(Follow instructions on the back)

1. Federal Agency and Organizational Element to Which Report is Submitted Dept. of Energy Golden Field Office		2. Federal Grant or Other Identifying Number Assigned By Federal Agency DE-FG36-04GO14281		OMB Approval No. 0348-0039	Page 1 of 1 pages
3. Recipient Organization (Name and complete address, including ZIP code) Solar Rating and Certification Corp C/o FSEC 1679 Clearlake Road, Cocoa, FL 32922					
4. Employer Identification Number 59-1220979		5. Recipient Account Number or Identifying Number 20128089		6. Final Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
7. Basis <input type="checkbox"/> Cash <input checked="" type="checkbox"/> Accrual					
8. Funding/Grant Period (See instructions) From: (Month, Day, Year) 06/01/2004		To: (Month, Day, Year) 5/31/2009		9. Period Covered by this Report From: (Month, Day, Year) 06/01/2004	
To: (Month, Day, Year) 05/31/2009					
10. Transactions:			I Previously Reported	II This Period	III Cumulative
a. Total outlays					2,182,555.60
b. Refunds, rebates, etc.					
c. Program income used in accordance with the deduction alternative					
d. Net outlays (Line a, less the sum of lines b and c)					2,182,555.60
Recipient's share of net outlays, consisting of:					
e. Third party (in-kind) contributions					
f. Other Federal awards authorized to be used to match this award					
g. Program income used in accordance with the matching or cost sharing alternative					
h. All other recipient outlays not shown on lines e, f or g					492,555.60
i. Total recipient share of net outlays (Sum of lines e, f, g and h)					492,555.60
j. Federal share of net outlays (line d less line i)					1,690,000.00
k. Total unliquidated obligations					
l. Recipient's share of unliquidated obligations					
m. Federal share of unliquidated obligations					
n. Total federal share (sum of lines j and m)					1,690,000.00
o. Total federal funds authorized for this funding period					1,690,000.00
p. Unobligated balance of federal funds (Line o minus line n)					0.00
Program income, consisting of:					
q. Disbursed program income shown on lines c and/or g above					
r. Disbursed program income using the addition alternative					
s. Undisbursed program income					
t. Total program income realized (Sum of lines q, r and s)					
11. Indirect Expense	a. Type of Rate (Place "X" in appropriate box) <input type="checkbox"/> Provisional <input type="checkbox"/> Predetermined <input type="checkbox"/> Final <input type="checkbox"/> Fixed				
	b. Rate	c. Base	d. Total Amount	e. Federal Share	
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation:					
13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purpose set forth in the award documents.					
Typed or Printed Name and Title Jim Huggins, Technical Director				Telephone (Area code, number and extension) 321/638-1503	
Signature of Authorized Certifying Official 				Date Report Submitted 08/31/2009	

U.S. DEPARTMENT OF ENERGY  
**FINANCIAL ASSISTANCE**

JUNE 2005

**PROPERTY CLOSEOUT CERTIFICATION**

<b>Award Number</b> DE-FG36-04G014281	<b>Recipient (Name and address)</b> Solar Rating and Certification Corp 1679 Clearlake Road Cocoa, FL 32922
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The purpose of this report is to facilitate the closeout of the Award. Based on the records maintained by the Recipient in accordance with the Property Management standards set forth in the Award, the following data reflects the Recipient's closeout inventory of real and personal property that was provided by the Department of Energy (DOE) or partially or wholly acquired with project funds.

**I. EQUIPMENT**

**A. Federally-Owned:** (Government Furnished Equipment): (10 CFR 600.133(a), 600.232, 600.322, or Federal Demonstration Partnership (FDP) General Terms and Conditions No. 33, as applicable):  No  Yes

(If **yes**, attach property inventory list that includes item description, manufacturer, model, serial number, original acquisition date, original acquisition cost and disposal condition code per the Federal Management Regulation 102-36.240)

**B. Equipment Acquired with Award Funds where Title Vests in the Recipient with further obligations to DOE:** (10 CFR 600.133, 600.134, 600.232, or 600.321, as applicable)

No  Yes

If **yes**, does the equipment have a per unit fair market value of \$5,000 or more?  No  Yes

(If **yes**, attach a property inventory list that includes item description, manufacturer, model, serial number, original acquisition date, original acquisition cost, disposal condition code per the Federal Management Regulation 102-36-240 and one of the disposition codes listed below)

- (1) The property will continue to be used for the purposes authorized in the Award.
- (2) The property is no longer needed for the purposes of the Award, and will be used on another Federally sponsored activity (List Activity and Federal Agency):
- (3) The Recipient wishes to retain the property and compensate DOE for its share of the current per unit fair market value. (Identify the fair market value on the attached property inventory list and describe how the value was determined).
- (4) The property is no longer needed for the purposes of the Award or other Federally sponsored activities and the Recipient requests DOE disposition instructions.

**II. SUPPLIES** (10 CFR 600.135, 600.233, 600.324, or FDP General Terms and Conditions No. 35, as applicable )

Does the residual inventory of unused supplies exceed \$5,000 in total aggregate value?  No  Yes (if **yes**, check block below)

The supplies will be used on another Federally sponsored activity (List Activity and Federal Agency).

The supplies will be sold or retained for use on non-Federally sponsored activities and the Recipient will compensate DOE for its share of the sales proceeds (or estimate of current fair market value). Attach a list of the supplies and complete the following Worksheet:

Sale proceeds or estimate of current fair market value.....	\$ _____
Percentage of Federal participation .....	_____ %
Federal share .....	\$ _____
Selling and handling allowance .....	\$ _____
<b>Amount to be remitted to DOE .....</b>	<b>\$ _____</b>

U.S. DEPARTMENT OF ENERGY  
**FINANCIAL ASSISTANCE**  
**PROPERTY CLOSEOUT CERTIFICATION**

**III. REAL PROPERTY:** (*Real Estate - 10 CFR 600.132, /600.231, 600.321, or FDP General Terms and Conditions No. 32, as applicable*)       No     Yes    (*If yes, complete A –C*)

**A. Description of Real Property:**

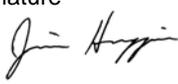
**B. Complete Address of Real Property:**

**C. Period of Federal Interest in the Property:** From \_\_\_\_\_ To \_\_\_\_\_ (Unless the award specifies otherwise, the Federal Interest in the property ends when the award project period ends.)

**D. Disposition Preference Request.** If the period of Federal Interest in the property exceeds the project period, check one of the following blocks to indicate your disposition preference:

- Transfer property to another Federal award.
- Sell and compensate DOE.
- Return to DOE.
- Retain title and compensate DOE for its share of the current fair market value of the property.

**Certification:** I certify to the best of my knowledge and belief that all information presented in this report is true, correct and complete, and constitutes a material representation of fact upon which the Federal government may rely.

Name <b>Jim Huggins</b>	Signature 	Title Technical Director	Date August 31, 2009
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U.S. DEPARTMENT OF ENERGY  
**FINANCIAL ASSISTANCE**  
**PROPERTY CLOSEOUT CERTIFICATION**

To be completed by the Department of Energy:

**DOE PROPERTY DISPOSITION**

Negative Report

Real Property:

Equipment:

Supplies:

Property Management Official Name

Signature

Date