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SOLAR ONE
OPERATION & MAINTENANCE REPORT #64
July, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One operated 2,029.44 MWh (gross) and 1,534.96 MWh (net) during 255.20 hours of on-line operation in the month of July 1987. The plant produced 22.62% MWh (net) more than the previous July record. July 1987 and June 1987 were the second and third best power production months respectively, of the five-year test program. Solar One incurred 67.83 weather outage hours and was down for 41.50 hours for scheduled and unscheduled maintenance. During the month, the plant set four power production milestones; (a.) thirty-eight consecutive days of operation, (b.) maximum power production week, (c.) maximum weekly operating time, and (d.) maximum power production day.

- The five-year test program was completed on Friday, July 31.

  During the initial two-year Test and Evaluation phase, the plant generally demonstrated design performance in each of its eight operating modes.

  In the following three-year Power Production phase, the plant was operated primarily in the receiver direct mode to maximize power production. In this three-year effort, plant equipment was subject to daily start-ups, providing an aggravated service environment which identified equipment, maintenance and operating limitations, information of which will be utilized in the design of future central receivers. Experience gained during this three-year period also allowed equipment, maintenance and operating procedure revisions which served to improve the plant's performance with each succeeding year of the Power Production phase.

  The Solar One five-year Test Program was a success, having accomplished each of its major objectives. The dedicated effort and team-work by McDonnell Dougals Astronautics, Rocketdyne, Martin Marietta, Stearns Catalytic, Sandia National Lab (Livermore), and Southern California Edison Company personnel were the underlying basis for Solar One's success. Members of these organizations spent endless hours of their own time working on either their own job or in the assistance of other organizations with the apparent singular objective of doing whatever it took to make Solar One a success story. The efforts of these dedicated individuals is greatly appreciated.

OPERATIONAL HIGHLIGHTS

- The early morning receiver inspection on Wednesday, July 1, found severe leakage on the panel 17 flowmeter and moderated leakage on panel 9 prefilter and temperature control valve. Leakage also was observed on the panel 15 vent valve and the air supply line to AOV-2007.

- The early morning receiver inspection on Thursday, July 2, found slight leakage on panel 11 temperature control valve packing, panel 9 temperature control valve bonnet and panel 15 prefilter. The collector chemical wash program was temporarily suspended pending review of the program by SCE Industrial Hygienist. Review of the procedure is scheduled for Tuesday, July 7, 1987. Refer to Attachment I for additional information

- Cooling tower acid day tank overflowed on Saturday, July 4, spilling 5-10 gallons of acid into the acid tank containment basin. Soda ash was added to the containment basin to neutralize the acid.

- The early morning receiver inspection on Sunday, July 5, found minor leakage on the panel 13 prefilter and AOV-2905 packing. Added additional soda ash to the cooling tower acid tank containment basin to neutralize the acid that was spilled on July 4.

- On Monday, July 6, TSS RGP was powered down due to continuous print out of erroneous messages. Per discussion with Phil Lane (SCE), regarding less than satisfactory BCS performance, found that the insolation indication used by BCS is incorrect. Accordingly, BCS operation was suspended pending correction of insolation input.

- On Tuesday, July 7, several new leaks were reported in the receiver core. Receiver panel 12 temperature control valve continued to go out of range. Therefore, it was necessary to reset the temperature control setpoint to 820 degrees and decreasing number of in service heliostats in wedge #6.

- Swapped from panel 19 "A" flux sensor to "B" flux sensor on Wednesday, July 7.

- Resumed the collector chemical wash program on Tuesday, July 7. The wash procedures were approved by SCE Industrial Hygienist.

- Energy production for the week of Sunday, June 28 through Saturday, July 4, was 470.420 MWH (net) setting a new weekly maximum power production record. This week's energy production was 14.620 MWH (net) more than that produced during the previous power production milestone week of Sunday, May 12 through Saturday, May 18, 1985 (455.80 MWH net).

Operating time for the above period was 76.52 hours, setting a new weekly maximum operating time record. This week's operating time was 3.5 hours longer than the previous record, which was set during the Sunday, June 17 through Saturday, June 23, 1984 time period; 73.02 hours.

- A Solar One Transition Meeting was conducted on-site regarding the plant's transition from the current five-year test program to the extended operating period of August 1, 1987 through September 30, 1988.

  Attendees:

MDAC	SCE R&D	SCE STEAM
John Raetz	Chuck Lopez	Jim Fuller
Bob Gervais	Bill vonKleinSmid	Bob White

SANDIA (SNLL)	SANDIA (SNLA)
Duncan Tanner	John Holmes
Al Baker	Greg Kolb
Al Skinrood	Dan Alpert

  Refer to the attached Agenda (Attachment 2) for subjects discussed during the meeting. Meeting participants were generally in agreement on transition requirements and the objectives for the extended operating periods.

- The early morning receiver inspection on Friday, July 10, found the tube leak (external) on panel 9 to be getting worse. Also noted was a tube leak on panel 21 and a valve packing stem leak on the steam downcomer block valve (UV-2905). The unit was placed on-line at 0815 hours and off-line at 1914 hours.

- On Saturday, July 11, placed receiver panel 12 temperature control valve into receiver feed pump speed control loop and at temperature setpoint of 825 degrees F at 1208 hours because the valve had gone wide open.

  On Sunday, July 12, placed receiver panel 12 in receiver feed pump speed control loop with panel metal temperature setpoint of 825 degrees F to keep the valve from going fully open at 1109 hours. In spite of this, heliostats had to be removed from panel 12 at 1240 hours to further control that panel's metal temperature.

- Solar One completed 38 days of consecutive operation on Monday, July 13, 1987 setting a new record for consecutive days of operation (see Attachments 3 and 4). The previous record of 36 days of consecutive operation was established in the July 31 through September 4, 1985 time period.

- Receiver panel 9 lost flux indication at 0717 hours on Monday, July 13. Because the remaining flux sensors on the panel were defective, the panel 8 "B" flux sensor was used to control panel 9. Placed panel 12 temperature control valve at 830 degrees F to control panel metal temperature at 1148 hours. Closed block valve on the steam dump valve (PV-1001) at 1755 hours and noted approximate 0.15 MW load increase. Maintenance personnel reset valve positioners to correct the problem.

- On Tuesday, July 14, receiver panel 12 temperature control valve was placed in receiver feedpump control and temperature control setpoint was raised to 830 degrees F to keep the valve from going full open.

- Solar One start-up was prevented on Wednesday, July 15, because of clouds throughout the day. Erin (HAC) failed and a reboot was not possible at the time. McDougal was in a stand alone status. Receiver panel RB-12 was reconfigured into the receiver feedpump valve control loop. Completed reflectivity readings and generated a north/south BCS candidate list. The early morning receiver inspection found the following leaks; (a.) tube leaks on panels 9, 13, 14 16 & 17, and (b.) panel 14 prefilter flange.

- Solar One start-up was aborted due to clouds on Thursday, July 16. The collector field was rain washed. Completed reflectivity calculations and found the average cleanliness to be 86.5%. Rebooted the HAC due to communication lines 1 and 2 failing over to backup lines, McDougal prime no backup and Erin would not reboot.

- A receiver outage was planned for the weekend (July 18-19) to allow receiver tube leak repairs and performance of other miscellaneous receiver repairs.

- Saturday, July 18, was a receiver maintenance outage day. The receiver was hydrostatically tested in order to identify tube leaks and was cleared for repairs. Refer to Attachment 5 for a listing of all repair work completed during the outage.

- On Monday, July 20, HAC failures continued; initiated a failover to Erin at 0720 hours to regain communication with the field. Start-up was aborted due to heavy clouds in the area. The collector field was rain washed.

- The early morning receiver inspection on Tuesday, July 21, revealed a tube leak on receiver panel 9 at the upper expansion guide. Also observed was an external tube leak on panel 21. Solar One was on-line for power production at 0804 hours and off-line at 1915 hours. Reflectivity readings were taken on four selected heliostats to determine effectiveness of the recent rain wash. The test measurement of the four selected heliostats found the collector field weighted average cleanliness to be 96.78%. The rain wash of July 16, improved field cleanliness 6.8% and the rain wash of July 20, made an additional 3.28% improvement.

- On Wednesday, July 22, receiver panel 7 required flux gain adjustments; the flux sensor was degrading. Receiver inspection revealed panel 11 had an outside tube leak at elevations 5 & 6.

  Solar One set a new daily power production milestone on Wednesday, July 22, of 89.19 MWH (net). Refer to Attachments 3 and 4 for additional milestones accomplished in the last two months.

- The HAC failed at 0021 hours on Thursday, July 23, McDougal failed to take over. Several reboots were attempted and failover tests were initiated. Rebooted McDougal prime, Erin backup: ISC indicated backup HAC had failed; proceeded with start-up. Solar One was on-line for power production at 0741 hours and off-line at 1919 hours. Receiver temperature setpoint was raised to 850 degrees F to compare plant efficiency at 850 degrees F with the normal operating temperature of 775 degrees F.

- Solar One generated 90.96 MWH (net) on this day during 11.38 hours of on-line operation, setting a new maximum Mode 1 power production milestone (see Attachments 3 and 4). The previous record was 89.18 MWH (net) during 11.77 hours of on-line operation on the previous day. Accordingly, July 22 and 23, 1987 were the two best maximum power production days to date.

- Heliostat Array Controller (HAC) problem diagnosis continued on Friday, July 24. During start-up, the receiver tripped at 0709 hours due to varying insolation. The unit was on-line for power production at 0910 hours and off-line at 1342 hours due to clouds. The unit was back on-line at 1409 hours and off-line at 1426 hours due to HAC failure. On swing-shift, Erin (HAC) would boot up without a backup. Memory clear routine of McDougal did not correct the problem. Maintenance personnel continued the HAC problem diagnosis into the following morning.

- Maintenance personnel completed the HAC problem diagnosis at 0425 hours on Saturday, July 25. At this time, McDougal was operational without a backup. Solar One was on-line for power production at 0744 hours and off-line at 1753 hours due to a receiver trip (RLU). The cause of the trip was due to a bad printed circuit card in the remote station one's discrete logic unit, i.e., CPU card in the Modicon 584. Receiver panel 10 "A" flux sensor failed at 1725 hours. The "A" flux sensor on panel 11 was then used to control panel 10 with panel 11 being controlled by its own "B" flux sensor.

- On Monday, July 27, an Electrician reported that there is discoloration on the receiver feedpump inboard and outboard motor bearings. After the bearings were inspected, indications were found that the babbitt had been severely rubbed. Inspection of the bearing oil found it to be discolored from overheat.

- Heliostat Array Controller (HAC) Erin was not available for operation on Wednesday, July 29. Solar One was on-line for power production at 0818 hours and off-line at 1343 hours because of an RLU trip on panel #14 due to failure of its flux sensor. Panel #14 was reconfigured to panel #15 "A" flux sensor for control. Both panels 14 and 15 were then being controlled by the panel 14 "A" flux sensor. On-line again at 1534 hours and off-line at 1903 hours because of declining insolation.

- Start-up was delayed on Thursday, July 30, because of excessive packing leakage on receiver panels RB-14 and RB-15 manual vent valves. Solar One was on-line for power production at 0924 hours and off-line at 1904 hours.

- A 480V ground was experienced on bus BO-1 on Friday, July 31, and it was determined to be air compressor CP-902. Power production for July 1987 was 2029.44 MWH (gross), and 1443.16 MWH (net). The July 1987 generation was the second highest monthly net generation for the five-year test program.

The Friday, July 31, issue of the Solar One Daily Highlights released and dated August 3, was the last issue, marking the end of the Solar One five-year test program. Future Solar One information will be published on an exception basis, i.e., significant events. Such exception data will be distributed to appropriate organizations.

MAINTENANCE HIGHLIGHTS

- On Wednesday, July 1, air compressor CP-902 was returned to service; the air compressor was overhauled and new rings installed. Air to air cooler and combination radiator air to air core were replaced. Receiver leaks on panel 17 flowmeter, panel 9 prefilter and temperature control valve packing, and panel 15 top vent valve packing were repaired during swing-shift.

- Air compressor CP-901 overflow line was repaired on Thursday, July 2. Receiver feed pump motor ventilation fan in the auxiliary bay was placed in service. Communication Maintenance, Inc., was on site to service HAC, DAS, BCS and OCS computer systems.

- Air compressor CP-901 oil sensing line was replaced on Monday, July 6. Air compressor CP-902 suction oil bath inlet filter was drained to be monitored. Shop and Test personnel returned to the station for an additional four-week assignment to continue with heliostat gear drive motor assembly repairs.

- On Tuesday, July 7, the following receiver core leaks were repaired on the graveyard shift; panel 9 temperature control valve bonnet leak, panels 11, 14 & 17 temperature control valve packing leaks, panels 13, 15 & 17 prefilters, panel 12 flowmeter flange, panel 11 I/P was replaced and panels 9, 11 14 & 17 temperature control valves were stroked.

- The acid spilled into the cooling tower acid containment basin was removed and sent to an approved disposal site on Wednesday, July 8. TSS RGP and TSS charging/extraction trip anomalies were resolved by rebuilding the TSS database. Phil Lane (SCE) is revising the BCS program to improve on its present reliability, i.e., making it operable in spite of defective data acquisition system (DAS) inputs. Replaced I/P on receiver panel 11.

- Following review of the collector field chemical wash program with SCE Industrial Hygienist, it was determined appropriate to resume the chemical wash program on Monday, July 6. However, due to failure of the wash-truck, the wash did not resume until Tuesday, July 7. During the Tuesday and Thursday wash effort, the truck operator was equipped with an acid monitor. The results obtained from the monitor will be evaluated to determine if any additional precautions will be required. The heliostat wash-truck starter, which failed on Wednesday, was replaced and the collector field wash resumed. Phil Lane (SCE) modified the BCS such that wind speed and insolation restraints do not automatically abort bias updates. These restraints were removed because the wind speed measurements were faulty, thus causing frequent abort of heliostat bias adjustments. Accordingly, operators have been instructed to abort bias updates manually when insolation values of less than 500 watts per square meter or wind speeds in excess of 25 MPH are experienced, i.e., perform program aborts previously performed automatically by the data acquisition system.

- On Friday, July 10, repaired the deaerator pH meter and continued diagnosis of data acquisition system problems. McDonnel Douglas Astronautics Company (MDAC) personnel will, in the next week, begin assisting the station in diagnosis of data acquisition system (DAS) problems.

- On Monday, July 13, maintenance personnel began investigating isolation of the thermal storage controls from the balance of the plant. During swing-shift, the instrument air filter on receiver vent valves (AOV-2093 and AOV-2007) were repaired. Other work accomplished on swing-shift; (a.) replaced panel 9 "A" flux sensor, (b.) steam downcomer block valve stem was repacked, (c.) repaired bonnet gasket on panel 9 temperature control valve, (d.) replaced flange gasket on the panel 12 flowmeter, and (e.) repaired packing on panel 11 temperature control valve.

- Inspected the instrument air prefilter and cleaned the sight glass on Tuesday, July 14. Bob Ebert (MDAC) is working with maintenance personnel on the diagnosis of data acquisition system (DAS) problem's. Replaced valve trim in the receiver panel 12 temperature control valve with standard trim on swing-shift. This will allow the panel to operate permanently in the receiver feedpump speed control logic, while at the same time preclude the necessity of increasing the panel's metal temperature setpoint and removing heliostats from service to maintain acceptable panel metal temperatures. Also on swing-shift, accomplished diagnosis of the Erin (HAC) failures. The diagnostic effort was not successful in restoring the unit to service. Maintenance personnel initiated a collector field water wash program which will be performed in conjunction with the heliostat chemical wash being performed by operations. This action was taken due to the severe soiling of heliostats that has transpired in the last month.

- SCE and MDAC continued to troubleshoot the data acquisition system (DAS) on Wednesday, July15. Swapped memory boards and replaced 5V power supply to no avail.

- Lube oil vapor extractor discharge flex line was replaced on Thursday, July 16. Muffin fan was replaced on MVCU C2-1. Removed aircraft warning light voltage suppressor and returned the lights to service. A new voltage suppressor will be installed on its receipt.

- On Friday, July 17, receiver panel 21 flow control algorithm gain reduced to dampen start-up flow oscillations.

- Receiver tube leaks and miscellaneous repairs were completed on Sunday, July 19 (see Attachment 5 for details). Receiver panels 12 and 16 temperature control valves were calibrated and in addition panel 16 I/P was replaced. Following the receiver repairs the receiver was hydrostatically tested a second time and leaks were observed on panel 22 inspection plugs 12, 22, 41, 54, 59 and 64. These leaks were repaired at a later time. A Communications Maintenance Inc. (CMI) representative was on site to troubleshoot the HAC's and OCS. A chip was replaced in Erin's memory for parity error. No hardware problems were found in OCS. Troubleshooting the HAC is ongoing due to HAC failures.

- On Monday, July 20, the McDougal memory board #4 was replaced with one memory board from OCS. HAC's rebooted okay at this time. DAS troubleshooting is ongoing.

- On Tuesday, July 21, the cooling tower sodium hypochlorite discharge line was temporarily repaired, parts are on order.

- Receiver panel 7 flux sensor "B" was replaced at 2140 hours on Wednesday, July 22.

- On Thursday, July 23, DAS unit in remote stations #1 & #4 were made operational; RS #1 gain amplifier and two 5V power supplies were repaired. RS #4 interface card was replaced. RS #3 troubleshooting has determined a bad 30V power supply.

- Maintenance personnel performed HAC diagnosis throughout graveyard-shift on Friday, July 24 and again on swing-shift. By the end of the swing-shift, McDougal was operational with work continuing on Erin. Shop and Test personnel completed overhaul of 269 heliostat gear drive assemblies on Thursday, July 23, marking the end of their scheduled assignments to Solar One.

- Replaced the discrete logic unit (Modicon 584) central processing unit card in remote station #1 on Saturday, July 25.

- Receiver panel 10 flux sensor "B" was replaced on Tuesday, July 28. Receiver panels 14 and 15 vent block valves were repacked. Receiver feedpump motor inboard bearing was replaced and outboard bearing scraped and refitted.

- On Wednesday, July 29, the receiver elevator was removed from service because the travelling cable was in bad condition. Receiver panel 14 flux sensor "B" was replaced on swing-shift. Maintenance personnel replaced two of the three back flow preventers on the service water system.

- Receiver manual vent valves on panels 14 and 15 were repacked on Thursday, July 30. Receiver elevator travelling cables were replaced. New control cable guides are needed in order to return the elevator back to service. Parts are on order. Maintenance has completed installation of back flow preventers (3) in the service water system. Waste water sump pump lubricating line solenoid was cleaned and returned to service.

- The north oil/water separator pump coupling was repaired on Friday, July 31.

June 30, 1987

JUL 02 1987

MR. M. R. WHITE, MANAGER
COOLWATER GENERATING STATION

SUBJECT: Hydrofluoric Acid Use At Solar I

Mr. Craig S. Inouye requested, through my supervisor, that I conduct a training session with a question and answer format on the subject of hydrofluoric acid, (HF).

I met with Craig and four other employees in the conference room of Solar I from 10:30 to 11:30 on 18 June, 1987 (see attached training attendance log). I brought along copies of two Material Safety Data Sheets (MSDS) we had in our files on HF acid; one developed by Dow Chemical U.S.A. and the other by J.T. Baker Chemical Company to use in the discussion. Craig informed me that they would be using "CEE-BEE Cleaner C-120" from McGean-Rohco, Inc. of Downey, California. He furnished me a copy of their MSDS which I feel is grossly inadequate for a chemical as toxic and dangerous as HF acid. Mr. Richard M. Warner, Supervisor Industrial Hygienist, has contacted the CEE-BEE Company regarding the development of a more detailed and informative MSDS for their product. (See attached letter).

I asked Craig to verbally walk me through the entire mirror cleaning process step-by-step from the time the HF is received until it has been disposed of. He stated that 165 fifty-five gallon barrels of the cleaner solution had been ordered. One-half of this total was to be delivered on 18 June, 1987 with the other half to follow in 3 to 5 days. I asked him where it would be stored. He said they would try to get it all under some type of shelter out of the direct sunlight. The solution is shipped in white barrels instead of heat absorbing black ones. I told him it must be stored below 125°F and preferably below 100°F, in a well-ventilated area. I recommended that they plan to wet-down all barrels with water once each hour when the ambient temperature exceeds 95°F. It is my understanding that any unused HF acid cleaner will be returned to the supplier and not stored on site.

The solution will contain 10% HF acid, 10% sulfonic acid, and 80% water. I have been told by the supplier that the sulfonic acid acts as a surfactant and is as safe as a soap solution. Craig indicated that you had a specially configured truck for mirror washing. He says it contains two tanks; one for the cleaner solution and the other for deionized (DI) water. He said the cleaner solution would be diluted approximately 5 to 1 with DI water. This will be a one man operation. The driver of the truck will make 3 wash passes across the mirror surface and 6 rinse passes using DI water. The last time they cleaned mirrors with this agent the weather was cold and the solution thick. It will be considerably warmer in late June and early July. Craig said the truck is not air conditioned. I envision a situation where the cleaner hits the hot mirror surface evaporates quickly and could produce significant amounts of HF vapor. The driver said he would have a complete chemical suit in the truck cab along with a gas mask, but will not be wearing them unless he sees a need to. This could place the employee in jeopardy should the wind shift and spray the truck cab or if he opens a window for cooling.

In order to document actual employee exposure to HF acid (if any), we would like to sample the employee involved in the truck cab and a sample downwind. If this is not possible during this cleaning, please contact me on PAX 37212 in sufficient time to sample the next scheduled cleaning operation.

HF acid is very subtle in the way it damages human tissue. When on the skin, one does not feel the burn immediately but severe damage can occur even under the fingernails. If ingested, severe irritation and damage to the esophagus and stomach can occur. If in the eyes, it will rapidly cause severe and deep-seated burns of eyes and eyelids. Permanent visual defects or blindness can occur. When the vapors are inhaled, even short exposures will cause serious systemic injury-even death. HF acid also has the unique quality of causing delayed reactions. When inhaled, one may be given oxygen and feel better right away, then suffer severe lung edema up to 72 hours after exposure. Any significant exposure should be referred to an M.D. immediately. Generally, the patient would be admitted to a hospital for observation for 72 hours to monitor for lung edema.

Each of these points were covered in detail with your 5 employees. They say they understand. They have worked with HF before, but in cold weather. They seem to realize the potential for injury and accept it.

The last time they used this solution, they left a quantity of the cleaner in the tank truck overnight. Whey they resumed work the next day they saw where the HF had eaten away the fittings and subsequently leaked onto the ground. There are very few things which HF will not corrode; among them are lead, wax, polyethylene and platinum. It is commonly used to etch glass.

We discussed spills and over spray of the cleaner. Craig says the county is not concerned since the soil there is highly alkaline. They said they used lime to neutralize the previous spill. They only had two bags of lime on hand, I suggested they get more prior to delivery of the first shipment. Should an act of carelessness result in breaking a barrel with the forklift or should one rupture from the heat, you should have the necessary materials immediately on hand to contain and neutralize the HF acid. Eye protection should always be worn anytime the cleaner is being transferred from drum to truck and during all cleaning operations.

We also discussed working on the buddy system with a second person watching the operation and staying in constant communication. Craig said the driver would have a portable radio and could call the control room at any time, and that he would look into the possibility of having a second employee involved to work on the "Buddy System".

Due to the nature of HF acid and its ability to produce delayed effects, I am sending a copy of this letter to Dr. Charles O. Thompson of our Health Care Services in San Bernardino to make him aware of our concern. I will attach copies of 3 MSDS's to this report for your careful perusal.

Should you have any questions regarding this report or any other occupational health matter, please call me on PAX 37212.

DOUGLAS J. DAVIS, CIH
INDUSTRIAL HYGIENIST

DJD: 09/87/402
cc: R.M. Warner (w/o attachments)
Dr. C.O. Thompson, San Bernardino (w/attachments)

Attachments (4)

1. MSDS - Dow Chemical
2. MSDS - J.T. Baker
3. MSDS - McGean-Rohco
4. MSDS - Letter to McGean-Rohco, June 25, 1987

ATTACHMENT 2

Sandia National Laboratories

Livermore, California 94550

date: June 23, 1987

to: Distribution

from: D. N. Tanner - 8133

subject: Solar One Transition Meeting

There will be a meeting on July 9, 1987 at Solar One starting at 8:30 am to discuss various subjects related to the transition from the Power Production Phase to the Semi-commerical Phase. This will be an informal meeting (presentations not required). The agenda for the meeting is:

1. Receiver operation

   What constraints should there be on future receiver operation. Start-up, morning and mid-day. Shutdown.

2. Energy Calculations

   SNLA energy calculations for 5 day operation. Are the current revenue estimates reasonable? Would operation of TSS increase revenue?

3. Plant operation

   Operating strategy to maximize energy production for the 5-day operation.

4. Equipment, Sandia, MDAC

   Disposition of Sandia and MDAC equipment after September 30th.

5. Receiver panel replacement.

   What contingency plans are needed for replacement of receiver panels? What modifications could be made?

6. Other transition activities.

   Open items related to the transition to the next phase.

Distribution:

W. von KleinSmid, SCE
C. Lopez, SCE
R. L. Gervais, MDAC
J. Raetz, MDAC
M. Lopez, DOE/SAN
R. Hughey, DOE/SAN
6222 J. V. Otts
6226 J. T. Holmes
6226 D. J. Alpert
6226 G. J. Kolb
6226 C. E. Tyner
8133 A. C. Skinrood
8133 A. F. Baker
8133 L. G. Radosevich
8133 D. N. Tanner

Solar One Test Center
July 15, 1987

Memo for Record

Operating Milestones

Solar One operation during June and first part of July, 1987 was highly successful and it resulted in establishment of three new operating milestones; (a.) consecutive days of operation, (b.) maximum weekly power production, and (c.) maximum weekly operation time.

During this period, power production for the month of June was the second highest level of monthly power production to date.

Solar One completed thirty-eight consecutive days of operation during the period of Sunday, June 7 through Tuesday, July 14 setting a new record for consecutive days of operation. These consecutive days of operation were interrupted by overcast skies on Wednesday, July 15. During the operating period Solar One generated 2117.600 MWH (net) during 377.33 hours of on-line operation. Solar efficiency for this period was 9.84%. Solar utilization time (pure) and solar utilization time corrected for weather and plant start-up time were 88.44 and 100.01 percent respectively.

Within these thirty-eight consecutive days of operation, Solar One generated 470.420 MWh (net) during 76.52 hours of on-line operation in the week of Sunday, June 28 through Saturday, July 4, 1987. This generation set new weekly records for maximum power generation and operating times. Solar efficiency (pure) for this week's operation was 11.26 percent. Solar utilization time (pure) and solar insolation time corrected for weather and plant start-up time were 96.45 and 107.27 percent respectively.

During the month of June 1987, Solar One generated 1443.160 MWH (net) during 262.13 hours of on-line operation. June 1987 was the second highest power production month to date. Solar efficiency (pure) for the month was 9.18 percent. Solar utilization time (pure) and solar utilization corrected for weather and plant start-up time were 83.60 and 07.01 percent respectively.

C.W. Lopez
Site Manager

Fax cc: Bob Hughey, DOE
Al Skinrood, SNLL
Ben Chu, LADWP
Howard Coleman, DOE
John Holmes, SNLA

File: OPMILE (C)

Solar One Test Center
July 23, 1987

Memo for Record

Power Production
Milestone

Solar One generated 89.18 MWH (net) on Wednesday, July 22 during 11.77 hours of on-line operation setting a new maximum Mode 1 power production milestone. The previous record was 88.100 MWH (net) during 11.85 hours of on-line operation on Saturday, July 19, 1986.

In the last two-months, Solar One has set a total of four (4) new operating records;

(a.) maximum power production day,

(b.) maximum power production week,

(c.) maximum weekly operating time, and

(d.) maximum consecutive days of operation.

In addition, during this recent operating period, Solar One's power production in June, 1987 was the highest power output for the month of June and current power production in July, 1987 will probably exceed power produced in any previous July.

Because weather conditions on Thursday, July 23 are nearly identical to that of Wednesday, July 22, 1987 the receiver is being operated at a receiver outlet condition of 850 degrees F today rather than the now normal 775 degrees F. This will allow comparison of total plant efficiency with these two different receiver steam outlet conditions. It is anticipated that todays energy output will exceed yesterday's power output record. Refer to the Attached tabulation for additional details.

C.W. Lopez
Site Manager

File: PWRMILE (C)

PLANNING SCHEDULE

ATTACHMENT 5

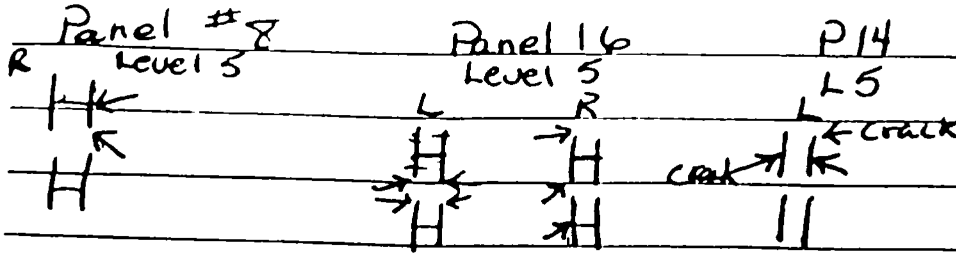
GEN[illegible] STATION: SOL[illegible] ONE | UNIT NO.: 1 | DATE: 7-18-87

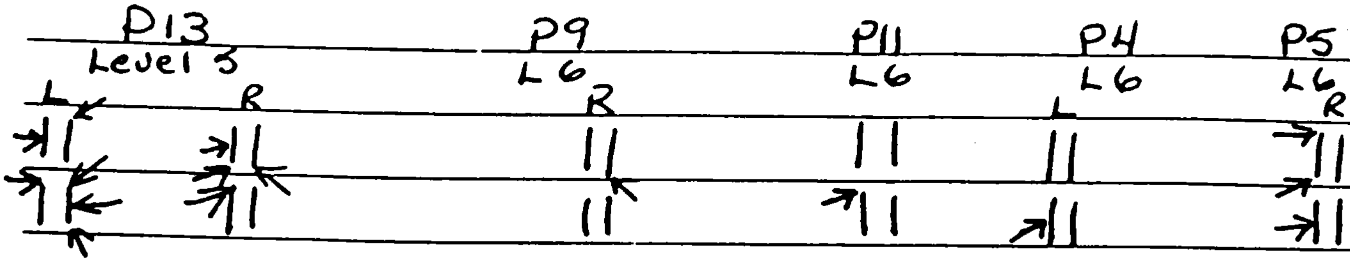
EQUIPMENT OR MANPOWER	7-18	7-19	Status	Remarks
PANEL 4 ELEVATION 6		–	Comp	Total of 29 tube leaks
" 5 " 6		–	Comp	repaired
" 9 " 3-6	–		Comp	Did not section Panels tubes
" 11 " 6		–	Comp	
" 8 " 5	–	–	Comp	Removed & Replaced Bar assy
" 13 " 5		–	Comp	" " " "
" 14 " 5		–	Comp	" " " "
" 16 " 5	–	–	Comp	" " " "
" 21 " 4	–	–	Comp	" " " "
" 22 INSPECTION PLUGS		–	Comp	Welded 7 plugs
" 16 TCV PACKING	–		Comp	
" 12 TCV PACKING	–		Comp	
" 14 PREFILTER FLANGE		–	Comp	
LV-1016 REPLACE VALVE	–		Comp	
LV-1013 REPLACE VALVE	–		Comp	
FV-1007 PIN HOLE LEAK IN V BODY		–	Comp	
MISC. PACKING LEAKS ON MEZZANINE	–		Comp	

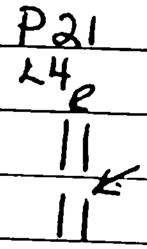
PSSD 129-A REV 3/73 (CW)

ATTACHMENT 5

MEMO TO ______________________ DATE PREPARED







Plugs Panel 22
#58, 16, 17, 43, 45, 14, 44

From ______________________

APPENDIX

- Solar One plant statistics and the performance summary for July, 1987 are presented in Table I.

- A summary of the O&M labor, material, contract, and other costs for the month of July, 1987 is shown in Table II. Expenses are categorized as follows:

Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	July 1986	July 1987	August 1984 To Date
Net Generation MWh	1187.8	1535.0	27321.1
Gross Generation MWh	1643.5	2029.4	38429.8
Mode 1 Peak Output MW	11.1	10.9	11.7
Available Insolation MWh #	5202.0	16341.9	432011.3
Available Insolation Hours	305.3	313.6	8851.1
Power Production Hours	204.0	255.2	5377.8
TSS Charging Hours	13.3	0.0	395.9
Weather Outage Hours	96.9	67.8	3363.1
Scheduled Outage Hours	44.5	27.9	661.8
Unscheduled Outage Hours	23.8	13.7	1097.5
Weather Overlap Hours	25.1	2.1	486.9

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 86.8

Subsystem Availability:
Receiver 88.3
Collector 98.5
Turbine 100.0

Utilization Factor % 60.1

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 20.6

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 9.4

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF JULY 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	8.3	0.5	1.4	0.1	10.3
OPERATIONS	40.2	6.9	0.0	0.2	47.3
MISC. SUPPORT	0.2	0.0	4.9	0.0	5.1
MAINTENANCE:					
Supv/Indirects	5.5	0.4	0.0	0.0	5.9
Control System	5.7	8.6	4.2	0.1	18.6
Receiver System	4.5	5.6	0.0	0.0	10.1
Thermal Str. Sys.	0.1	0.0	0.0	0.0	0.1
Collector System	30.0	44.5	0.0	2.5	77.0
EPGS System	1.0	2.0	0.1	0.0	3.1
Miscellaneous	1.0	4.7	0.0	0.0	5.7
TOTAL MAINTENANCE	47.8	65.8	4.3	2.6	120.5
SUBTOTAL	96.5	73.2	10.6	2.9	183.2
Division O.H.					17.0
TOTAL DIRECT:					200.2
Workman's Compensation					0.7
Payroll Tax					7.2
Pension & Benefits					21.3
Administration & General					38.8

GRAND TOTAL.. 268.2

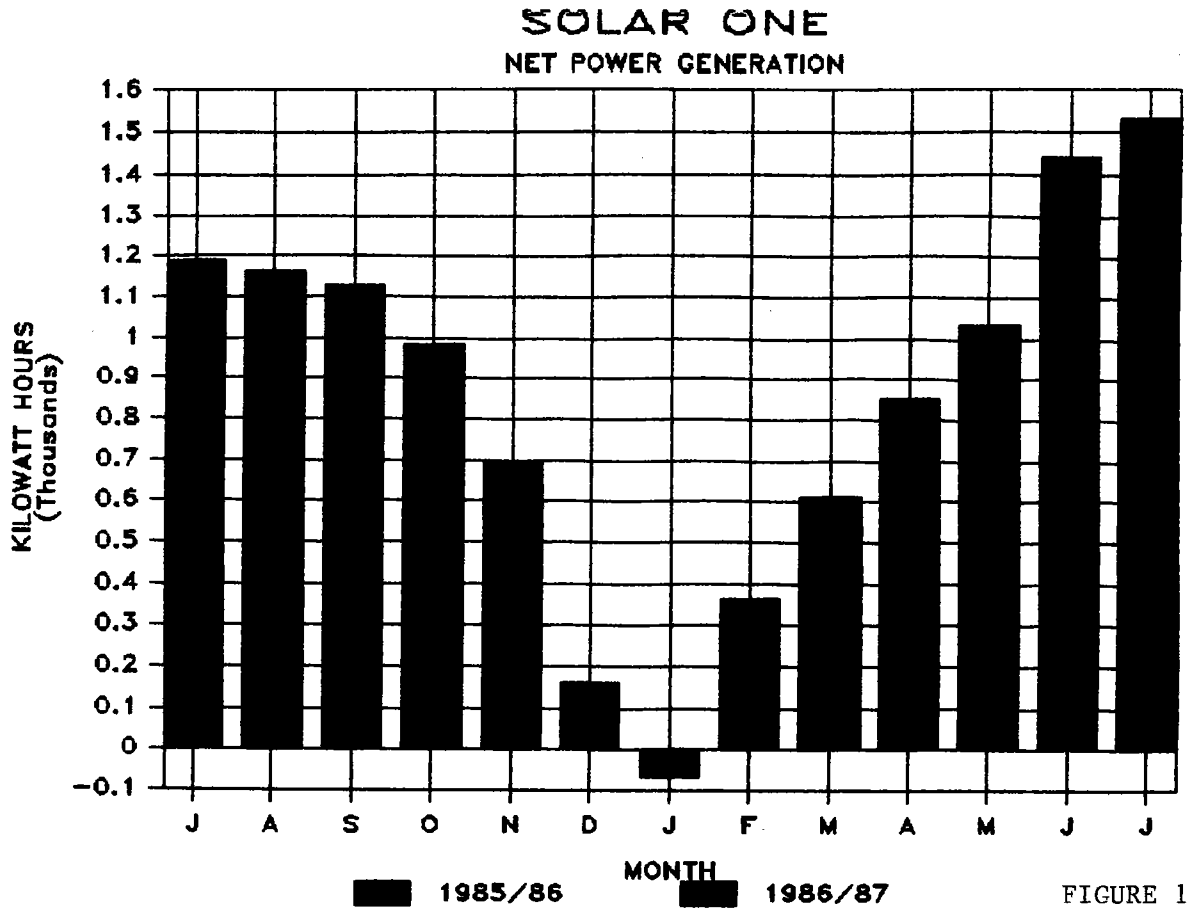


FIGURE 1

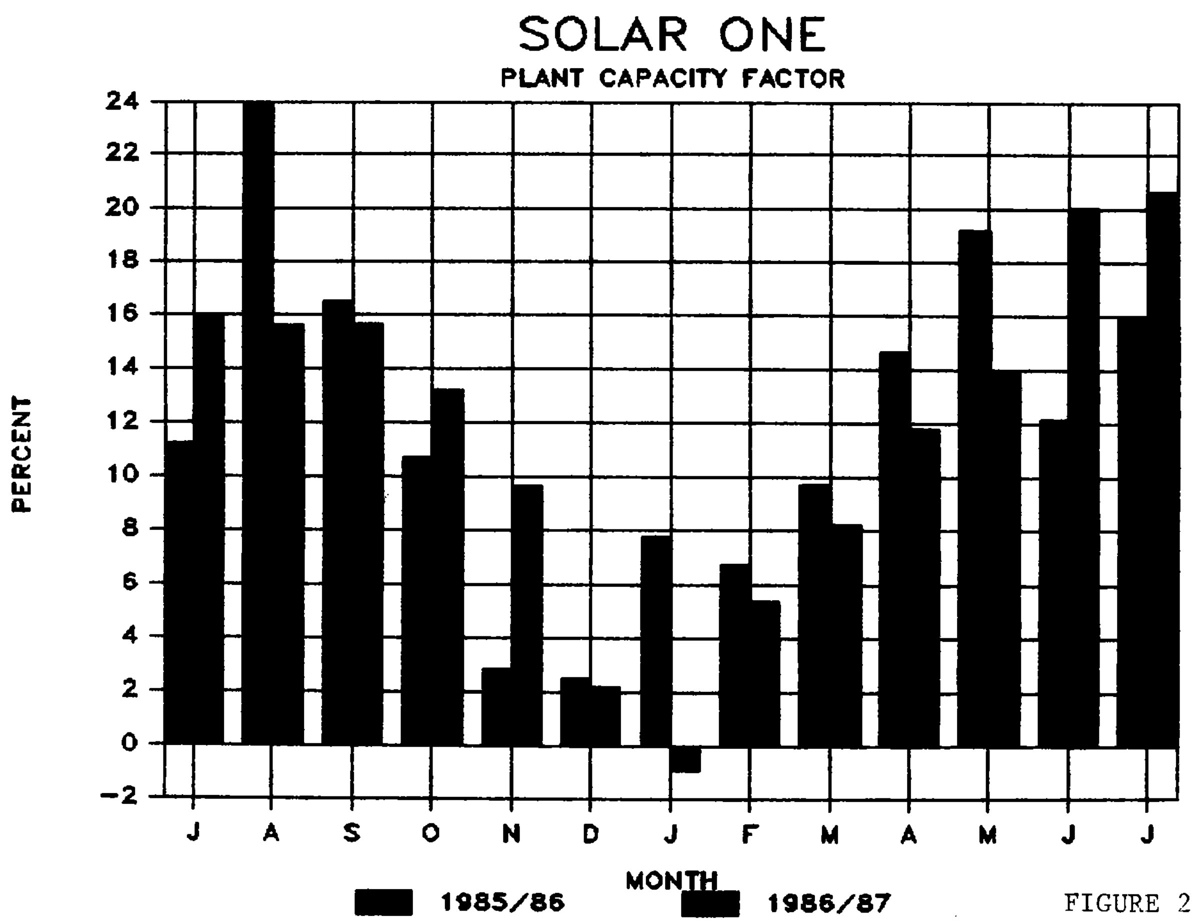


FIGURE 2

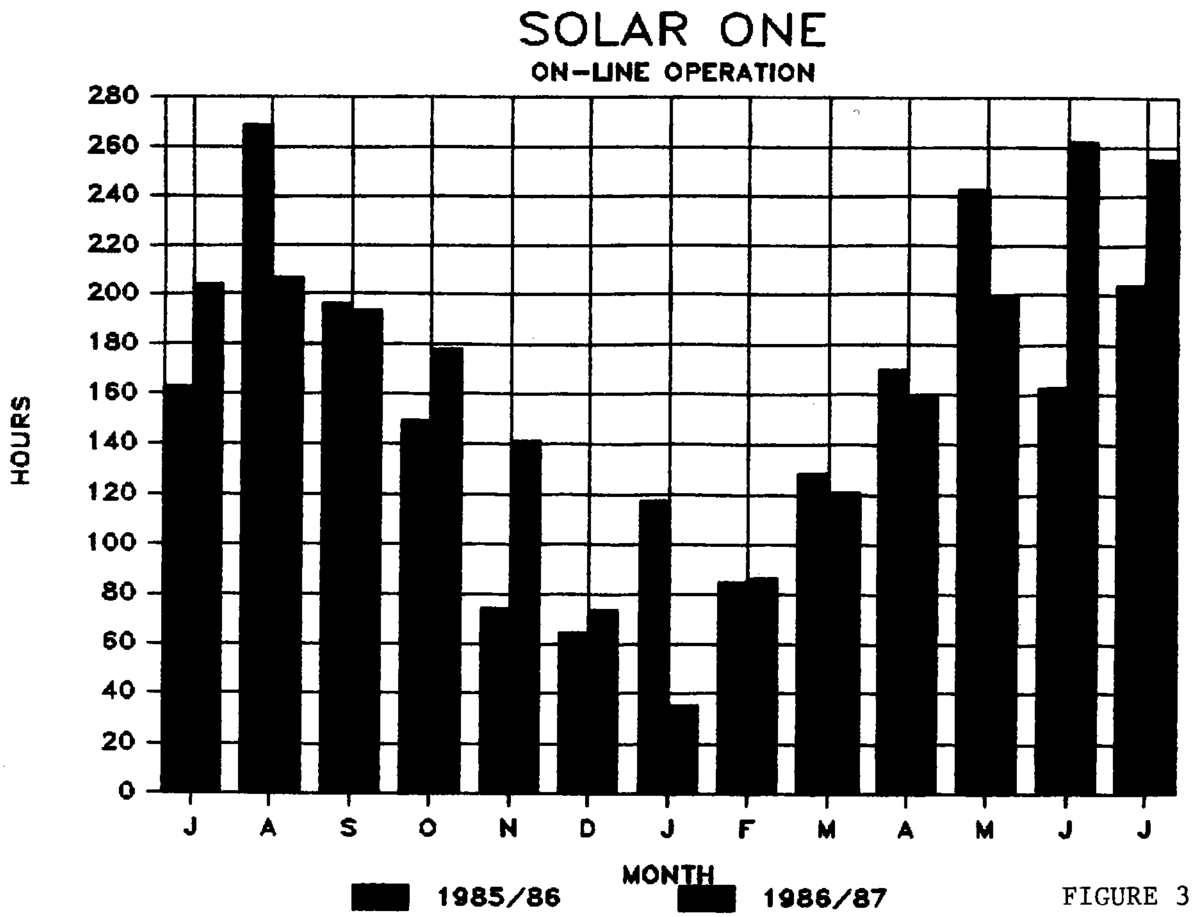


FIGURE 3

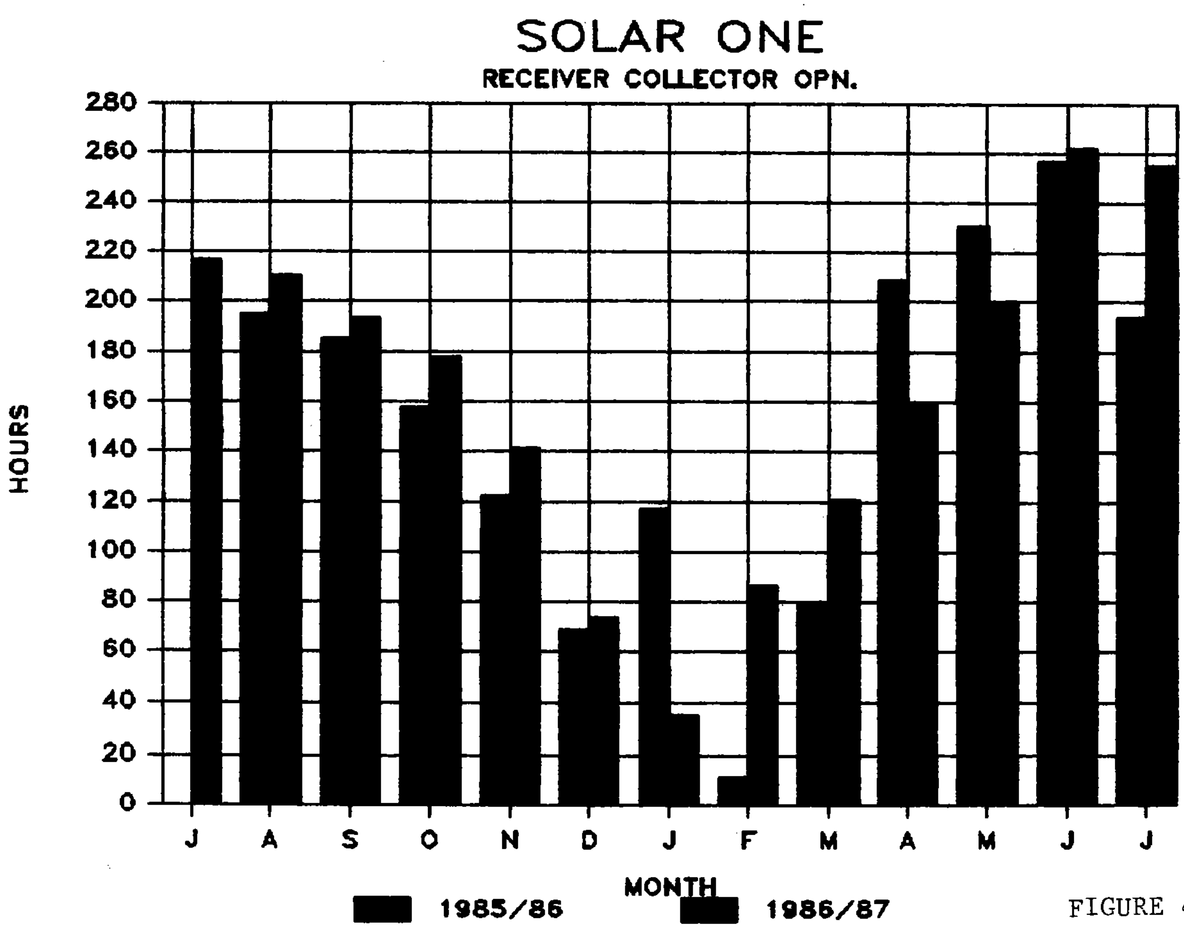


FIGURE 4

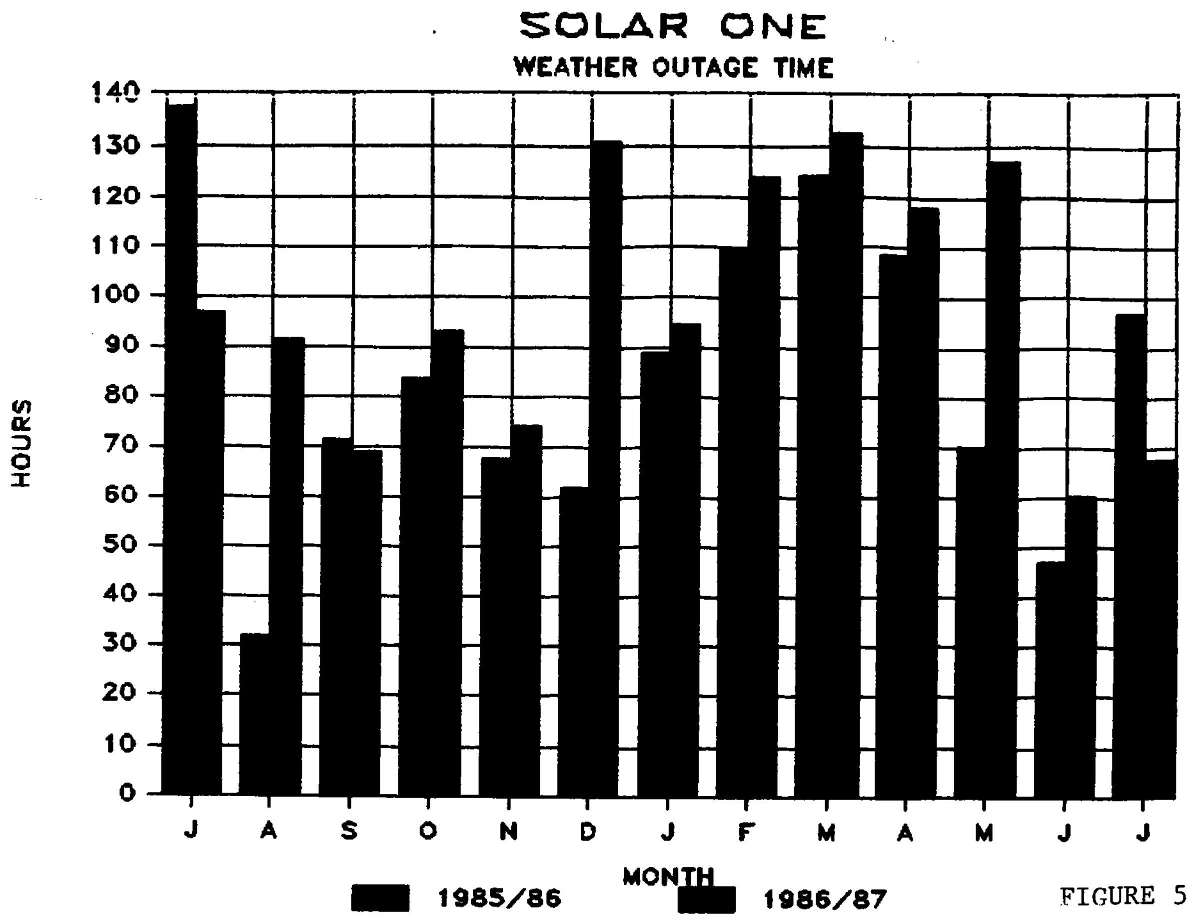


FIGURE 5

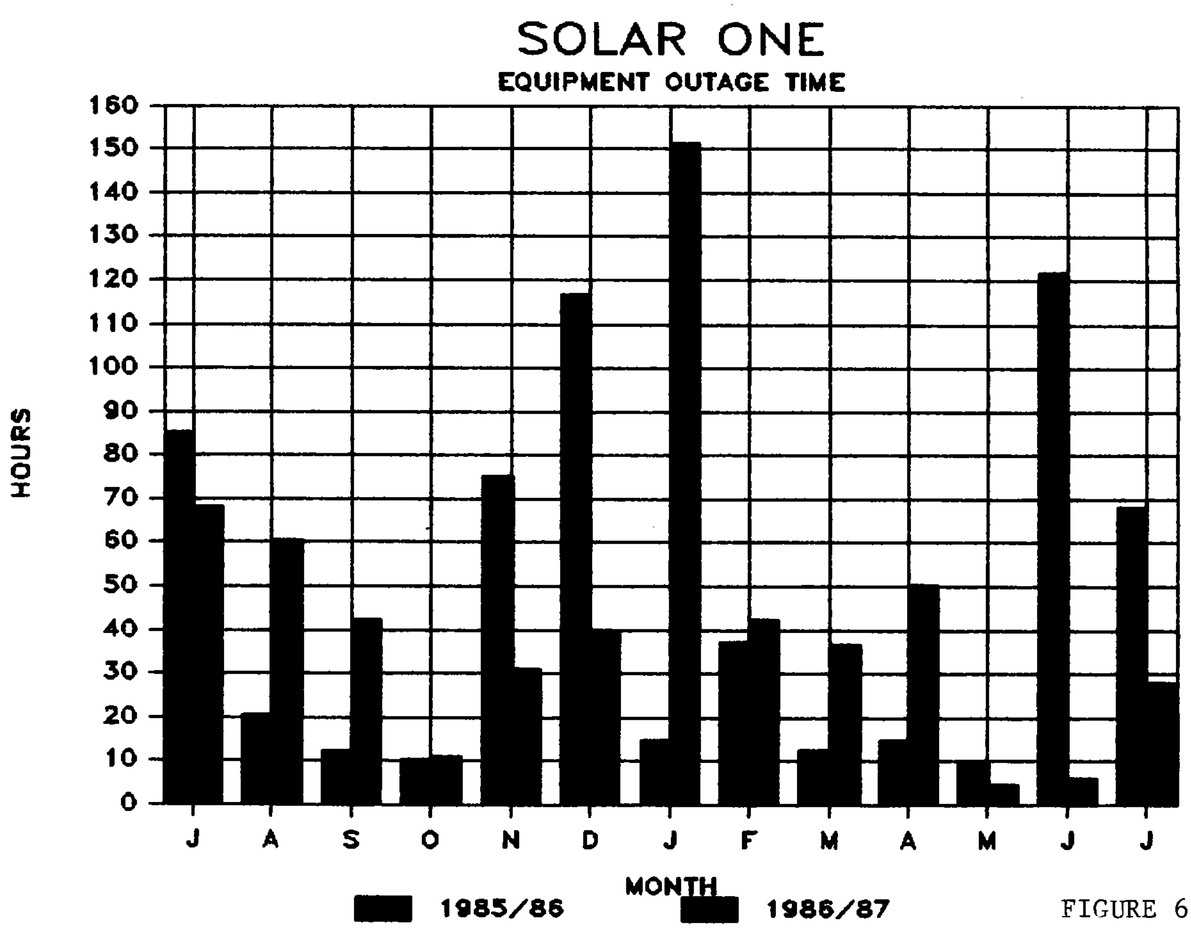


FIGURE 6

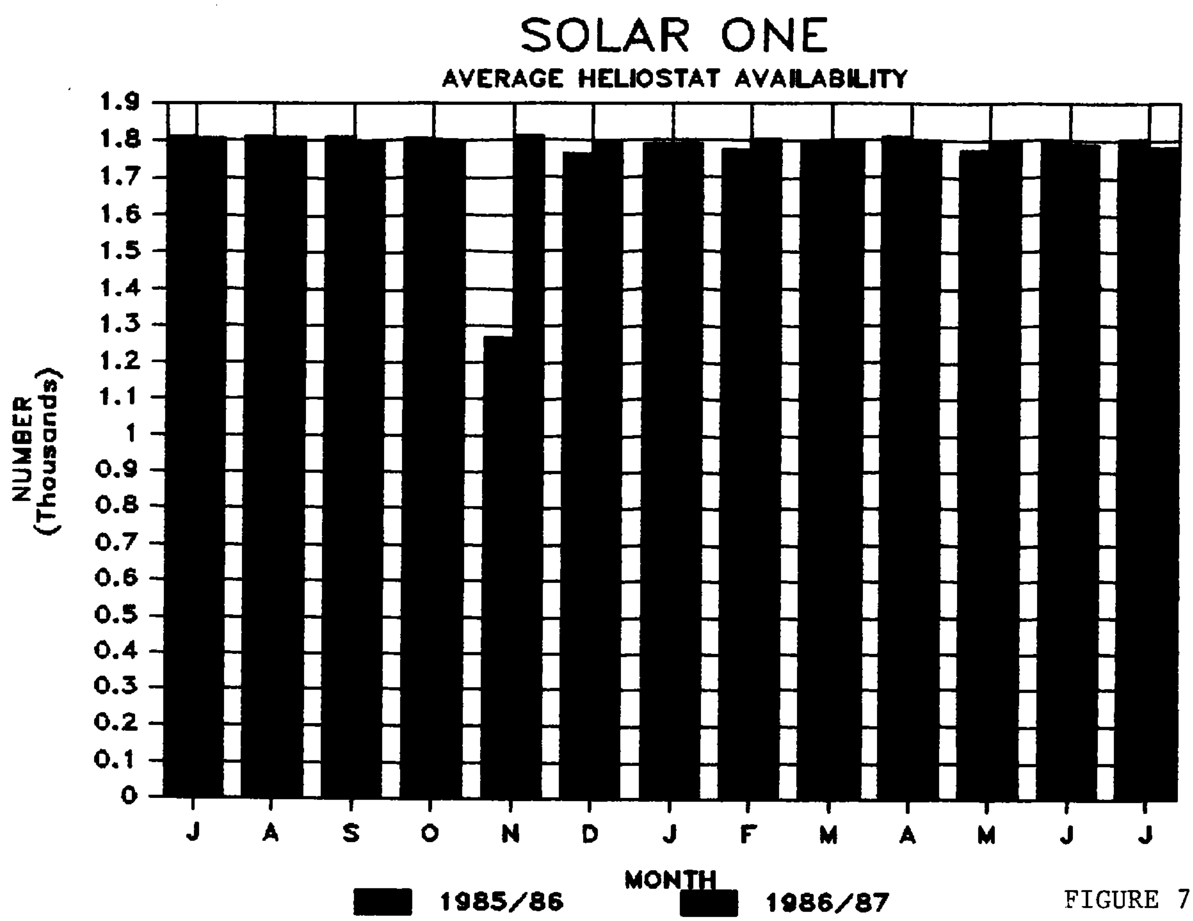


FIGURE 7

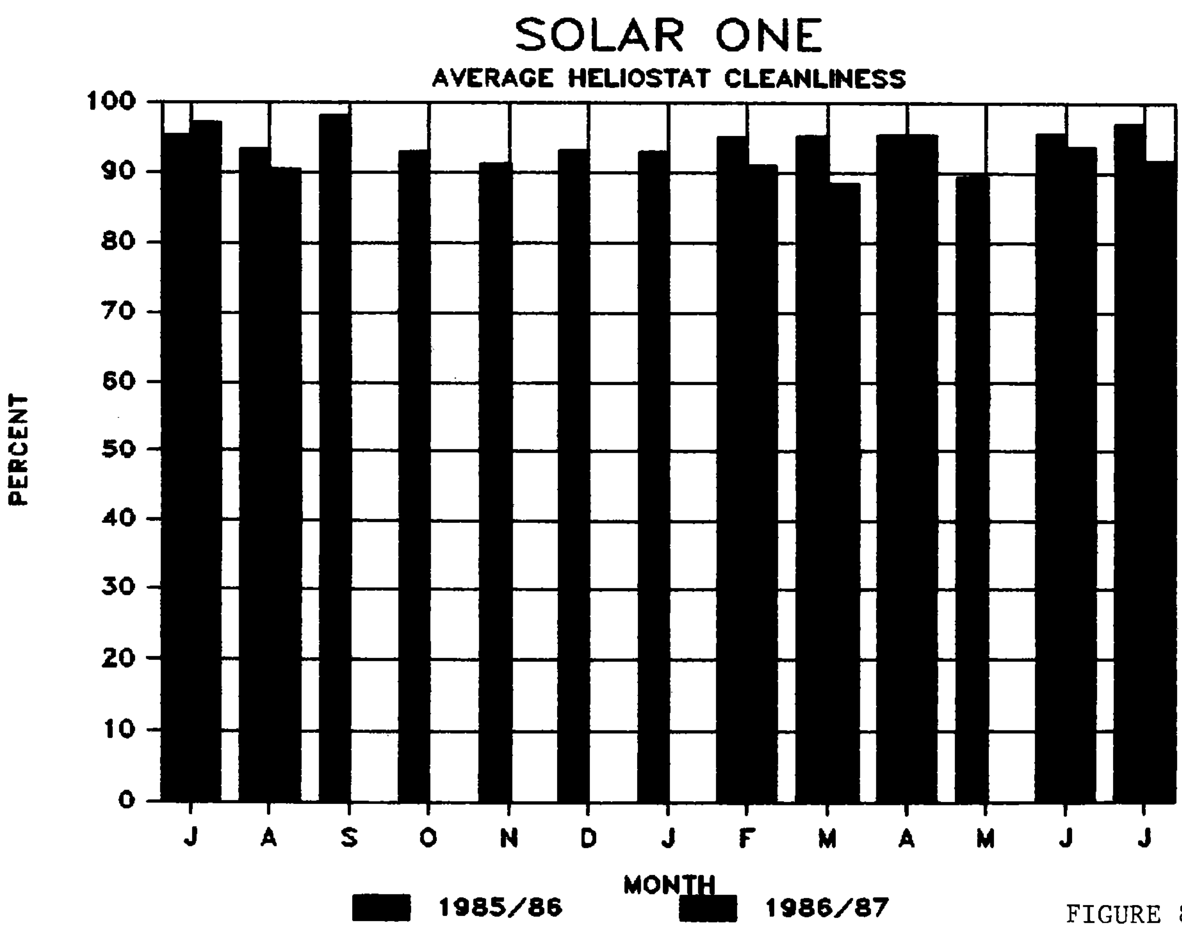


FIGURE 8

DOE/SF/10501-263
(STMPO 263) 8

SOLAR ONE
OPERATION & MAINTENANCE REPORT #63
June, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One generated 1,973.76 MWh (gross) and 1,443.16 MWh (net) during 262.13 hours of on-line operation in the month of June 1987. The plant produced 39.36% MWh (net) more than the previous June record. Solar One incurred 60.25 weather outage hours and was down for 30.90 hours for scheduled and unscheduled maintenance. Began chemically washing the heliostat field on Saturday, June 20, per a joint program developed by McDonnell Douglas Astronautics and SCE. As of June 30, 242 heliostats were chemically washed.

OPERATIONAL HIGHLIGHTS

- An early morning receiver leak inspection on Monday, June 1, revealed new leaks at panels 5, 9 and 14 prefilter gaskets, packing leak on panel 10 temperature control valve and instrument air filter leak on the preheat panel vent (AOV-2002).

- The unit was shut down early on Tuesday, June 2, to allow repair of a receiver panel 9 tube leak and to perform miscellaneous receiver maintenance (see Maintenance Highlights for details).

- Early morning inspection on Wednesday, June 3, found receiver panel 8 prefilter flange gasket to be leaking. Operators tightened the bolts and proceeded with the plant start-up at 0627 hours. Flux sensor "B" failed on panel 9 at 0704 hours. Operators reconfigured panel 9 control loop to use the panel 8 "B" flux sensor for its control. Because of limited flux sensor life and replacement expense, receiver panel flux sensors "A" are not now being replaced. It should be noted that at this time, both panels 8 and 9 were sharing the panel 8 "B" flux sensor. Solar One was on-line for power production at 0814 hours and off-line at 1658 hours due to low superheat steam on panel 9. Prior to the shut down, operators attempted flux gain changes on panel 8 to control its high metal temperature which may have been aggravated by excessive prefilter flange leakage.

- Plant start-up was aborted at 0509 hours on Saturday, June 6, due to heavy cloud cover. A second plant start-up was attempted at 0918 hours as cloud cover began to dissipate. The second start-up was aborted again due to clouds. Close proximity lightning strikes were experienced at 1305 hours and therefore, the collector field was placed at stow. A receiver red line unit (RLU) trip was experienced at 1420 hours. The collector field wash was suspended at 1430 hours due to lightning activity. Power dipped at 1436 hours, at which time the heliostat array controller (HAC) and all collector field communication lines failed over. At this time the remaining HAC was only communicating with 69 heliostat controllers. Also at this time, received erratic data on receiver multiplexers and on the weather satellite monitor. A second severe power dip was experienced at 1459 hours and all communications with the collector field was lost. Also lost "A" side of multiple variable control unit (MVCU C1-10). Rebooted HAC and reset alarms. Inspection of switch gear found the lightning arrestor counter to have incremented from 13 to 14. A third severe power dip was experienced at 1614 hours at which time the receiver and collector field power loss alarms were received. Receiver power loss RLU trip was experienced at 1617 hours. The receiver was transferred from line to the backup uninterruptible power supply (UPS) at 1641 hours. HAC's rebooted at 1800 hours with McDougal prime and Erin backup. On rebooting, communications was limited to 986 heliostat controllers. Accordingly, power was tripped and reset to the collector field at 1807 hours. This action recovered communications with all but 86 heliostat controllers.

- An early morning inspection on Sunday, June 7, revealed the following leaks; receiver panels 11 and 13 temperature control valve packing leaks, panels 11, 13 and 21 tube leaks and miscellaneous inspection plug leaks. Collector field was placed in rain wash position at 1946 hours and 17 received a forty-five minutes of light rain.

- An early morning start-up was aborted on Monday, June 8, due to receiver panel 21 temperature control valve packing being blown. While stroking the valve, the I/P failed. The I/P was replaced and the valve was repacked.

- Measurement of collector field sample heliostats, found the collector field to be 93.67% clean.

- The HAC failed over and the receiver feed pump tripped at 1541 hours on Friday, June 12, consequent to a momentary electrical system low voltage condition.

- Start-up was delayed on Sunday, June 14, when the interlock logic system (ILS) tripped the receiver feedwater pump. The communications line connector in the computer room's discrete logic unit was replaced with one from the thermal storage system (ILS-301). The unit was on-line at 1357 hours.

The unit tripped off-line due to low superheat caused by panel 12 temperature control valve going wide open. Placed the valve in manual and tried to close the valve but the valve did not respond. Replaced the valve positioner on Monday morning, June 15. The panel 12 prefilter and the receiver inline strainer were inspected and cleaned on Tuesday, June 16. The panel 12 temperature controller was also calibrated.

- Start-up was delayed on Tuesday, June 16, due to the electric auxiliary boiler electrical problem and panel 14 temperature control valve packing leak. The electric auxiliary boiler control power fuses (2) were replaced and panel 14 temperature control valve was repacked. The unit was on-line at 1132 hours. Receiver panel 12 prefilter was inspected on swing-shift to determine if it was causing flow restriction in that panel. The inspection found the prefilter to be clean. The control room elevator was removed from service pending repair of its hydraulic system.

- Troubleshooting of receiver panel 12 low flow anomaly was conducted on Wednesday, June 17, with the unit on-line. Up to this time, the receiver inline filter was cleaned, panel 12 prefilter was inspected and found clean, and the panel 12 controller was recalibrated, in an effort to identify and correct the problem. Following flow tests on swing-shift, and subsequent days, it was determined that the special valve trim installed in panel 12 was the flow limitation. Accordingly, this valve trim was scheduled for replacement with standard valve trim.

- An early morning receiver inspection on Thursday, June 18, confirmed a tube leak on tube 70 on panel 9 and leakage at its prefilter. It was also noted that preheat vent valve (AOV-2007) air prefilter was leaking air and that panel 13 had a tube leak (top west side). Turbine drains 617, 904 and 941 were closed at 1247 hours and load increased 0.2 MW. These drain valves were then scheduled for repair.

- The second, or backup, turbine lube oil pump has in the past years operated routinely in parallel with the prime lube oil pump. Investigation of the turbine lube oil problem on Friday, June 19, found the lube oil pressure controller to be set at 32 psi rather than 25 psi. Consequently, the second (backup) pump started automatically to hold the higher than design setpoint pressure. The lube oil pressure controller was reset to 25 psi on the following Monday. It should be noted that the pressure controller indicates in english units and the turbine oil header in metric units (Refer to June 22 Maintenance Highlights for further details).

- Closed the steam dump valve at 1256 hours on Sunday, June 21, and noticed a load increase of 0.5 MW. Also suspect that the receiver moisture seperators drain valve may be leaking through. Maintenance was notified to recalibrate the steam dump valve controller.

- Start-up was delayed on Monday, June 22, when panel 12 temperature control valve failed wide open and would not close in manual. Replaced the valve positioner and the unit was on-line at 1248 hours. The temperature setpoint was increased to 820 degrees F on Tuesday, June 23, to provide some measure of control. (See Attachment 1 for more details).

- During the early morning receiver inspection Tuesday, June 23, operators reported that the panel 9 external leakage is continuing to get worse. Solar One was on-line for power production at 0744 hours and off-line at 1737 hours due to clouds. At midday, receiver panel 12 temperature control valve was operating at a wide open position. To provide some measure of control, receiver panel 12 temperature setpoint was raised to 820 degrees F until declining insolation allowed operation to return to a normal cascade configuration on the control loop. The panel 12 adjustments at midday continued until the panel 12 valve trim was replaced with standard valve trim.

- Several new minor leaks were identified during an early morning inspection on Thursday, June 25; panels 11 and 16 temperature control valve packings, panel 13 prefilter, and panel 17 flowmeter flange.

- On Friday, June 26, receiver panel RB-12 was placed in receiver feedpump valve control loop to check its operating characteristics. The control logic was returned to normal at 2125 hours. Panel 12, while in active feedpump control, evidenced steady state feedwater pump speed control. Air compressor CP-901 began operating intermittently. It should be noted that this was the only operational air compressor and that its operation is essential for plant operation. Checked air compressor oil and water levels and found them to be normal. The discharge of service water on the air compressor's air cooler did not correct the problem. On filling the compressor oil reservoir to the maximum level, the low oil pressure alarms did not repeat. Service water was connected to the radiator and the drain valve cracked open on Saturday, June 27. The radiator air temperature dropped from 150 degrees F to 125 degrees F. At this time, the oil pressure increased from 27 to 30 psi. Subsequently, the compressor did not experience any trips.

- New receiver leaks were identified on Monday, June 29; panel 14 temperature control valve packing and prefilter, and panel 17 temperature control valve packing.

MAINTENANCE HIGHLIGHTS

- The following items were repaired during the unit's maintenance outage of Tuesday, June 2:

  1. Panel 9, elevation 4, exterior tube leak. Previously, two tube leaks at this location had been ground and weld repaired. It was determined that the lower leak had been previously repaired.

  2. The receiver feedwater bypass control valve (PV-2002) plug and seat were lapped because of severe plug and seat erosion. They will have to be replaced in the near future.

  3. Receiver panel differential pressure transmitter (PDTX-2332) pin hole leak in bonnet.

  4. Panel 10 temperature control valve packing.

  5. Panels 5, 9 and 14 prefilter flange leaks.

  6. Panel 17 flowmeter flange leaks.

  7. Panel 11 vent valve leak.

  8. Panel 9 inspection plugs 20 and 30.

  9. Panels 4 and 10 temperature control valve positioner and I/P were replaced and the inline instrument air filters were cleaned. To date thirteen of the eighteen temperature control valves have been serviced on swing-shift. Receiver panels 5-9 temperature control valves will be serviced on day-shift as plant operation will allow.

- Receiver panel RB-9 flux sensor "B" was replaced and receiver panel RB-8 prefilter leak was repaired on Wednesday, June 3.

- On Thursday, June 4, the thermal storage system flowmeter (FE-3105) was removed and a blank flange installed.

- Receiver panel 12 temperature control valve positioner and I/P were replaced at 0625 hours on Monday, June 15. Electric auxiliary steam boiler circuit breakers 13, 17 and 18 were replaced. Receiver inlet filter element was replaced on swing-shift to correct high receiver panel pressure differential which was restricting receiver panel flow.

- The flux sensor on panel 12 was changed from "A" (120 kWSM) to "B" (230 kWSM) at 0942 hours on Friday, June 19. The flux gain was changed from 1.5 to 1.35 to improve control response. Panel 14 temperature sensor was swapped from "A" to "C" thermocouple in order to correct erroneous red line unit (RLU) alarms.

- On Monday, June 22, the flange bolts on the west turbine lube oil pump were tightened. Adjusted turbine lube oil pressure regulator from 32 to 28 psi (cold oil) at the turbine front standard to correct auto start of the backup lube oil pump. Replaced I/P on receiver panel 12 temperature controller. Unplugged the cooling tower acid feed line. Inspection of the cooling tower sodium hypochlorite pump found internals to be corroded, the pump was declared out of service. Cleaned and calibrated the receiver drain controller (AOV-2901) to correct valve leakage to the receiver flash tank.

- PV-1001, steam dump I/P, was adjusted to correct 0.5 MW equivalent of steam bypass to the condenser on Tuesday, June 23. Circulating water pH meter was calibrated. Replaced turbine steam seal vapor extractor motor coupling which had failed.

Solar One Test Center
June 30, 1987

Memo for Record

Receiver Panel 12 Control Problem

In recent weeks during high insolation periods of 950 watts per square meter or higher, it was found that receiver panel 12 temperature control valve goes to 100 percent open. On June 15, heliostats were removed from panel 12 to control its metal temperatures. The following initial corrective measure was to clean the receiver inlet filter which was severely plugged. This effort, although improving flow regulation through all of the receiver panels did not restore acceptable control of receiver panel 12, i.e., its temperature control valve continued going full open during high level insolation periods. Temperature swings of 775 to 838 degrees F were observed. Maintenance then inspected the receiver panel 12 inline strainer since the flow problem appeared to be limited to panel 12. The inspection of the strainer did not find any contamination. Accordingly, the panel 12 temperature control valve and associated controls were cleaned, calibrated and the temperature control valve stroked. These subsequent efforts were unsuccessful in correcting the flow problem. In the interim operators have been increasing the panel 12 temperature setpoint from 775 degrees to 820 degrees F to keep its temperature control valve in a controllable range during high insolation periods.

Al Baker, Sandia National Lab, reviewed receiver operation and found that the valve was also found to have gone fully open on June 18, 1987 while the station was performing its annual summer solstice test. This review indicates that the receiver panel 12 flow characteristics to include the temperature control valve have not changed significantly in the last year. Comparison of valve lift vs flow for the present operation compared to its operation last year were found to be similar. It should be noted that during last year's summer solstice test receiver operation was upgraded to 850 rather than the present 775 degrees F receiver outlet temperature. The consequence being less steam flow for the same insolation value during last year's operation. Consequently, it was not necessary to remove heliostats from panel 12 during last years summer solstice test program.

It is not, however, certain that panel 12 may not have been experiencing a flow problem a year ago. It is therefore planned to exchange valve trim between panels 12 & 13 and to compare panel flow characteristics before and after the exchange to determine if the flow control problem is panel or temperature control valve related. If the test finds that the flow problem is temperature control valve related, the valve trim in panel 13 will then be replaced with standard valve trim common to panels 11, 12 and 14.

C.W. Lopez
Site Manager

File: PANEL12 (13)

APPENDIX

- Solar One plant statistics and the performance summary for June, 1987 are presented in Table I.

- A summary of the O&M labor, material, contract, and other costs for the month of June, 1987 is shown in Table II. Expenses are categorized as follows:

Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	June 1986	June 1987	August 1984 To Date
Net Generation MWh	875.2	1443.2	25786.1
Gross Generation MWh	1288.3	1973.8	36400.4
Mode 1 Peak Output MW	10.6	9.7	11.7
Available Insolation MWh #	16003.1	15713.8	415669.4
Available Insolation Hours	318.9	313.6	8537.5
Power Production Hours	162.7	262.1	5122.6
TSS Charging Hours	14.3	0.0	395.9
Weather Outage Hours	47.1	60.3	3295.3
Scheduled Outage Hours	0.0	6.3	633.9
Unscheduled Outage Hours	121.9	24.7	1083.8
Weather Overlap Hours	7.5	1.0	484.8

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 90.2

Subsystem Availability:
Receiver 90.9
Collector 100.0
Turbine 99.3

Utilization Factor % 55.1

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 20.0

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 9.2

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF JUNE 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	6.5	1.0	1.6	1.3	10.4
OPERATIONS	37.6	5.5	0.0	0.1	43.2
MISC. SUPPORT	0.4	0.0	3.7	0.3	4.4
MAINTENANCE:					
Supv/Indirects	5.2	0.1	0.0	0.1	5.4
Control System	4.1	0.1	1.5	0.0	5.7
Receiver System	3.1	0.2	0.4	0.2	3.9
Thermal Str. Sys.	0.0	0.0	0.0	0.0	0.0
Collector System	29.5	2.4	0.0	1.2	33.1
EPGS System	1.9	1.6	0.0	0.0	3.5
Miscellaneous	1.1	3.8	1.7	0.0	6.6
TOTAL MAINTENANCE	44.9	8.2	3.6	1.5	58.2
SUBTOTAL	89.4	14.7	8.9	3.2	116.2
Division O.H.					16.5
TOTAL DIRECT:					132.7
Workman's Compensation					0.6
Payroll Tax					6.5
Pension & Benefits					18.9
Administration & General					25.8

GRAND TOTAL.. 184.5

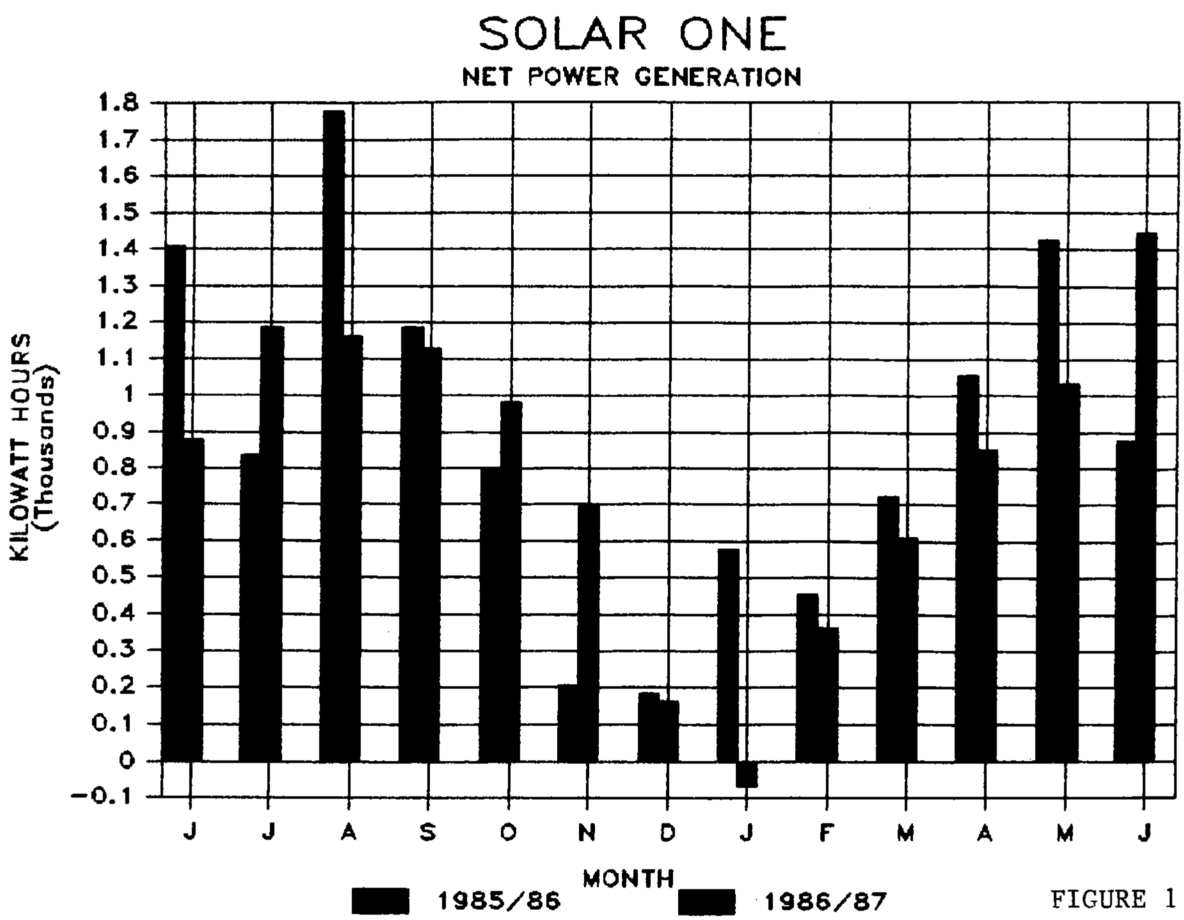


FIGURE 1

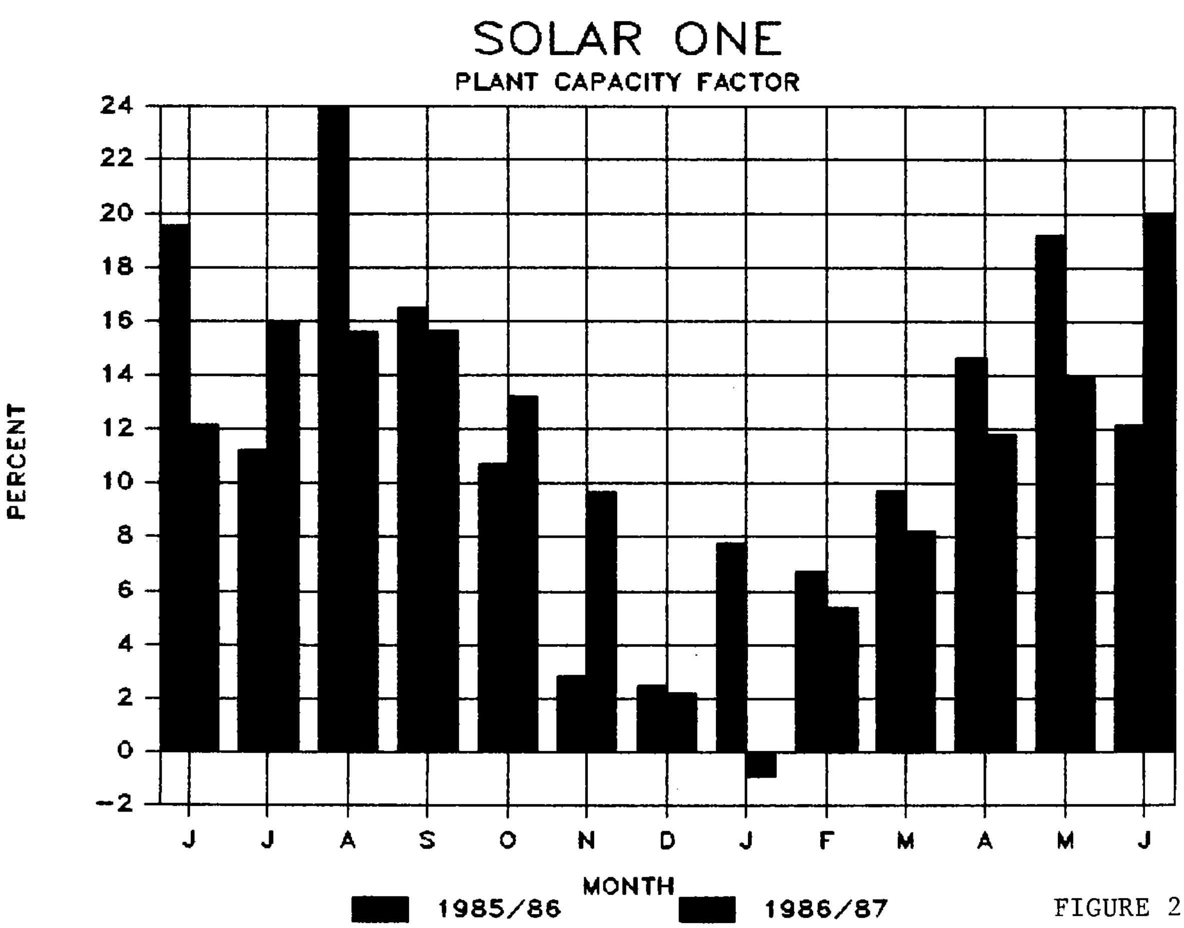


FIGURE 2

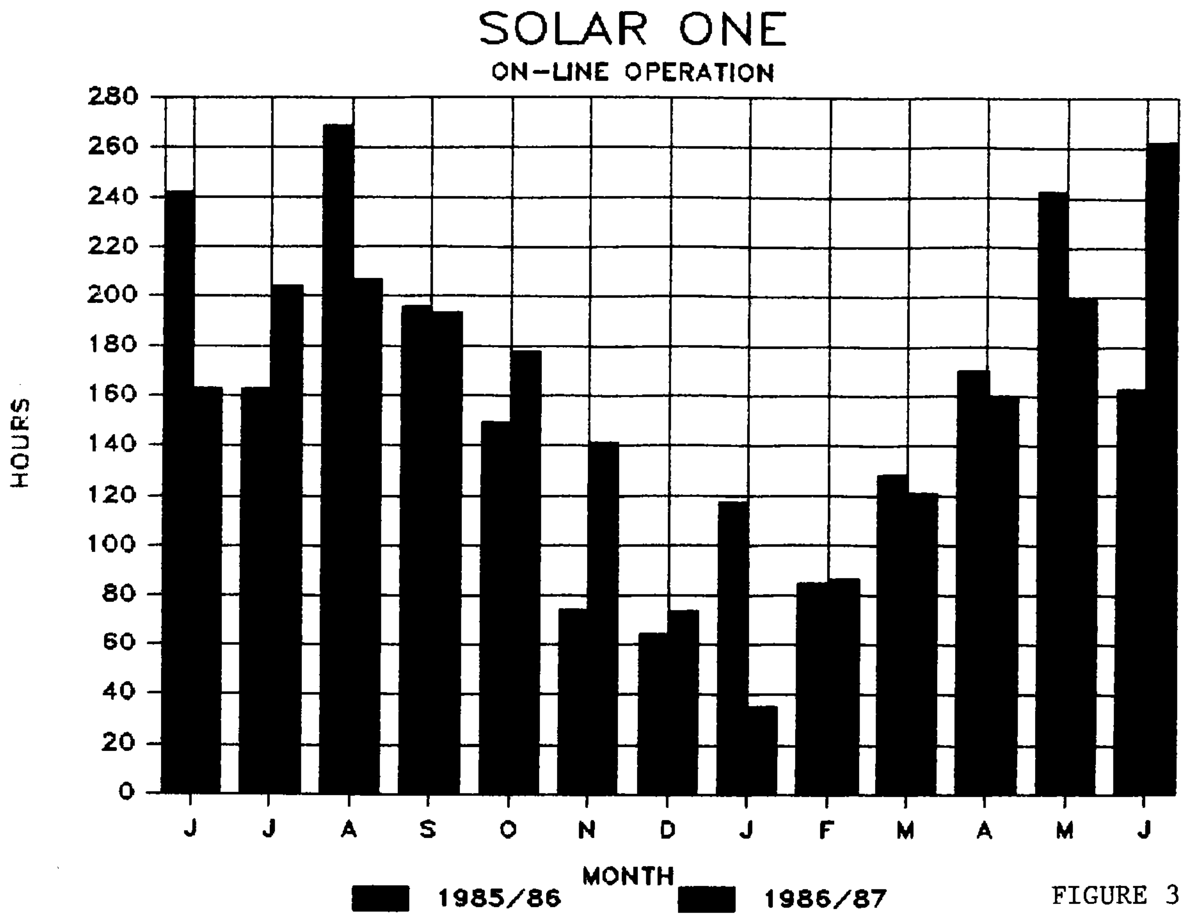


FIGURE 3

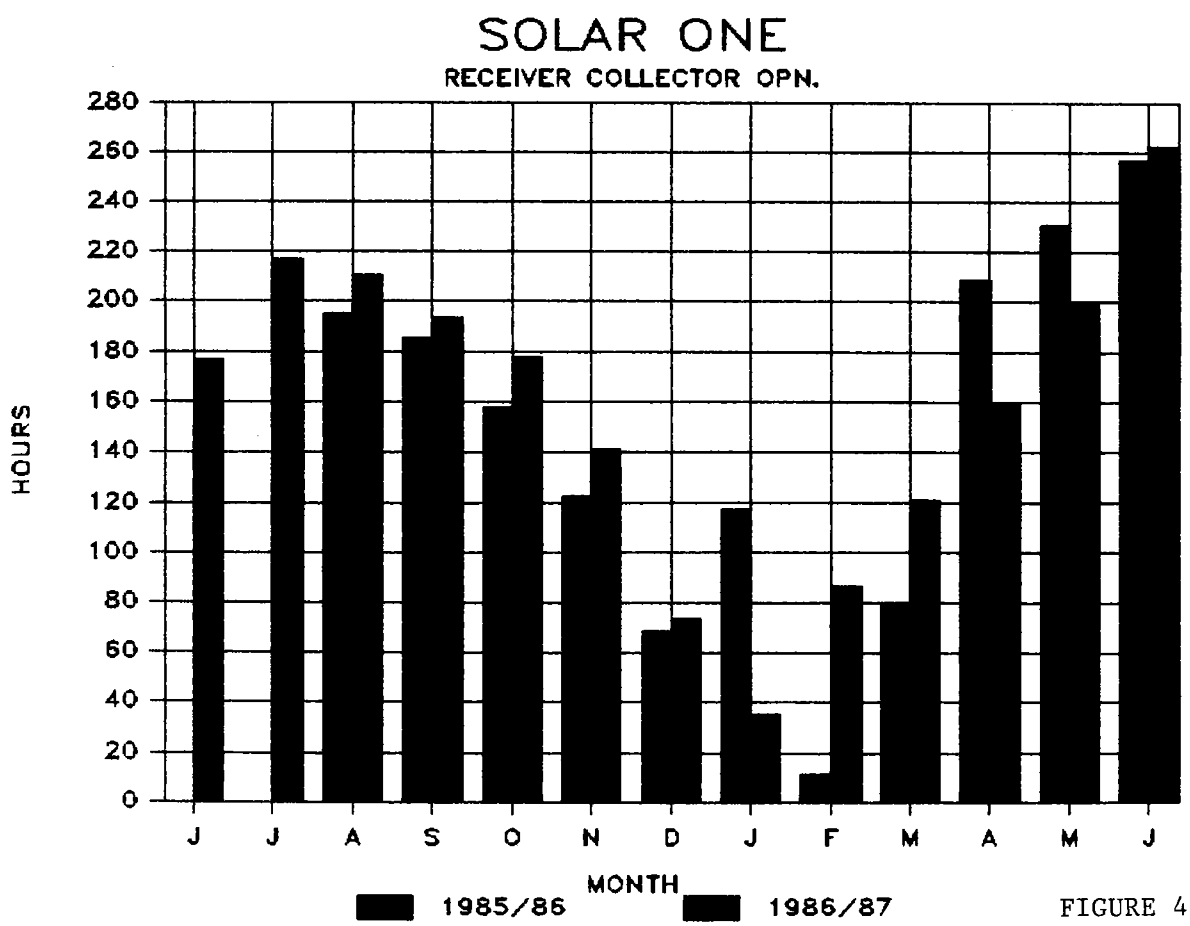


FIGURE 4

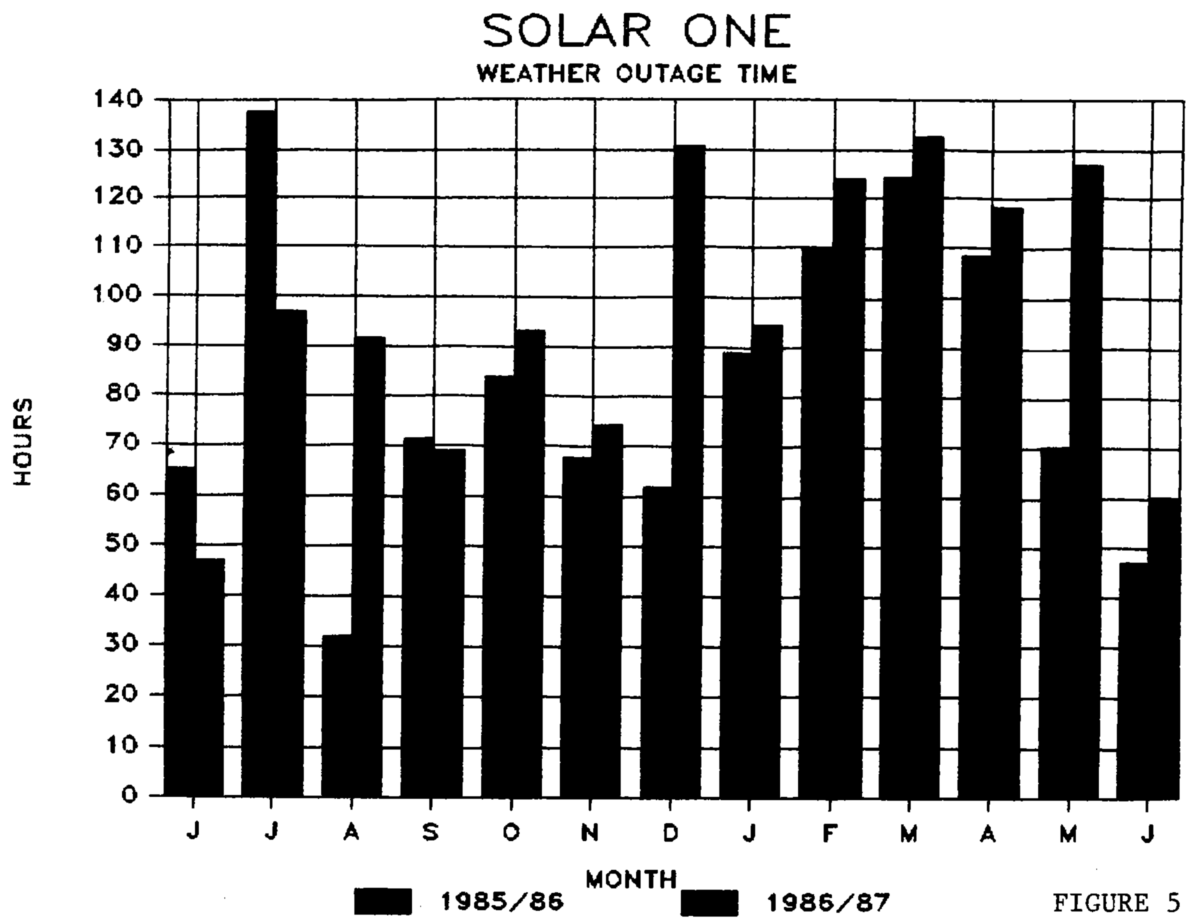


FIGURE 5

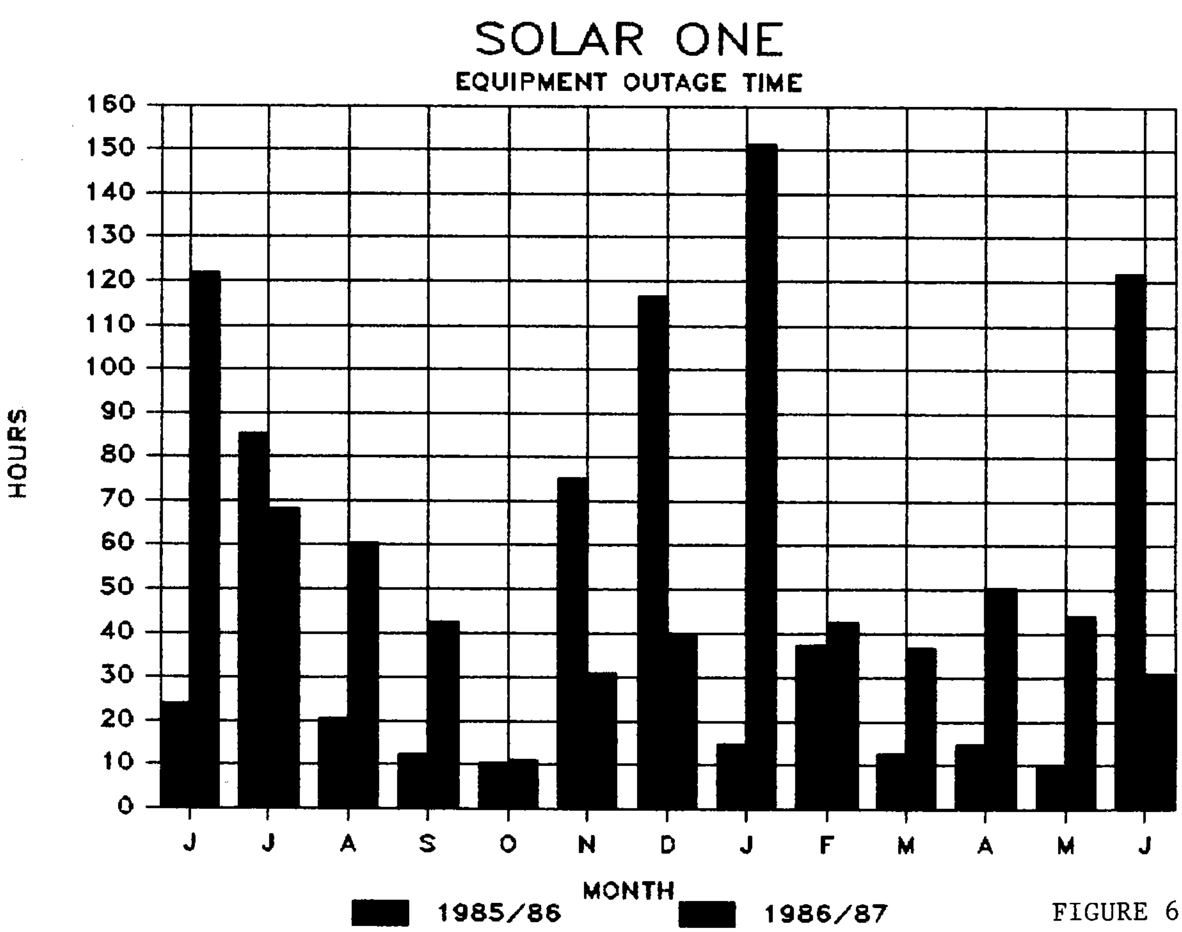


FIGURE 6

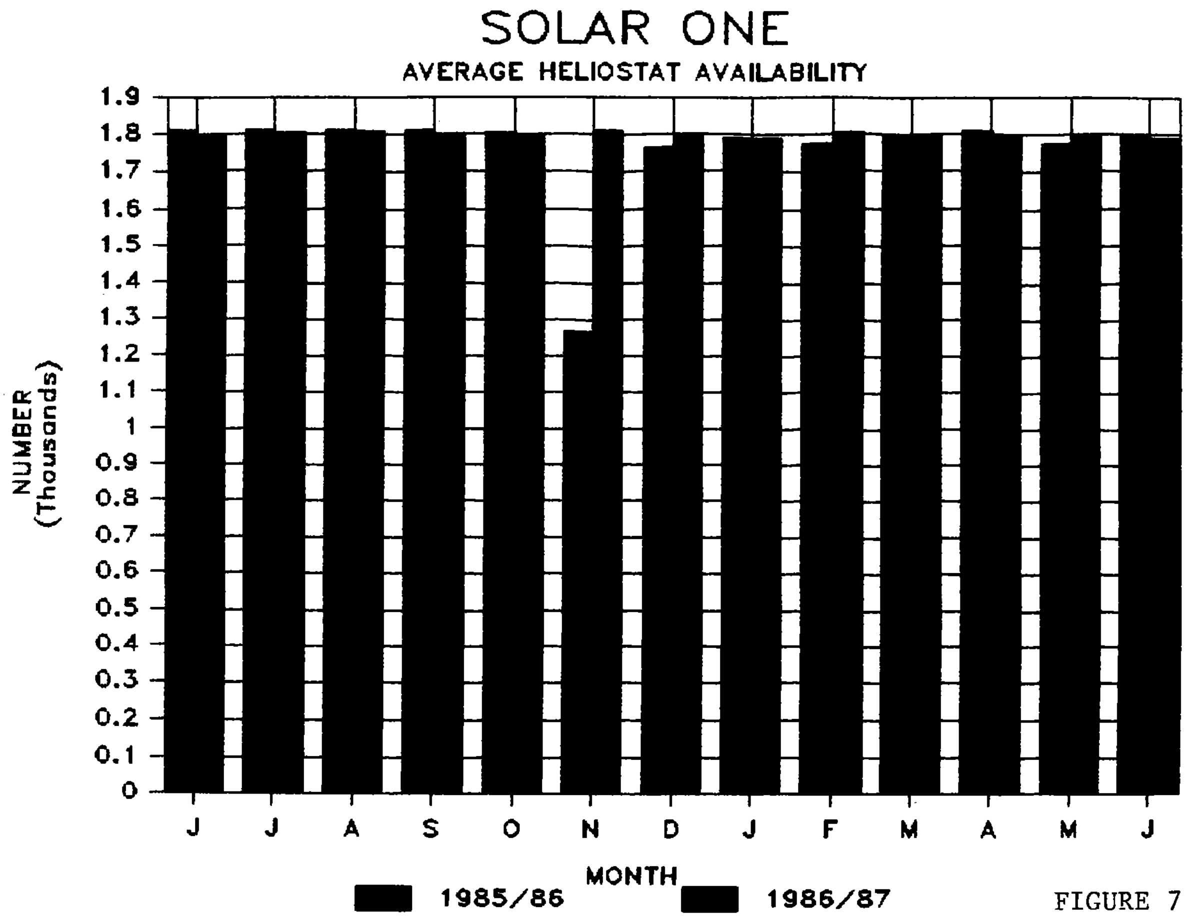


FIGURE 7

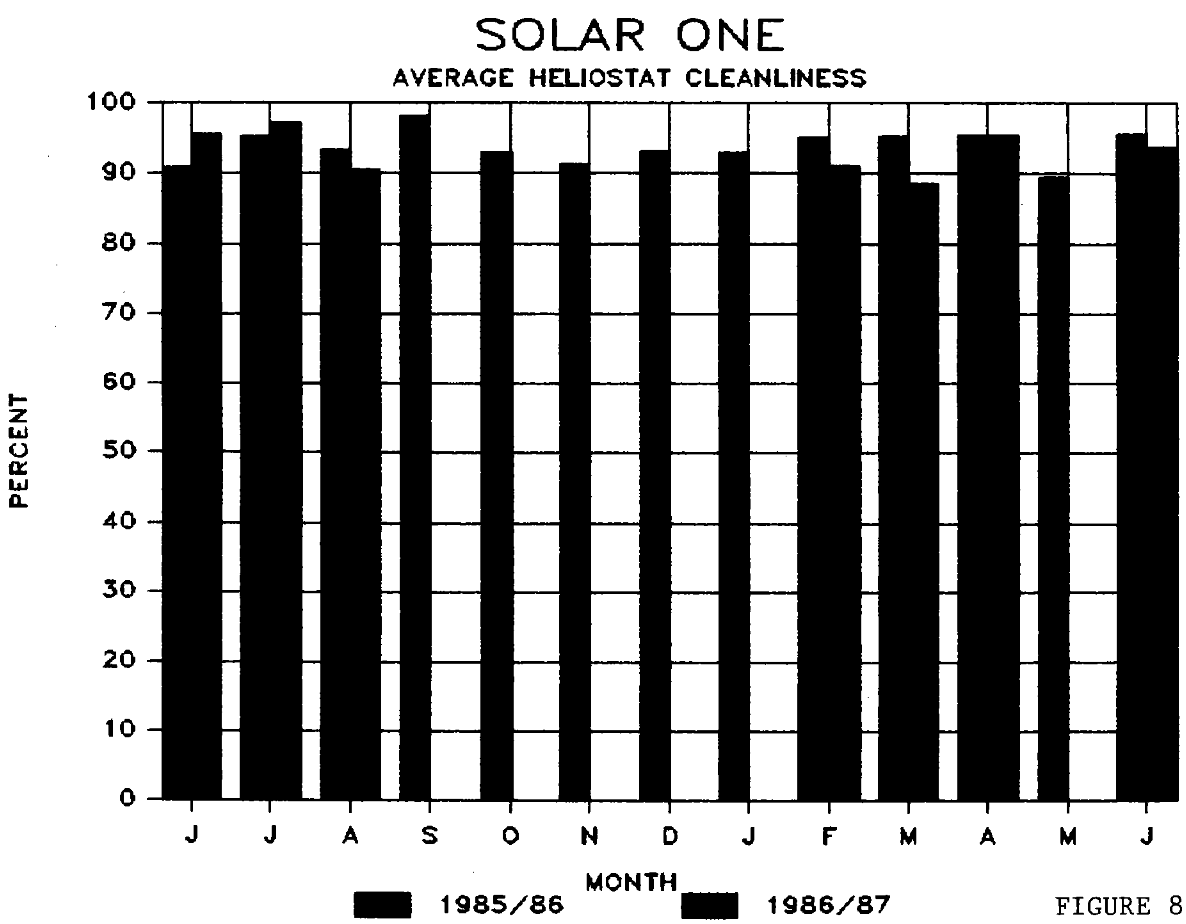


FIGURE 8

DOE/SF/10501-262
(STMPO 262)

SOLAR ONE
OPERATION & MAINTENANCE REPORT #62
May, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One generated 1,541.76 MWh (gross) and 1034.26 MWh (net) during 199.32 hours of on-line operation in the month of May 1987. The plant produced 37.96% MWh (net) less than the previous May record. Solar One incurred 127.13 weather outage hours and was down for 43.84 hours for scheduled and unscheduled maintenance. SCE announced its plans to continue Solar One's operation past July 31, 1987, the end of the present Five-year Cooperative Agreement between the Department of Energy and the Associates (refer to the attached press release).

OPERATIONAL HIGHLIGHTS

- Solar One tripped off-line on Friday, May 1, at 1147 hours due to high inlet pressure. Receiver panel 6 temperature control valve was found to be stuck closed. The valve would not open when placed in manual control. The positioner was replaced at 1345 hours.

  The flux gain on panel 4 was changed from 1.4 to 1.54 at 0935 hours. An hour later, the flux sensor was changed from "A" to "B" to correct the panel's temperature control problem.

- On Sunday, May 3, the receiver steam boot leg drains (LV-1015 and LV-1016) were opening and closing for no apparent reason. The level pots appeared to be normal. The boot leg drain block valves were closed at 1255 hours to stop erratic operation. At 1455 hours the air conditioner in remote station #2 (RS-2) was found not to be running. The thermostat was adjusted and the air conditioner came on and began cooling. The controls for boot leg drains LV-1015 and LV-1016 are located inside RS-2.

  The receiver feedpump in-board motor bearing was found to be running hot at 1500 hours. A portable air horn was placed near the bearing to reduce the bearing's temperature.

- On Tuesday, May 5, the receiver tripped at 0641 hours on a red line unit (RLU) indication of a 1200 degree F metal temperature on panel 21. Based on available insolation at this time (~ 476 watts per square meter), this was determined to be a false trip. All of the other receiver panels were at 400 degrees F or less. The trip was reset at 0645 hours and no other problems were encountered.

  Halted both Heliostat Array Controllers (HAC's) at 2005 hours to reestablish communication links with the Beam Characterization System (BCS). McDougal failed to reboot. Tried swapping disks with Erin, tried spare disk, and tried memory clear routine, but to no avail. After abandoning start-up attempts on McDougal, tried to boot Erin by itself. Erin's disk drive would not show a "ready" light. The disk speed sensor was pushed in but the "ready" light still would not come on, although the mainframe did boot up. As a result of this problem, plans were to operate with Erin prime without backup.

- Experienced HAC failures at 0443 hours on Wednesday, May 6. Attempted to reboot Erin three times but it was unable to communicate with the field via the ISC terminal. After a memory location change, both HAC's booted up at 0910 hours. The unit was on-line at 1053 hours.

- An early morning inspection on Thursday, May 7, found the following leaks; panel 4 temperature control valve packing, panel 6 pressure differential valve body, panels 11 and 15 outlet vent valve packing, two tube leaks on panel 9 on the expansion guide side and one leak on the flux side, preheat panel vent valve (AOV-2007) flange and air line filter, and nitrogen valve (AOV-2903) air line filter.

  Unable to accomplish any rain wash of the heliostat field on Thursday, May 7 and Friday, May 8 because of lightning and high wind gusts.

- Received a red line unit (RLU) trip at 0144 hours on Friday, May 8 for no apparent reason. Reset the RLU trip at 0146 hours. The cause of the trip is unknown.

  During the early morning inspection, the following leaks were discovered; panel 17 flowmeter downstream flange, panel 13 tube leaks at level 5 right-side, panel 11 manual vent valve, and panel 9 inspection plug #34.

  During the attempted plant start-up at 0859 hours, the receiver tripped due to passing clouds. Solar One was on-line for power production at 1105 hours and off-line at 1418 hours due to clouds. During operation it was necessary to decrease the receiver panel 15 gain twenty percent. Plant voltage excursions were experienced at 1505 hours and again at 1515 hours which caused shut down of plant operating equipment. At this time rain, erratic winds and close proximity lightning strikes were being experienced. Following the second voltage excursion and reboot of the heliostat array controller, control of the collector field was not possible in that only approximately 200 heliostats were communicating with the HAC's. Accordingly, power to the collector field center was toggled off and on. Toggling of the collector field 4kV circuit breaker at 1634 hours restored communications with all but 169 heliostats. Control of all but 39 heliostats was established by 2337 hours.

- An early morning receiver inspection on Saturday, May 9, found a tube leak on panel 16 level 4. Receiver panel 15 flowmeter failed at 0721 hours. This 30 GPM meter was replaced with a 24 GPM meter. Flow test of the meter at 1808 hours found that the meter would require additional calibration. The flowmeter work suspended operation for this day.

- Receiver panel 15 failed to toggle into temperature control at 0707 hours on May 10. On reconfiguring its control loop, the valve transferred to temperature control. The receiver panel 20 positioner failed at 0730 hours delaying the plant's start-up. Plant start-up was reinitiated at 1214 hours, following replacement of the receiver panel 20 temperature control valve positioner. Receiver panel 15 failed to transition into temperature control at 1254 hours. Operators cycled the temperature setpoint to force the valve into temperature control. Solar One was on-line for power production at 1400 hours and off-line at 1604 hours due to clouds. The collector field was rain washed for five minutes at 1725 hours. The rain wash, however, may not have been successful in that the heliostat reflective surfaces were then streaked with the dust that had accumulated during the previous windy days.

- Solar One did not operate on Tuesday, May 12, because of heliostat power center #1 transformer bushing had failed. Transformer oil leaking from the electrical bushing. Also, panel 19 temperature control valve was operating erratically.

- An early morning inspection on Thursday, May 14, found an air leak on the preheat panel vent valve (AOV-2007) air filter and a stem packing leak on receiver panel 6 temperature control valve. On rebooting OCS/DAS computer, Beckman CCM's went off-line at 0435 hours. Reset of CCM's did not resotre communications. On reinitializing SDPC and rebooting OCS, communications were restored.

- The collector field was rain washed on Friday, May 15.

- Swapped in service air compressor from CP-902 to CP-901 at 0004 hours on May 16. CP-902 was removed from service pending correction of its high temperature operating problem.

- Start-up on Sunday, May 17, was delayed due to panel 17 temperature control valve failure. The positioner was replaced at 1200 hours and the unit was on-line at 1344 hours.

- Early morning receiver inspection on May 19 found the tube leak on panel 9 (tube 70) to be getting worse. This tube leak is on the flux side of the receiver tube.

- Review of receiver data found that the receiver panel metal temperature rates of temperature rise, exceeds design limitations when the unit is resynchronized to the system within minutes of a unit trip. Operating Memorandum 4-87 describes this condition and imposes restart limitations.

- The flux gain on receiver panel 21 was changed by 10% on Wednesday, May 20.

- Reported low 33kV voltage to Lugo Substation at 1455 hours on on Thursday, May 21. Lugo Substation reported that the 33kV voltage is unregulated and that the only way to correct the condition is to reposition the transformer tap changers (manually) at Gale Substation.

- On Friday, May 22, a low generator terminal alarm was received at 0945 hours. The distributed process controller indicated a drop to 12.2 kV with an immediate restoration to 13.5 kV. Comparing the distributed process controller (E1 5100) with the generator analog indicator found a discrepancy in generator terminal voltage. Test of the voltage found (E1 5100) to be correct. Accordingly, the operators were instructed at 1118 hours to adjust the generator excitation to maintain 13.5 kV or higher, terminal voltage using E1 5100 as the reference voltage.

- Early morning inspection on Sunday, May 24, found the external leakage on tube 70 on receiver panel 9 to have gotten significantly worse. Plant start-up was delayed due to clouds. Unit on-line for power production at 0834 hours and off-line at 1228 hours due to clouds. Resumed tracking the receiver at 1250 hours but the receiver panels 6 and 18 temperature control valves failed to transfer to flow control. Tracking the receiver resumed again at 1328 hours. However, at 1349 hours it was necessary to defocus the collector field due to the fact that various receiver panels were toggling in and out of flow control. Transferred interlock UI-7299 from manual to auto at 1404 hours and resumed plant start-up. Solar One was on-line for power production at 1522 hours and off-line at 1830 hours due to declining insolation.

- Panel 9 inspection plug #34 leak was identified during the receiver inspection on Thursday, May 28. The inspection plug was replaced that day.

MAINTENANCE HIGHLIGHTS

- o Repaired the distributed process controller interface with the data acquisition system to allow archiving of process control data on May 1. Replaced receiver panel 6 temperature control valve positioner.

- o On Thursday, May 7, receiver panel 4 flux sensor "A" was replaced. also completed the following receiver repairs; repacked panel 4 temperature control valve, repacked panels 11 and 15 outlet vent valves, replaced flange gasket on preheat vent valve (AOV-2007), and repacked the drain valve on the main steam downcomer (LV-1013).

- o Panel 15 flowmeter was replaced on Saturday, May 9. A 24 GPM flowmeter replaced the 30 GPM flowmeter because a 30 GPM flowmeter was not available.

- o Replaced panel 20 temperature control valve positioner on Sunday, May 10.

- o On Monday, May 11, maintenance personnel reported oil leaking from a electrical bushing on the collector field power center #1 transformer. At this time, the transformer oil level was just above the minimum oil level setpoint with oil dripping continuously from the bushing. Collector field power center #1 transformer was cleared to correct oil leakage at 1739 hours. An effort to tighten the transformer bushing connection did not work. The transformer was returned to service at 2001 hours in an attempt to regain control of the collector field for a possible rain wash.

- o Receiver panel 19 temperature control valve positioner was replaced on Tuesday, May 12. Installed insulation on panels 9 and 11 at level 6 and panel 16 at level 5. Heliostat power center #1 transformer bushing was found cracked. Bushing was replaced and oil was added to the transformer on Wednesday, May 13 and the transformer returned to service.

  The west air compressor (CP-902) was over heating at 1655 hours on Wednesday, May 13. The water pump drive belt was replaced on Thursday, May 14, and the compressor was returned to service. Two employees from Shop and Test completed their four-week assignment, having overhauled 247 heliostat drive motors. Following a two-week break, four Shop and Test personnel will return to Solar One for an additional four-week period of heliostat drive motor repairs.

- o Diagnosed receiver trip anomaly and found loose trip wire which was repaired on May 15.

- On Saturday, May 16, the west air compressor (CP-902) was over heating again. The air compressor was removed from service until the problem could be found and resolved. Began repairing the air compressor radiator and pistons on Monday, May 18.

- Replaced the receiver panel 19 temperature control valve positioner. Maintenance personnel began working swing-shift to correct the problem with the receiver temperature control valve positioners on Tuesday, May 19.

From
Southern California
Edison Company

FOR IMMEDIATE RELEASE

SOLAR ONE TO OPERATE
UNDER REVISED SCHEDULE

In the interests of efficiency and economy, Solar One, the world's largest central receiver solar thermal generating station, will operate on a two-shift, five-day week power production schedule beginning Aug. 1, it was announced this week by Southern California Edison Company.

"The new schedule will allow Edison to reduce costs and still retain maximum benefit from the plant's output which closely coincides with the utility's afternoon peak-power needs," according to Bill von KleinSmid, a spokesman for SCE's Research and Planning Department.

The research facility, nearing the end of its five-year test program, is located on a 130-acre site at Daggett, near Barstow, Calif. It was completed in 1982 through a cooperative agreement by Edison, the Los Angeles Department of Water and Power and the U.S. Department of Energy.

During peak daylight hours, the plant produces 10 megawatts of electricity, enough for approximately 5,000 customers.

DOE contributed about $120 million for its construction, while Edison and DWP contributed $21 million. DOE has been paying $2.5 million yearly for operations and maintenance, with Edison paying $400,000 and DWP $100,000.

Under the new "bare bones" operating schedule, Edison has calculated the value of the electrical energy to be produced and compared it to SCE's expenses for operation and maintenance. The difference in these numbers

-MORE-will no longer be paid by Edison ratepayers as research costs, he said. For the year beginning Oct. 1, both DOE and the Electric Power Research Institute (EPRI) have agreed to pay the difference in O&M expenses and the value of the power produced.

Solar One is made up of a field of 1,818 heliostats (mirrors). Each heliostat has a solar collection surface of 430 square feet. Computers aim the sun-tracking mirrors to reflect sunlight onto a central receiver located 300 feet above the ground. The receiver-boiler absorbs solar heat, converting water to steam, driving a turbine to make electricity.

-- SCE --

APPENDIX

- Solar One plant statistics and the performance summary for May, 1987 are presented in Table I.

- A summary of the O&M labor, material, contract, and other costs for the month of May, 1987 is shown in Table II. Expenses are categorized as follows:

Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	May 1986	May 1987	August 1984 To Date
Net Generation MWh	1426.9	1034.3	24342.9
Gross Generation MWh	1908.5	1541.8	38374.2
Mode 1 Peak Output MW	11.2	10.0	11.7
Available Insolation MWh #	16045.1	12732.0	399955.6
Available Insolation Hours	318.0	265.3	8223.9
Power Production Hours	242.7	199.3	4860.5
TSS Charging Hours	20.4	0.0	395.9
Weather Outage Hours	70.5	127.1	323.5
Scheduled Outage Hours	2.8	4.5	627.6
Unscheduled Outage Hours	7.4	39.3	1059.1
Weather Overlap Hours	0.9	16.2	483.8

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 83.4

Subsystem Availability:
Receiver 89.0
Collector 94.4
Turbine 100.0

Utilization Factor % 51.9

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 13.9

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 8.1

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF MAY 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	3.9	0.1	1.7	0.0	5.7
OPERATIONS	38.0	2.7	2.3	0.1	43.1
MISC. SUPPORT	1.9	0.0	2.6	0.1	4.6
MAINTENANCE:					
Supv/Indirects	4.4	0.3	0.0	0.1	4.8
Control System	3.0	0.4	1.6	0.3	5.3
Receiver System	2.1	0.0	0.1	0.0	2.2
Thermal Str. Sys.	0.0	0.0	0.0	0.0	0.0
Collector System	20.4	1.0	0.0	0.1	21.5
EPGS System	1.3	0.1	0.0	0.0	1.4
Miscellaneous	2.0	2.1	0.0	0.0	4.1
TOTAL MAINTENANCE	33.2	3.9	1.7	0.5	39.3
SUBTOTAL	77.0	6.7	8.3	0.7	92.7
Division O.H.					11.9
TOTAL DIRECT:					104.6
Workman's Compensation					0.5
Payroll Tax					5.4
Pension & Benefits					15.9
Administration & General					20.3

GRAND TOTAL.. 146.7

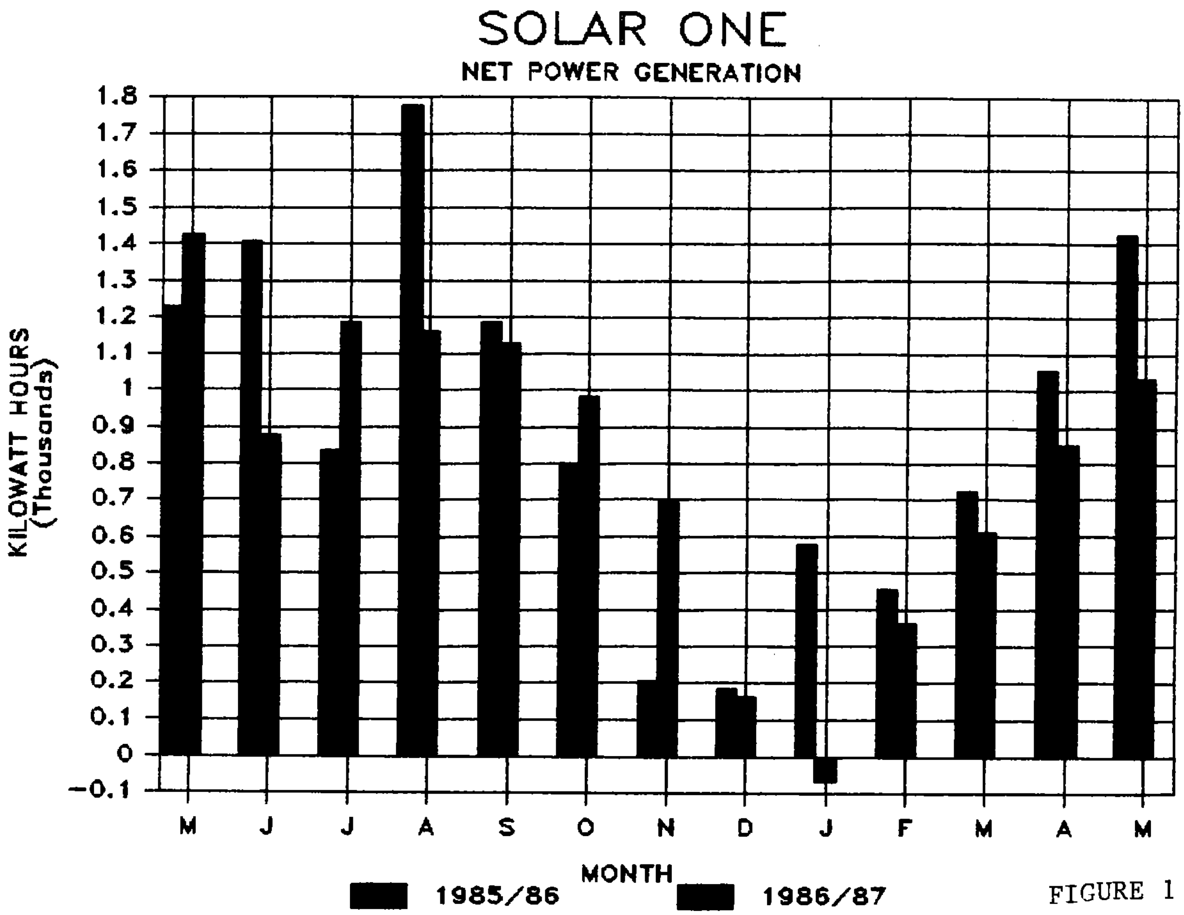


FIGURE 1

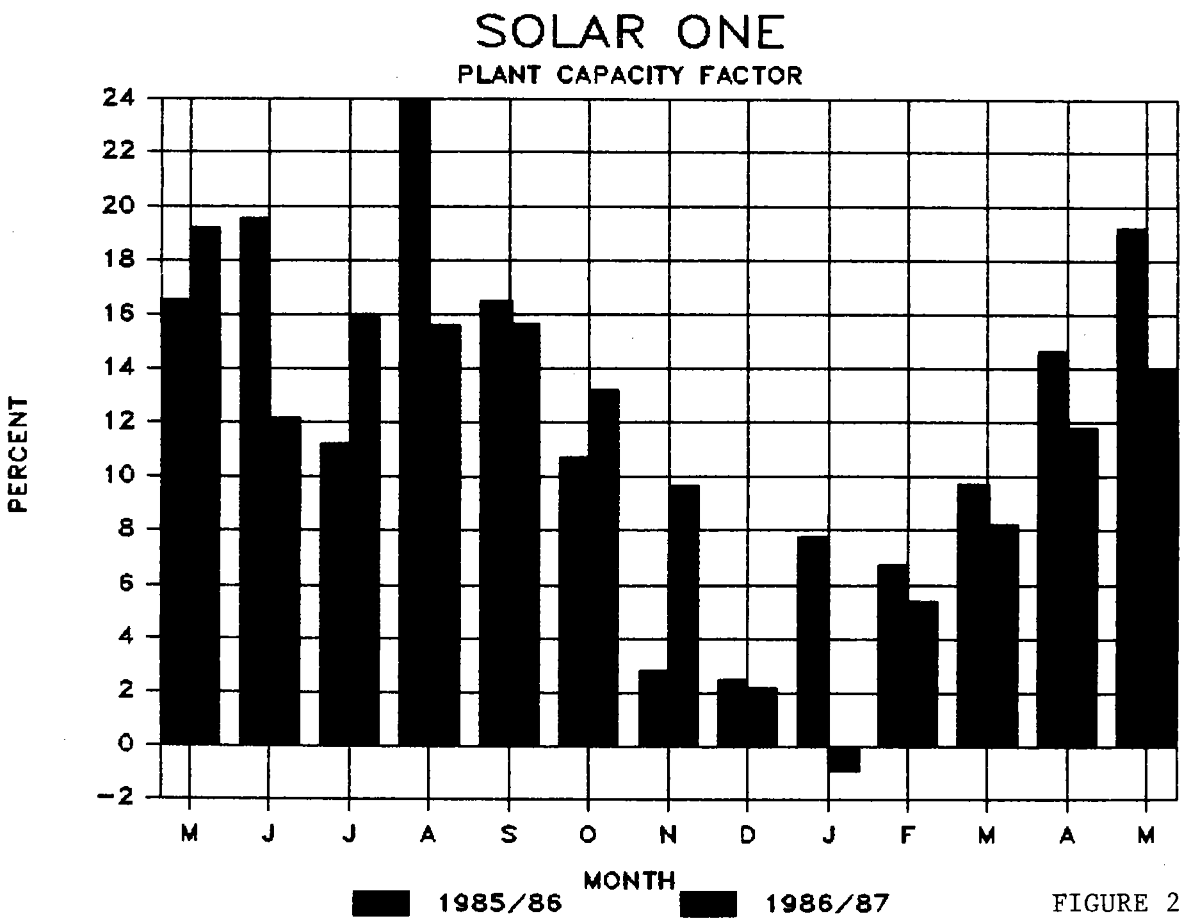


FIGURE 2

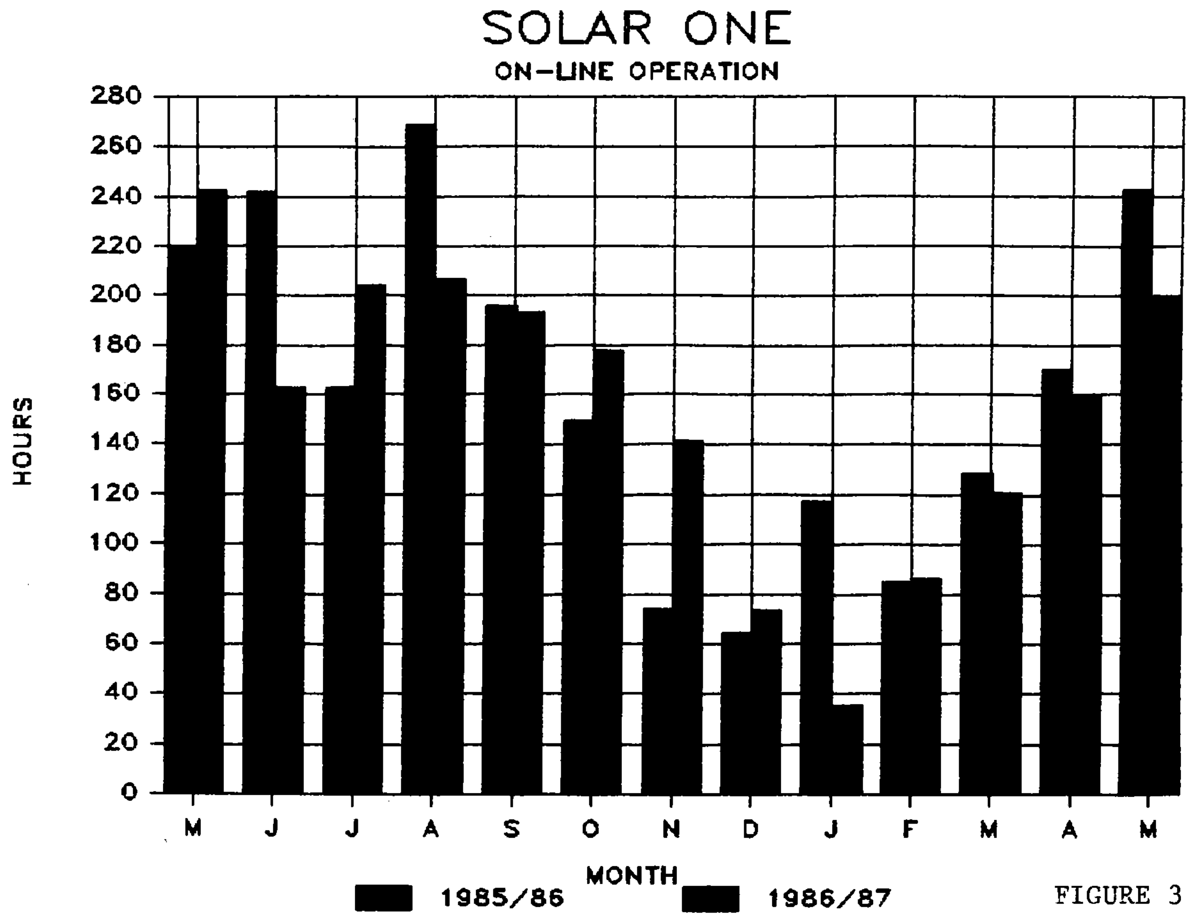


FIGURE 3

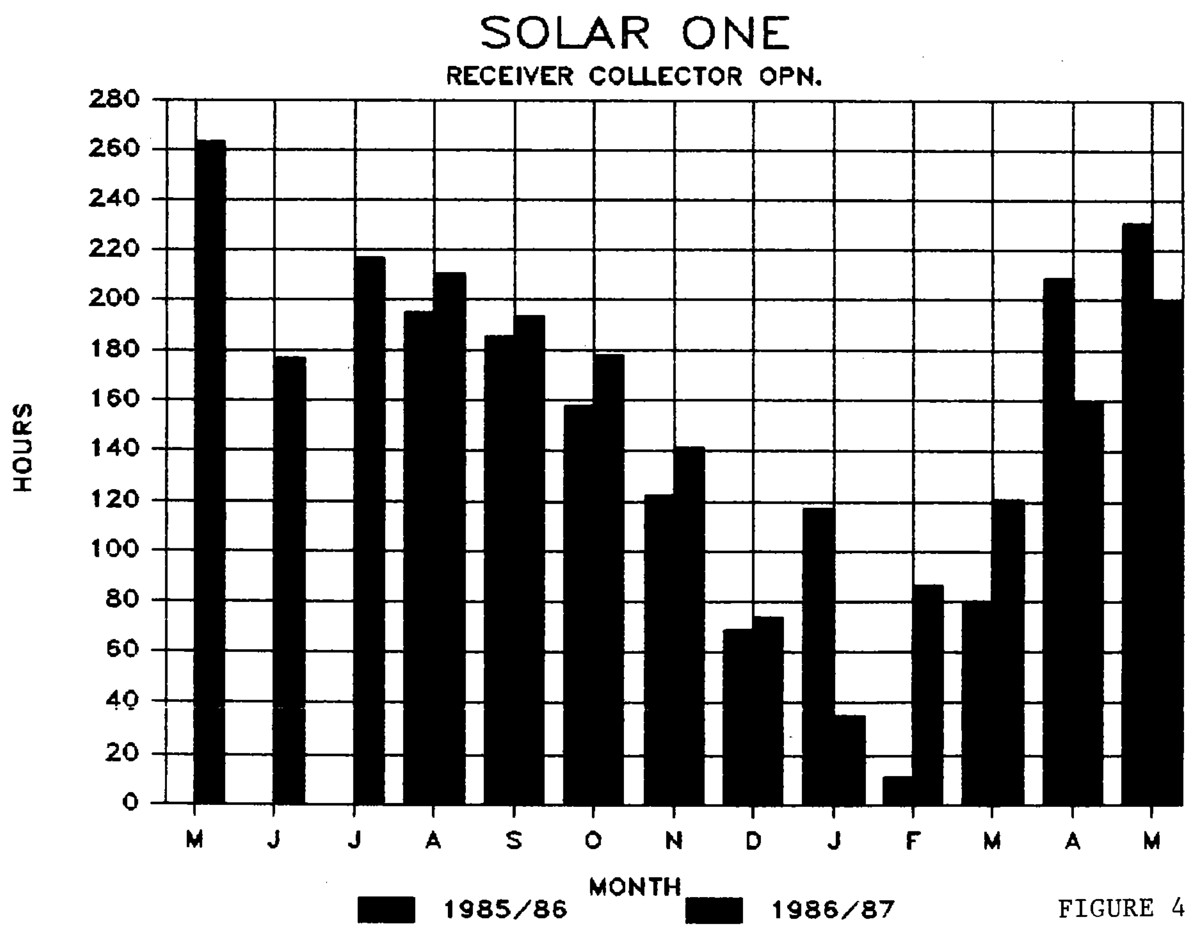


FIGURE 4

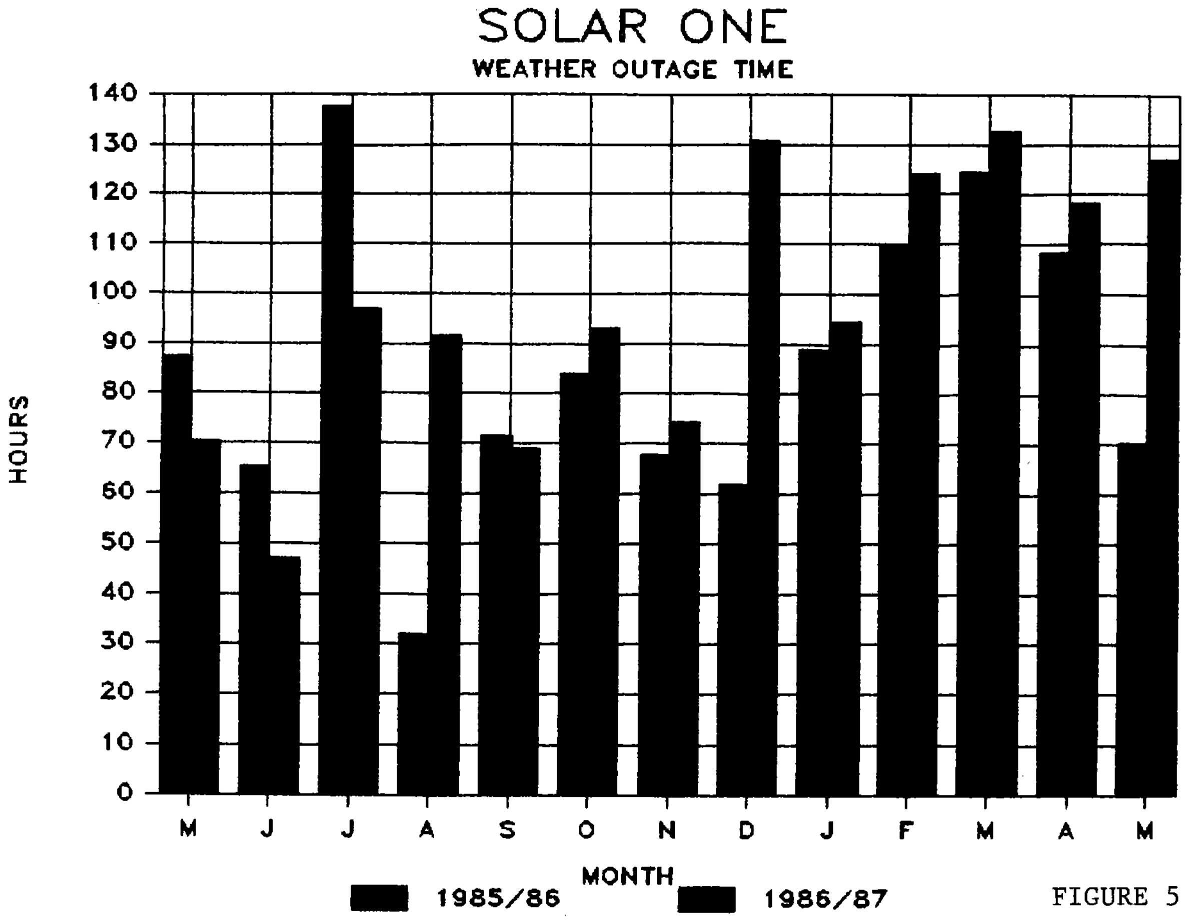


FIGURE 5

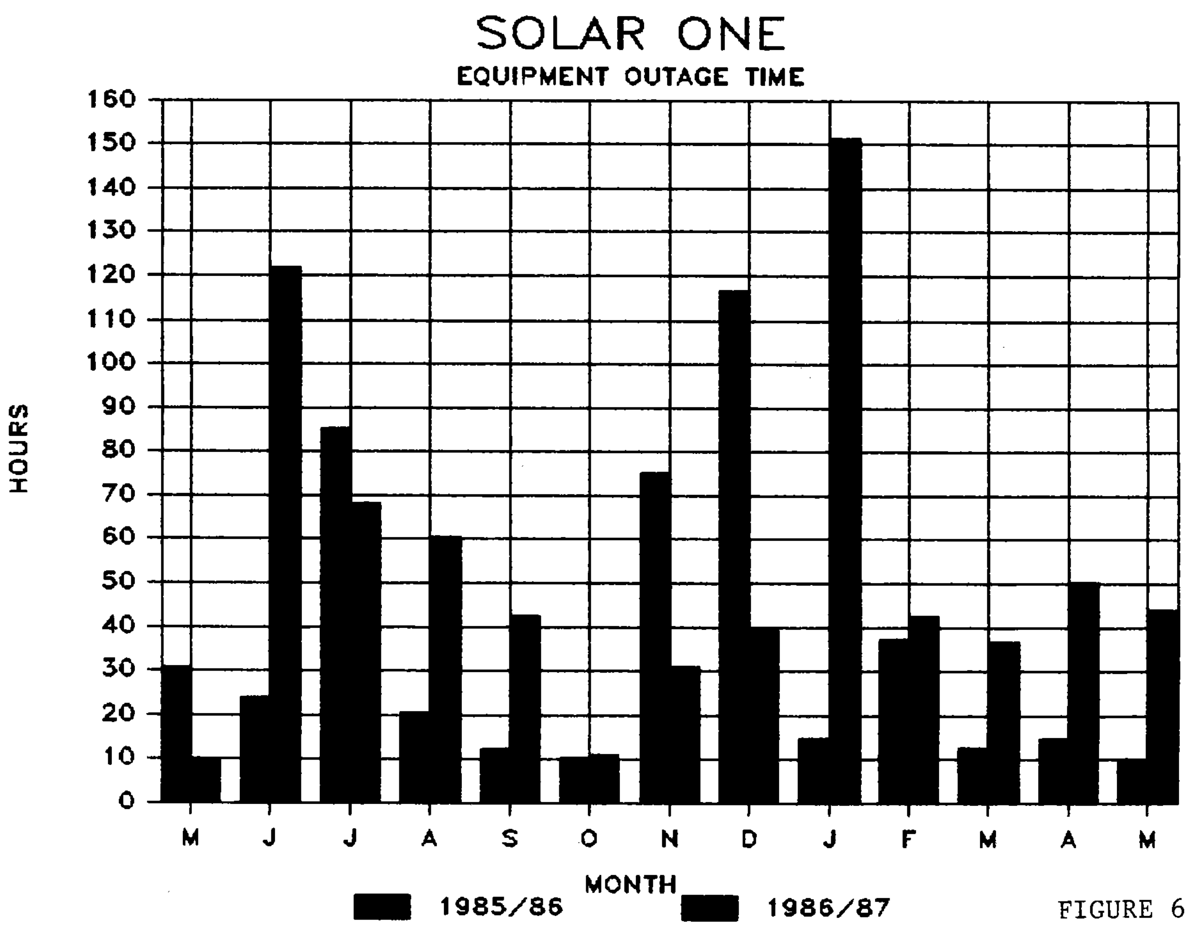


FIGURE 6

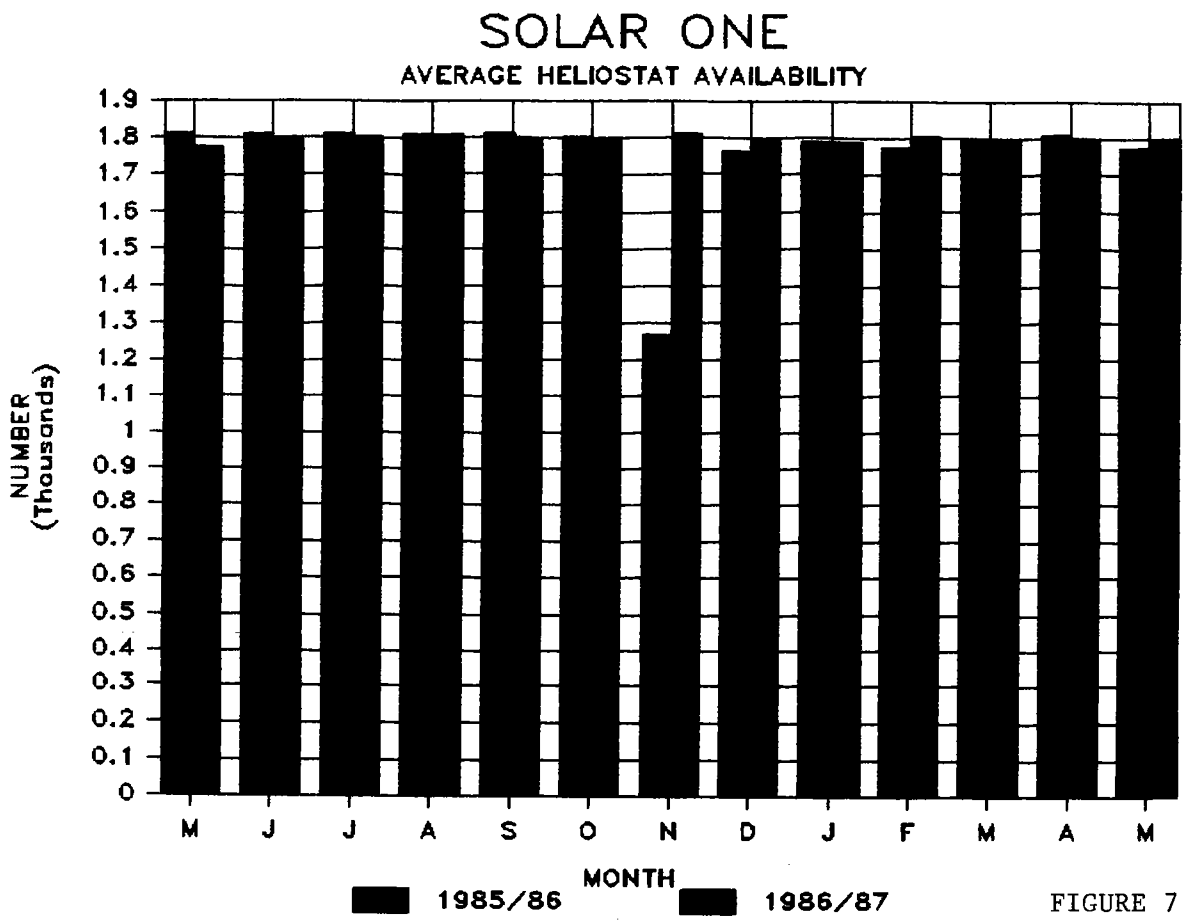


FIGURE 7

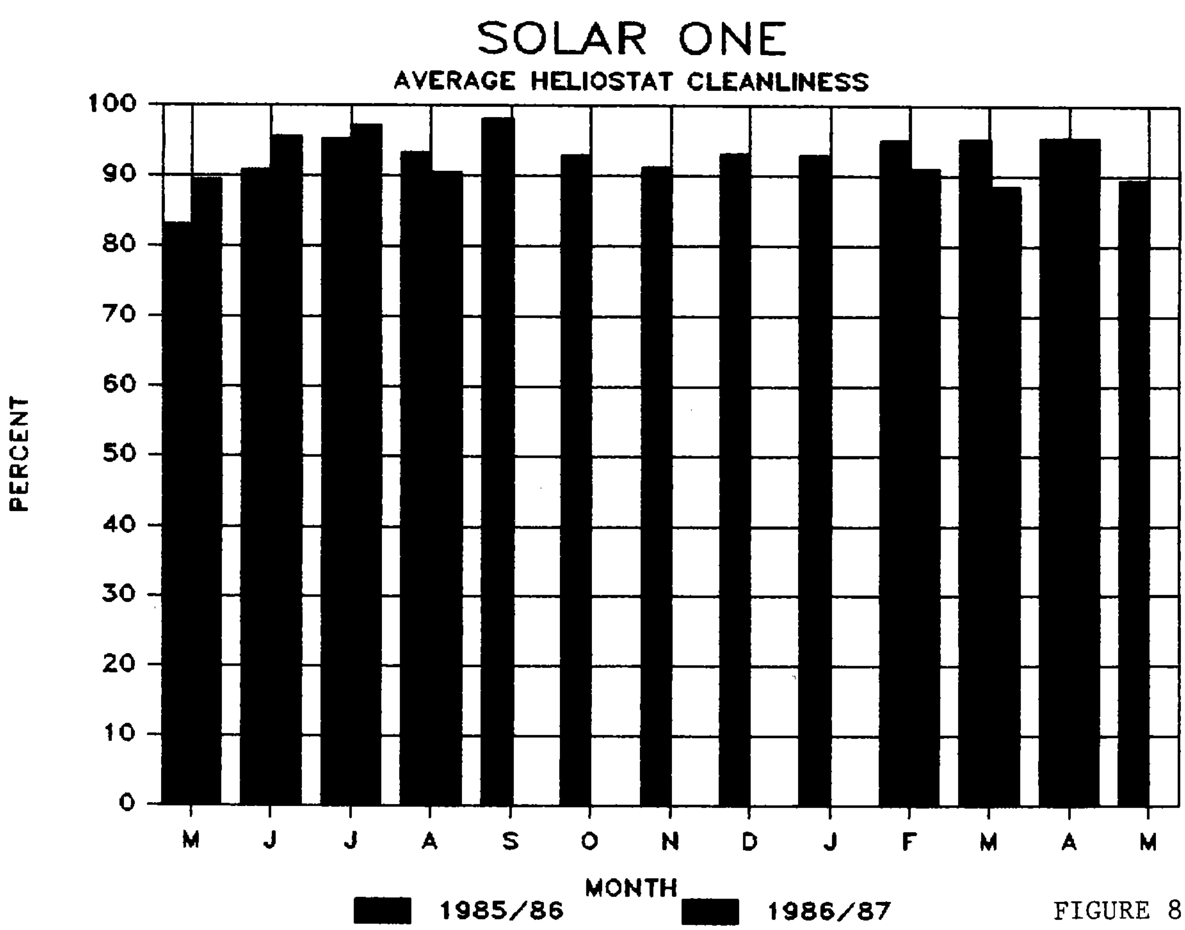


FIGURE 8

87-RD-73

DOE/SF/10501-261
(STMPO 261)

SOLAR ONE
OPERATION & MAINTENANCE REPORT #61
April, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One generated 1,315.20 MWh (gross) and 852.22 MWh (net) during 160.05 hours of on-line operation in the month of April 1987. The plant produced 24.07% MWh (net) less than the previous April record. Solar One incurred 118.08 weather outage hours and was down for 50.31 hours for scheduled and unscheduled maintenance.

OPERATIONAL HIGHLIGHTS

- On Wednesday, April 1, panel 5 flowmeter did not indicate flow. After impacting flowmeter, flow indication was reestablished.

- The Heliostat Array Controller (HAC) was rebooted eight times on Thursday, April 2, at which time maintenance personnel exchanged field communication links between both HAC's. The unit was on-line for power production at 1121 hours and off-line at 1655 hours because of clouds. The HAC's were rebooted and "Memory Clear" was performed several times on swing-shift to identify HAC anomalies. On completion of test, the HAC continued failing into the following morning each time commands were issued to the collector field.

- During start-up on Friday, April 3, receiver panel 15 flux sensor indicated "zero". Switched to flux sensor "A" to correct problem.

  On Friday, April 3, the following leaks were found: Feedwater inlet block valve (AOV-2004) bonnet leak, panel 5 temperature control valve packing leak, panel 6 temperature control valve upstream transmitter block valve had a hole in the body, panel 9 temperature control valve bonnet leak, panel 18 prefilter leak (also the positioner was blowing air constantly), panel 3 drain valve bonnet leak, and panel 22 inspection plugs #1, 3, 58 and 59.

- o Start-up was delayed on Saturday, April 4, and Monday, April 6, because operators were unable to command the collector field from either the Intelligent System Corporation (ISC) or the Chromatics terminals. Rebooted the Heliostat Array Controller (HAC); McDougal prime and Erin backup. Installed correct configuration code into the Texas Instrument printer and corrected the problem.

- o On Thursday, April 9, early morning receiver inspection found the following leaks; tube leak on receiver panel 11 at the right-side elevation 4, receiver panels 7 and 9 temperature control valves and receiver panel 15 prefilter.

- o Collector field communication lines 1 & 2 failed over at 0515 hours on Friday, April 10, while transitioning to the alternate #2 heliostat position. Early morning receiver inspection found a leak on the panel 15 prefilter. Solar One was on-line for power production at 0826 hours and off-line at 1551 hours because of a passing cloud. The unit was placed back on-line at 1557 hours and removed from service at 1818 hours because of declining insolation. Heliostat reflectivity readings were acquired on representative heliostats and they were found to be 95.4% of clean. It should be noted that a collector field wash was in progress at this time. Rebooted HAC's at 2113 hours with Erin prime and McDougal backup. The prime HAC failed at 2117 hours and the backup took over. At this time all prime communication lines failed over to the backup lines. Rebooted HAC with Erin prime and McDougal backup, and received continuous alarm messages. Rebooted HAC's again at 2155 hours with McDougal prime and Erin backup, with occasional no motion alarm being received.

- o On Saturday, April 11, the receiver inspection found leaks on the panel 16 flowmeter flange and on the panel 18 temperature control valve stem packing.

- o On Sunday, April 12, the temperature control valve on panel 12 went wide open. Increased the flux gain and removed 24 heliostats from the panel. The flux sensor was swapped from "B" (~200 kWSM) to "A" (~500 kWSM) and removed 19 more heliostats from the panel in order to regain temperature control of the panel. NOTE: Panel 12 temperature control valve has non standard valve trim for better low flow control. This valve is not in the receiver feedpump control loop.

- o Monday, April 13, found panel 21 temperature control valve bonnet gasket to be leaking. On Wednesday, April 15, panels 7 and 9 temperature control valve bonnet gaskets were also found to be leaking.

- o On Wednesday, April 15, panel 5 did not again indicate flow. After tapping on the flowmeter, flow indication was reestablished. Start-up was delayed due to low superheat on panel 12. The flowmeter was removed and inspected and no problems were found. The panel's prefilter was then removed and tested. The flow across the filter appeared to be normal.

- The east air compressor (CP-901) was removed from service on April 16, because it was not properly loading. The receiver preheat panel inline filter was replaced to correct receiver temperature control valve problems. Valves were going full open at less than design flow. Inspection of the replaced filter element found it to be plugged with iron oxide. Subsequent receiver operation found that the panel flow control problem was corrected by the maintenance action. The following day pressure differential indicator (PDI-2009) was reset to alarm at about 75 psi differential to allow early detection of inline filter flow restrictions. Oil was added to the west air compressor due to excessive oil leakage. The following day a defective compression fitting on the oil pressure sensing line was replaced to correct the oil leakage problem.

- Early morning receiver inspection on April 17, found the following leakage; (a.) panels 7, 11, 16, 17 and 21 temperature control valve stem packings, (b.) panel 9 flowmeter flange and, (c.) the boiler panel ring inlet header angle block valve. Receiver panel 5 lost flow indication. Impacting the flowmeter body restored the flow indication at 0627 hours.

- The receiver tripped on high inlet pressure on Saturday, April 18, during start-up. Panel 8 controller (FCM-2402) output was at 99%, but the temperature control valve was stuck closed. An investigation revealed that no instrument air was going to FCM-2402 controller. The supply was valved in and air filter blown down to no avail. The defective valve positioner was replaced later that day. The collector field was placed at the high wind stow position at 1930 hours due to wind gusts of 45-50 mph. After completing a collector field stow, mark, stow sequence at 2205 hours and commanding the field to high wind stow, communications were lost with both the ISC and Chromatics terminals. Computers were rebooted with McDougal prime and Erin backup without further problems.

- Early morning receiver inspection on Sunday, April 19, revealed the following leaks; panel 7 temperature control valve bonnet gasket, panel 9 temperature control valve packing, panel 11 tube leak, right side, fourth level, and panel 15 prefilter flange leak. While moving the collector field at 0018 hours on April 19, communications with the Chromatics terminal were lost. Rebooted HAC's at 0043 hours but lost communication with Chromatics again at 0131 hours. Chromatics was then powered down for five minutes. On reenergizing the Chromatics, the collector field operation was normal. Communicaiton with both the Chromatics and ISC terminals was then lost at 0545 hours and communication with the Chromatics lost repeatedly at 0626 and 0727 hours, in spite of successful HAC reboots. The plant proceeded with the plant start-up at 0841 hours, but the HAC's did not respond properly. Prior to tracking the receiver, it was necessary to impact the receiver panel 5 flowmeter body to establish a panel flow indication. A HAC memory clear routine at 1009 hours corrected the HAC problems. On tracking the receiver at 1159 hours the receiver tripped on high inlet pressure because of the panel 8 temperature control valve failure (valve went fully open). The panel 8 temperature control valve positioner was replaced at 1648 hours and unit was placed on-line at 1750 hours and off-line at 1850 hours. Communication with the collector field Chromatics terminal was lost again at 1950 hours. The OCS and HAC printers were exchanged at 2030 hours and successful HAC reboot completed at 2250 hours.

- The HAC Chromatics terminal lost communication with the collector field at 0545 hours on April 20. The plant proceeded with the start-up without the Chromatics terminal. The early morning receiver inspection found the receiver panel 6 temperature control valve stem packing to be leaking.

- Start-up was delayed on Tuesday, April 21, because panel 18 valve positioner would not close off the temperature control valve. The valve positioner was replaced.

- HAC software was modified by Phil Lane (SCE). Alarm processing was modified to disregard low priority processing, i.e., line errors, communication errors, etc. to improve HAC reliability.

- Phil Lane (SCE) forced a HAC failover for testing purposes at 0824 hours on April 26, to test the recent HAC software revision. The failover was successful and no accompanying line failovers were encountered. The plant start-up then proceeded without a backup HAC as a further test of the HAC software revision. The plant start-up was then delayed due to a planned trip test program by Lugo Substation. Subsequently, the station was notified that the trip test program had been cancelled. Pending this notification, maintenance reinstalled the receiver panel 11 elevation 5 expansion guide. This work was completed at 1021 hours. The start-up was then delayed to allow retorquing of the receiver inlet ring header angle block flange bolting. Passing clouds during the balance of the day precluded the plant's operation.

MAINTENANCE HIGHLIGHTS

- On Wednesday, April 1, daylight savings time was entered into the Beam Characterization System (BCS) and both Heliostat Array Controllers (HAC's).

- A loose wire was found on the Heliostat Array Controller (HAC) communication link at 2009 hours on Thursday, April 2, causing line failures whenever the prime HAC failed over to the backup HAC. The loose wire was reconnected.

- The following leaks were repaired on Friday, April 3; panel 5 temperature control valve packing leak, panel 18 prefilter leak, panel 3 drain valve bonnet leak, panel 22 inspection plugs leak (#1, 3, 58 and 59), and feedwater inlet block valve bonnet leak.

- Five tube leaks were repaired on Monday, April 6, on panel 9; three of the leaks were on the flux side and two of the leaks were internal, i.e., at expansion guide connections. Maintenance continued diagnosis of the heliostat array controller problems.

- On Tuesday, April 7, the cooling water shaft seal on air compressor CP-902 was replaced.

- The receiver panel prefilters on panels 12 and 15 were "swapped" on April 14, in an effort to determine the flow control problem being experienced on panel 12. As a comparison, panel 12 indicated 8250 lb/hr with its temperature control valve at 96% open, whereas panel 13 indicated 8100 lb/hr with its temperature control valve at only 56% open.

  Also on this day, the following receiver repairs were accomplished; panels 12 and 15 prefilter gaskets were replaced, panel 16 flowmeter gasket was replaced, panels 7 and 21 temperature control valve bonnets were replaced, and packing were adjusted on panels 4, 9 and 18 temperature control valves.

- A representative from the 3M Company was on site on Wednesday, April 15. The representative installed reflective film on four mirror facets on heliostat #2901. This heliostat also has four facets that are overlayed with an earlier version of the 3M Company reflective tape, which is now severely degraded.

- The generator collector ring brush that had been previously observed to be arcing was replaced at 0845 hours on April 17. The air loading solenoid on air compressor (CP-901-E) was replaced at 1501 hours. However, test operations at 1506 hours found the compressor to continue to be experiencing loading problems. Accordingly, the compressor was to be used in an emergency only.

- Air compressor (CP-901-E) was returned to service at 1433 hours on April 20, after replacing the air loading seal valve disk. Test operation of the air compressor after this repair was unsuccessful.

- The following receiver repairs were accomplished on Tuesday, April 21; panel 5 flowmeter was replaced, panel 9 temperature control valve bonnet gasket was repaired, panels 7 and 9 temperature control valve packings were repaired, and ring header bonnet gasket was repaired. Shop Services Instrument Division Motor Shop personnel arrived on station to repair collector field motors. They remained on-site for four-weeks and returned after a two-week absence for an additional four-week period.

- Thursday, April 23, panel 11 tube leak at elevation 5, right hand side was repaired. Reinstalled the receiver panel expansion guide at elevation 5 on Friday, April 24.

- Replaced turbine thurst bearing metal temperature transmitter on April 27.

APPENDIX

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Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	April 1986	April 1987	August 1984 To Date
Net Generation MWh	1057.3	852.2	23308.6
Gross Generation MWh	1476.5	1315.2	36832.4
Mode 1 Peak Output MW	11.0	11.0	11.7
Available Insolation MWh #	12800.0	11998.8	387223.6
Available Insolation Hours	258.7	257.1	7958.6
Power Production Hours	170.3	160.1	4661.2
TSS Charging Hours	10.2	0.0	395.9
Weather Outage Hours	108.3	118.1	3107.9
Scheduled Outage Hours	0.0	24.5	623.1
Unscheduled Outage Hours	14.8	25.8	1019.8
Weather Overlap Hours	2.6	12.1	467.6

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 80.4

Subsystem Availability:
Receiver 86.7
Collector 93.7
Turbine 100.0

Utilization Factor % 53.2

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 11.8

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 7.1

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF APRIL 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	6.1	0.1	1.3	0.6	8.1
OPERATIONS	43.3	5.2	0.0	0.2	48.7
MISC. SUPPORT	0.9	0.2	2.8	0.1	4.0
MAINTENANCE:					
Supv/Indirects	4.7	0.1	0.2	0.2	5.2
Control System	6.4	0.0	3.7	0.2	10.3
Receiver System	2.7	0.0	0.0	0.0	2.7
Thermal Str. Sys.	0.0	0.0	0.0	0.0	0.0
Collector System	10.4	2.3	0.0	0.0	12.7
EPGS System	1.7	0.3	0.5	0.0	2.5
Miscellaneous	2.1	2.8	0.4	0.0	5.3
TOTAL MAINTENANCE	28.0	5.5	4.8	0.4	38.7
SUBTOTAL	78.3	11.0	8.9	1.3	99.5
Division O.H.					11.9
TOTAL DIRECT:					111.4
Workman's Compensation					0.5
Payroll Tax					5.8
Pension & Benefits					18.2
Administration & General					18.6

GRAND TOTAL... 154.5

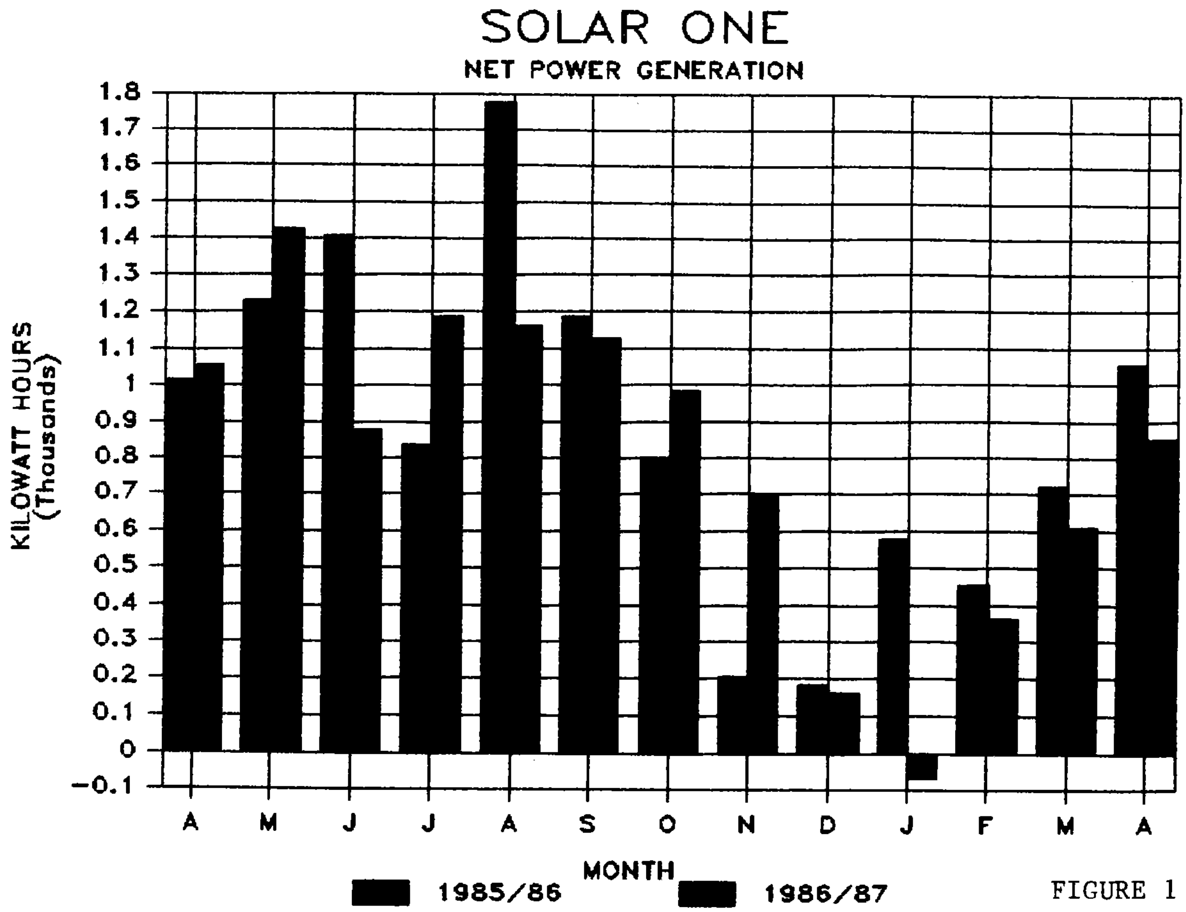


FIGURE 1

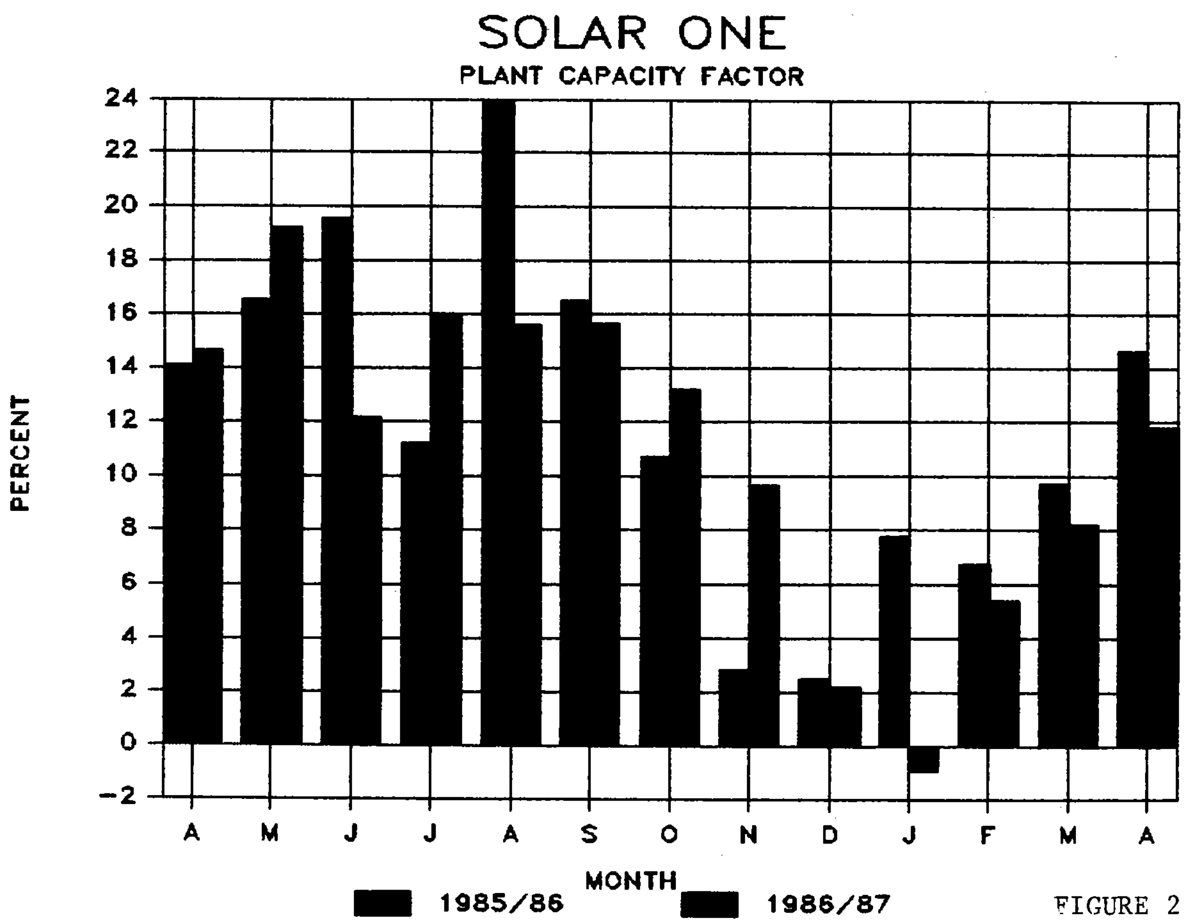


FIGURE 2

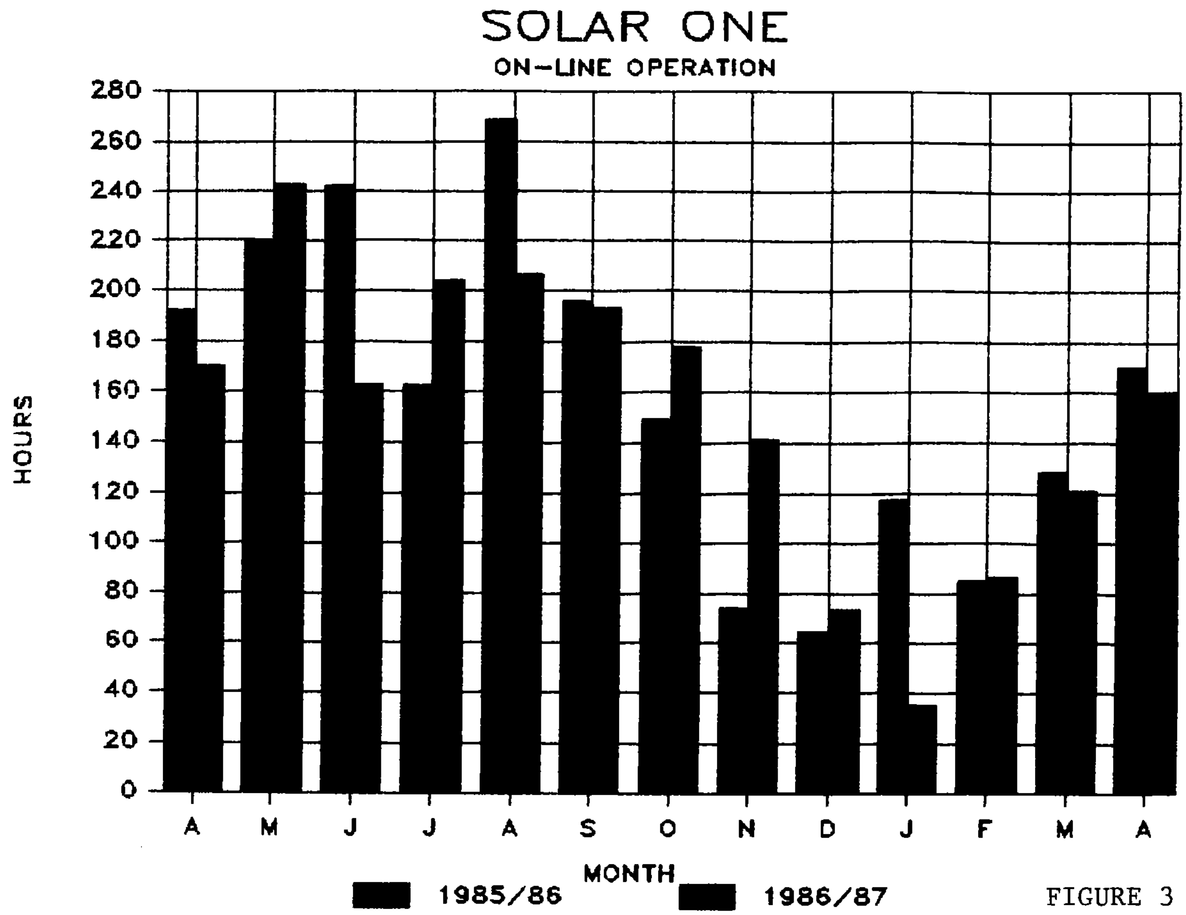


FIGURE 3

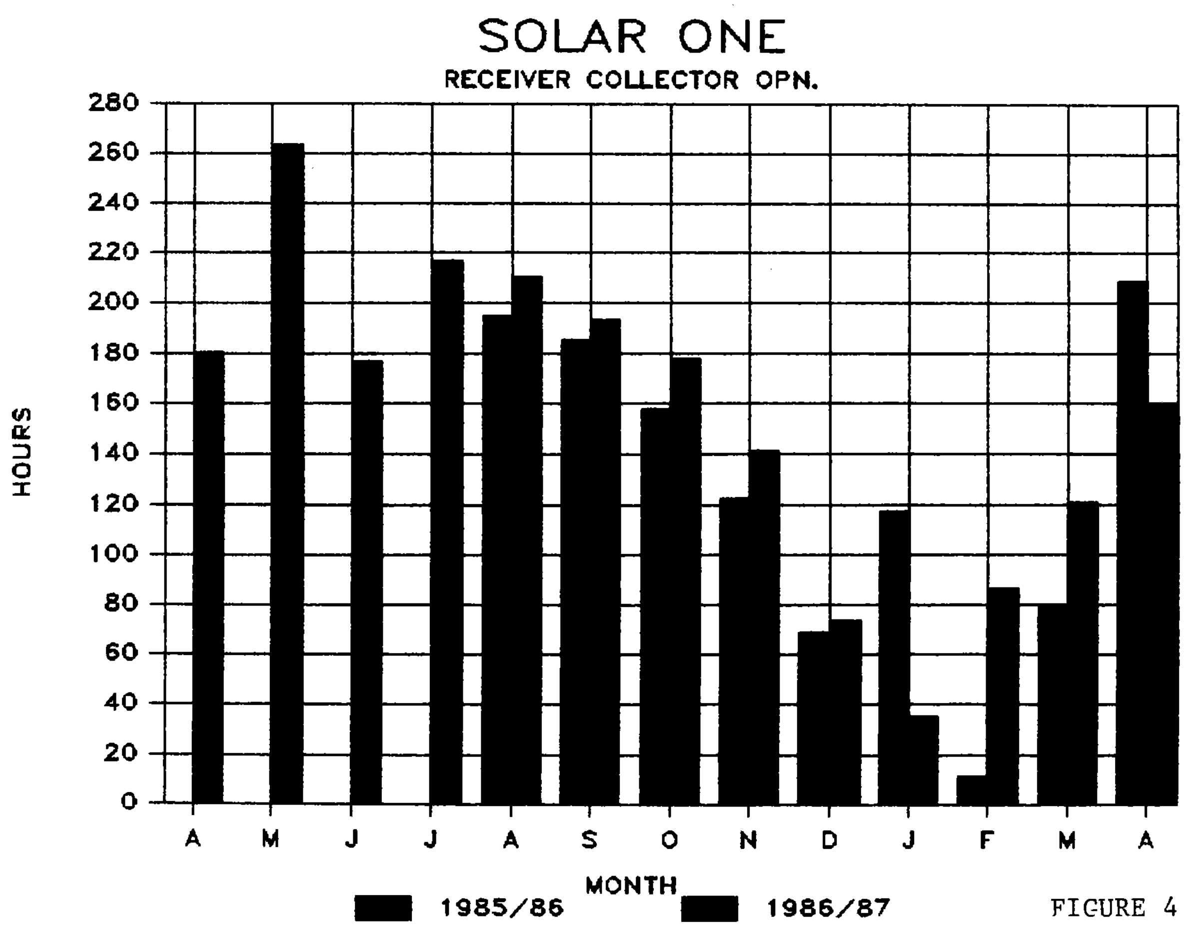


FIGURE 4

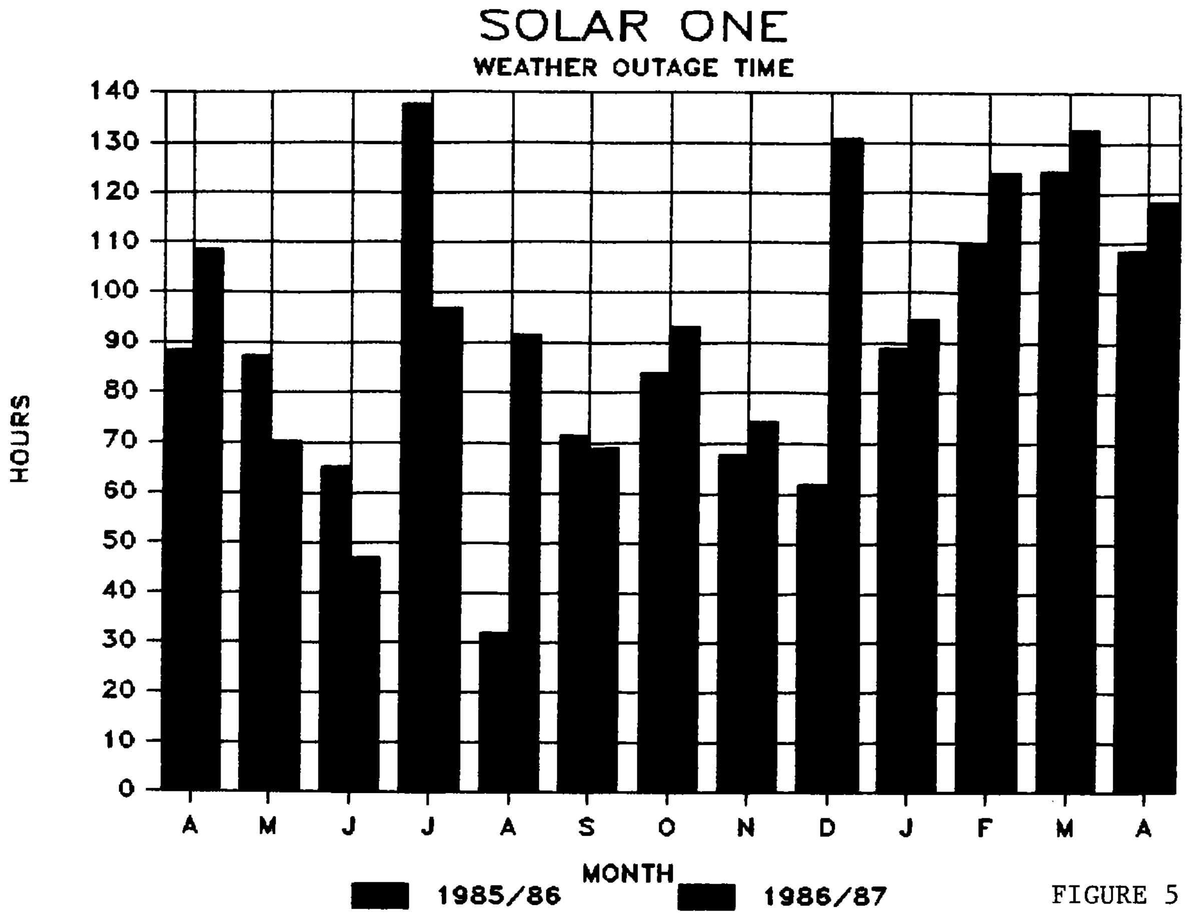


FIGURE 5

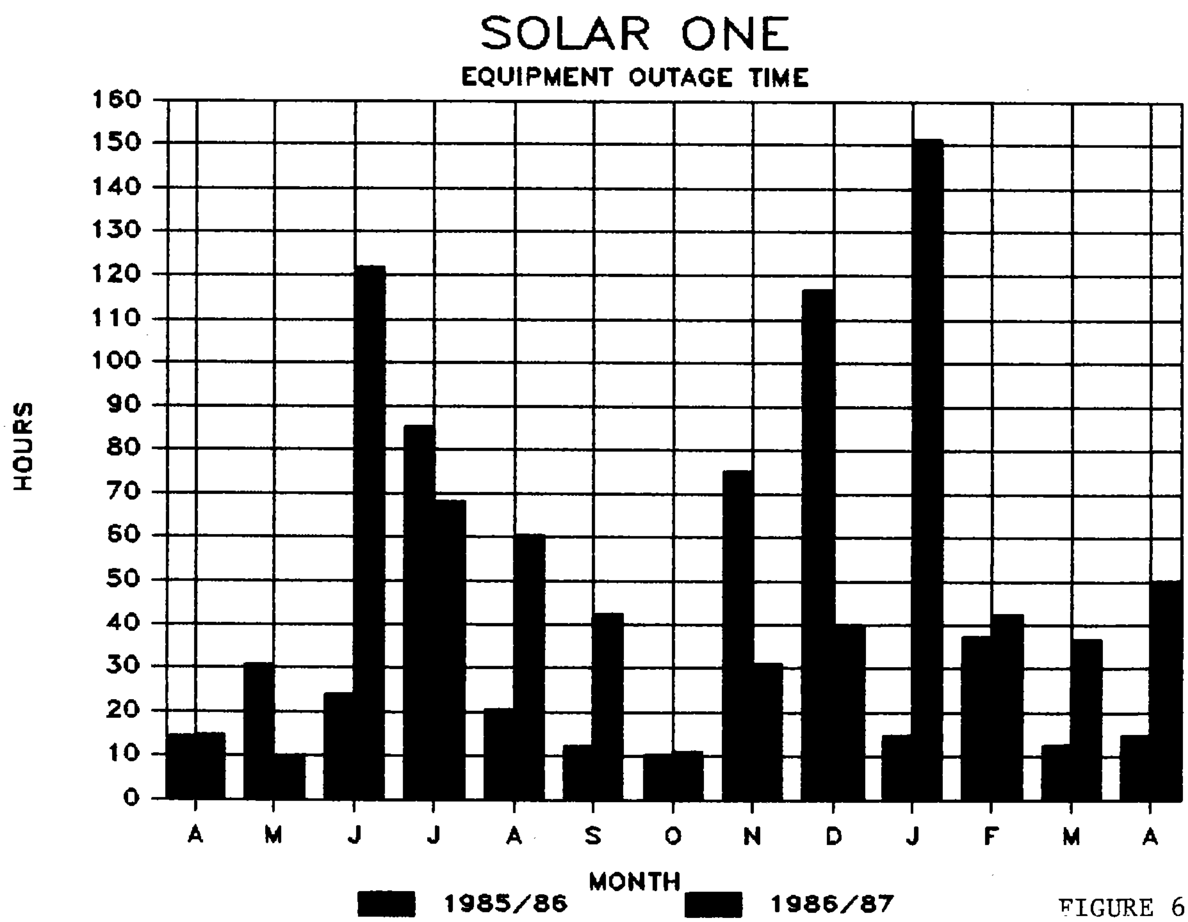


FIGURE 6

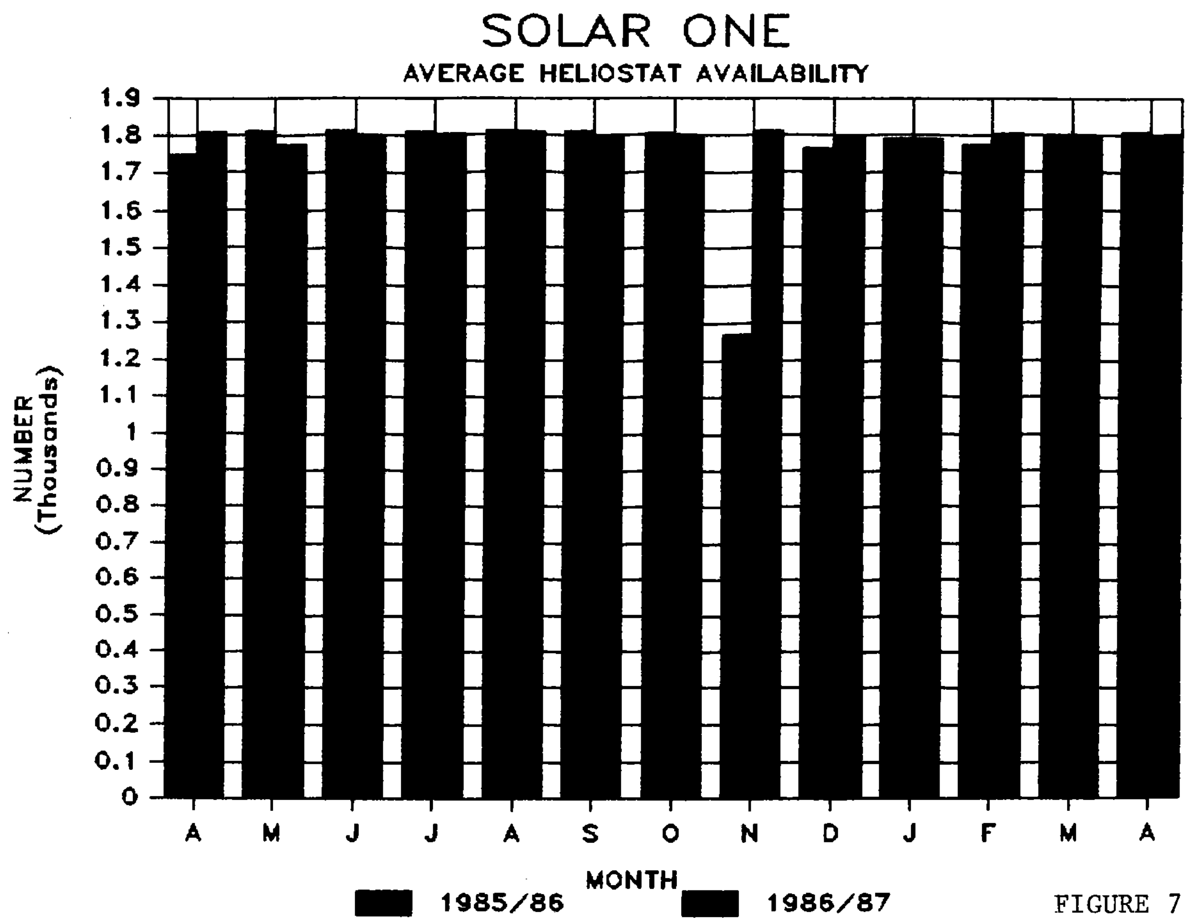


FIGURE 7

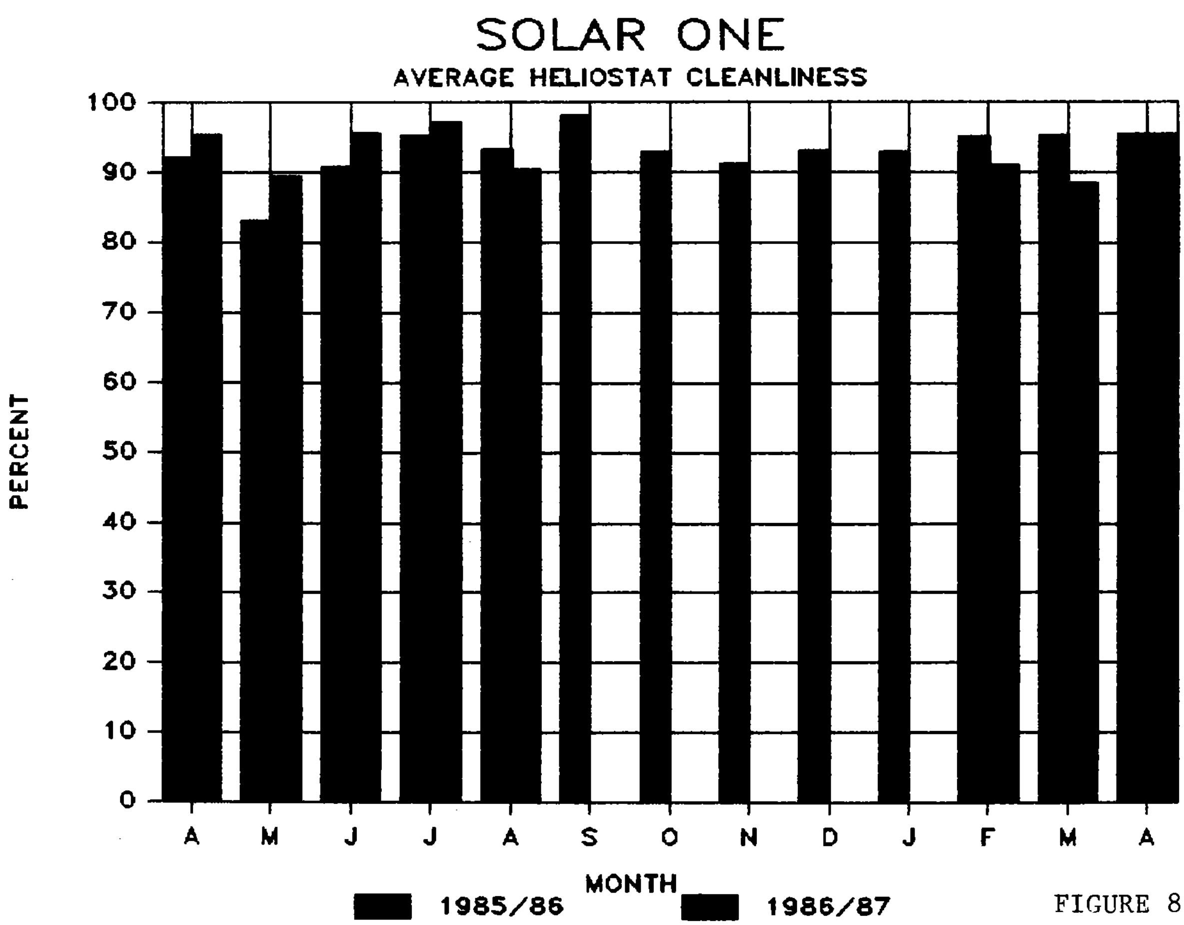


FIGURE 8

DOE/SF/10501-260
(STMPO 260)

SOLAR ONE
OPERATION & MAINTENANCE REPORT #60
March, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One transmitted 1,034.88 MWh (gross) and 612.20 MWh (net) during 120.80 hours of on-line operation in the month of March 1987. The plant produced 18.10% MWh (net) less than the previous March record. Solar One incurred 132.70 weather outage hours and was down for 36.71 hours for scheduled and unscheduled maintenance.

OPERATIONAL HIGHLIGHTS

- Start-up was delayed on Sunday, March 1, due to excess warpage on panel 9. The receiver core inspection did not evidence structural damage. A normal start-up was initiated following the inspection.

- Solar One tripped off-line on Monday, March 2, due to failure of the interlock logic system (ILS) which caused the receiver feedpump to trip. Replaced the J-200 expander module on the ILS.

- Start-up was delayed on Tuesday, March 10, because the turbine control valves (V1) would not open past 47%. After an investigation was conducted, it was found that the speed control dial wasn't at a true zero position. The dial set screw was tightened and the dial was reset to a true zero position.

- The receiver tripped on high inlet pressure on Friday, March 13. The automatic downcomer pressurization sequence stalled when the system was toggled from automatic to manual and then back into automatic at this time. The main steam inlet valve (UV-2905) closed quickly, then reopened very slowly causing the high inlet pressure.

  The downcomer was pressurized manually during start-up on Saturday, March 14, and Sunday, March 15, pending correction of the control problem.

- Plant start-up was delayed on March 18 to allow identification of a receiver panel 9 tube leak.

- On Friday, March 20, panel 5 flowmeter failed to indicate flow. After tapping the flowmeter with a hammer, a normal flow indication was established.

  Started tracking the receiver at 0612 hours on March 21 but had to defocus at 0621 hours because receiver panel 5 temperature control valve was stuck at 50% open with panel flow indicating "0". After tapping the flowmeter body, flow indication was established but temperature control valve remained at 50% open. The plant systems were then secured due to overcast sky conditions. After blowing out the receiver panel 5 temperature control valve positioner, the valve began operating. However, on restarting the receiver, resultant flow on panel 5 increased slowly with time for no apparent reason. Plant systems were once again secured due to increasing clouds at 1045 hours. Collector field positioned at high wind stow at 1501 hours due to high winds (40+ mph). Positioned the collector field for rain wash at 1650 hours. The HAC failed over at 1755 hours. At this time the collector field communication lines 7 and 8 failed over. Tried to stow collector field with position command at 1759 hours. Halted both HAC's at 1838 hours to regain control of the collector field, McDougal would not respond. Accordingly, rebooted with only Erin. Erin reboot was unsuccessful. Maintenance performed a memory clear task and subsequent reboot of HAC's was successful with Erin prime and McDougal backup. The backup HAC then failed at 2301 hours. After repeating memory clear task, the HAC's rebooted successfully at 2344 hours.

- The backup HAC failed at 0241 hours on March 22 and all communication lines failed over with loss of communication between HAC and collector field. There were no alarm messages indicated on either the prime or backup HAC printers. At 0323 hours the HAC was rebooted with Erin prime and no backup. All communication lines failed over. HAC was rebooted in same manner at 0403 hours and communication lines failed over again. Powered off McDougal and rebooted Erin only. Once again communication lines failed over. At 0750 hours maintenance found a "Solid Memory Error" on McDougal. After clearing error message, rebooted Erin without backup at 0851 hours.

- Early morning receiver inspection on March 27, did not evidence any new tube leakage. Receiver panel 5 failed to indicate flow at 0545 hours. Tapping of the flowmeter body restored the proper flow indication. Unit on-line for power production at 0814 hours and off-line at 1210 hours due to clouds. Unit placed back on-line at 1225 hours and back off-line at 1231 hours because of clouds. The unit was then placed back on-line at 1258 hours and back off-line at 1312 hours, once again due to clouds. The backup HAC (McDougal) failed over at 1351 hours. At this time the HAC (Erin) apparently lost communication with the collector field. Heliostats then began walking the wire walks down to their stow position under command of the heliostat field controllers. By 1413 hours all but 103 heliostats were at stow. Booted Erin (prime) without backup at 1417 hours and recovered control of the collector field.

- Panel 11 temperature control valve was operating erratically on March 27. The control output would go to "zero" but the position indication remaining at 50% while the actual flow was very high. Later that day, the temperature control valve positioner was replaced and the valve was stroked.

- Power production was hampered by HAC anomalies on March 29. The unit was on-line for power production at 1404 hours and off-line at 1736 hours because of declining insolation. HAC failover was experienced at 0457 hours. Rebooted HAC's at 0553 hours but lost field communications. Halting backup HAC did not reestablish communications. Accordingly, rebooted with Erin prime with no backup at 0724 hours. Lost field communication at 0801 hours. Failed Erin and allowed heliostat field controllers to control field to stow position. Rebooted HAC Erin and McDougal as prime without backup several times to no avail. After performing a "Memory Error Clear" routine, HAC rebooted; Erin prime with no backup. Operations was then able to establish control of collector field. Receiver panel 5 flow indication problem was experienced at 1228 hours. After impacting the flowmeter body, normal flow indication was established.

- Start-up was delayed due to HAC anomalies on March 30. Unit on-line at 0850 hours and off-line at 1450 hours due to HAC failures. Received a unit and receiver trip at approximately 1449 hours. The HAC experienced a line failure on all communication lines and consequently, communication was lost with the field. Because of the immediate loss of flux on the receiver, all temperature control valves went closed, thereby, increasing receiver inlet pressure which initiated a receiver RLU trip and a defocus command. Heliostat field controllers immediately brought the field down to stow when the HAC lost communications with the field.

MAINTENANCE HIGHLIGHTS

- On March 4, moved control of the auxiliary steam desuperheater spray water control valve (TV-1004) and receiver steam to auxiliary steam header pressure control valve (PV-1003) from multi-variable controller C-2-4 to C-2-5 to facilitate operation of the valves through the receiver distributed process controller.
- On Monday, March 2, placed insulation around panel 9 in order to prevent the solar energy from entering the receiver core.
- Replaced heliostat gear drive on heliostat #1971 on March 10.
- Insulation was installed on panels 8 and 9 on levels 4 and 5, and panels 14 and 15 on level 5, on Monday, March 9.
- Replaced turbine thrust bearing metal temperature transmitter on March 18.
- New cooling tower acid day tank placed in service on March 19, and also replaced selected receiver metal temperature thermocouples.
- On March 20, repaired and respanned temperature indication on turbine first and sixth stage metal thermocouples TI-954A and TI-996A respectively, which are now spanned 100-800 degrees F and 100-900 degrees F. Recalibrated wind speed transmitter STX-1810, 1839 and 1843.
- Replaced the receiver panel 5 temperature control valve positioner on March 22, with one borrowed from the thermal storage system, at 1210 hours. Because the "B" sensor was also bad, the panel "B" flux sensor on panel 18 was connected to the panel 19 control loop as an interim measure. Solar One was placed on-line at 1434 hours and off-line at 1710 hours due to declining insolation.
- Temperature control valve on panel 8 was repacked and two inspection plug leaks were repaired on panel 11 on Monday, March 23. Also, receiver panel 19 flux sensors "A" and "B" were replaced on this date.
- Air compressor CP-902 was removed from service on Monday, March 23 to overhaul its motor and to repair other deficiencies.
- Initiated "Memory Clear" task on Erin, disconnected all links of communication with HAC, i.e., DAS, BCS and chromatics, for troubleshooting at 0551 hours on March 20, and then returned the HAC's to service at 0640 hours.

- The station experienced repeated HAC failures in the past week. Although computer repairs by Communication Maintenance, Inc. (CMI) had been timely and reliable in the past years, their current performance has been less than satisfactory. CMI was requested to assist the station in resolving the computer problems. In the interim, the BCS, OCS, DAS and selected peripheral equipment were disconnected from the HAC system Monday, March 30, to isolate the problem(s). Since disconnecting these equipment systems, the HAC's experienced only one failure.

  Phil Lane (SCE) was on site to review the HAC software to address the recent change in daylight savings time, i.e., daylight savings time now begins in the first rather than the last week of April. Phil, as time permited, investigated problems relating to the recent HAC failures.

APPENDIX

- Solar One plant statistics and the performance summary for March, 1987 are presented in Table I.

- A summary of the O&M labor, material, contract, and other costs for the month of March, 1987 is shown in Table II. Expenses are categorized as follows:

Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	March 1986	March 1987	August 1984 To Date
Net Generation MWh	723.0	612.2	22456.4
Gross Generation MWh	1119.4	1034.9	35517.2
Mode 1 Peak Output MW	11.5	11.2	11.7
Available Insolation MWh #	10375.3	11211.8	375224.8
Available Insolation Hours	215.9	226.0	7701.5
Power Production Hours	128.5	120.8	4501.1
TSS Charging Hours	12.6	0.0	395.9
Weather Outage Hours	124.4	132.7	2989.8
Scheduled Outage Hours	0.0	7.7	598.6
Unscheduled Outage Hours	12.8	29.0	994.0
Weather Overlap Hours	0.0	14.8	455.5

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 83.7

Subsystem Availability:
Receiver 96.5
Collector 89.1
Turbine 98.1

Utilization Factor % 50.7

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 8.2

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 5.5

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF MARCH 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	11.3	1.8	2.1	0.0	15.2
OPERATIONS	59.8	7.1	0.0	0.1	67.0
MISC. SUPPORT	6.0	0.0	2.2	0.2	8.4
MAINTENANCE:					
Supv/Indirects	8.4	0.5	0.2	0.2	9.3
Control System	7.8	0.5	4.8	0.1	13.2
Receiver System	5.1	0.1	0.1	0.0	5.3
Thermal Str. Sys.	0.7	5.6	0.0	0.0	6.3
Collector System	10.4	3.6	0.0	0.0	14.0
EPGS System	4.0	0.8	0.0	0.0	4.8
Miscellaneous	5.7	0.0	0.4	0.0	6.1
TOTAL MAINTENANCE	42.1	11.1	5.5	0.3	59.0
SUBTOTAL	119.2	20.0	9.8	0.6	149.6
Division O.H.					22.6
TOTAL DIRECT:					172.2
Workman's Compensation					0.8
Payroll Tax					9.0
Pension & Benefits					28.2
Administration & General					28.7

GRAND TOTAL... 238.9

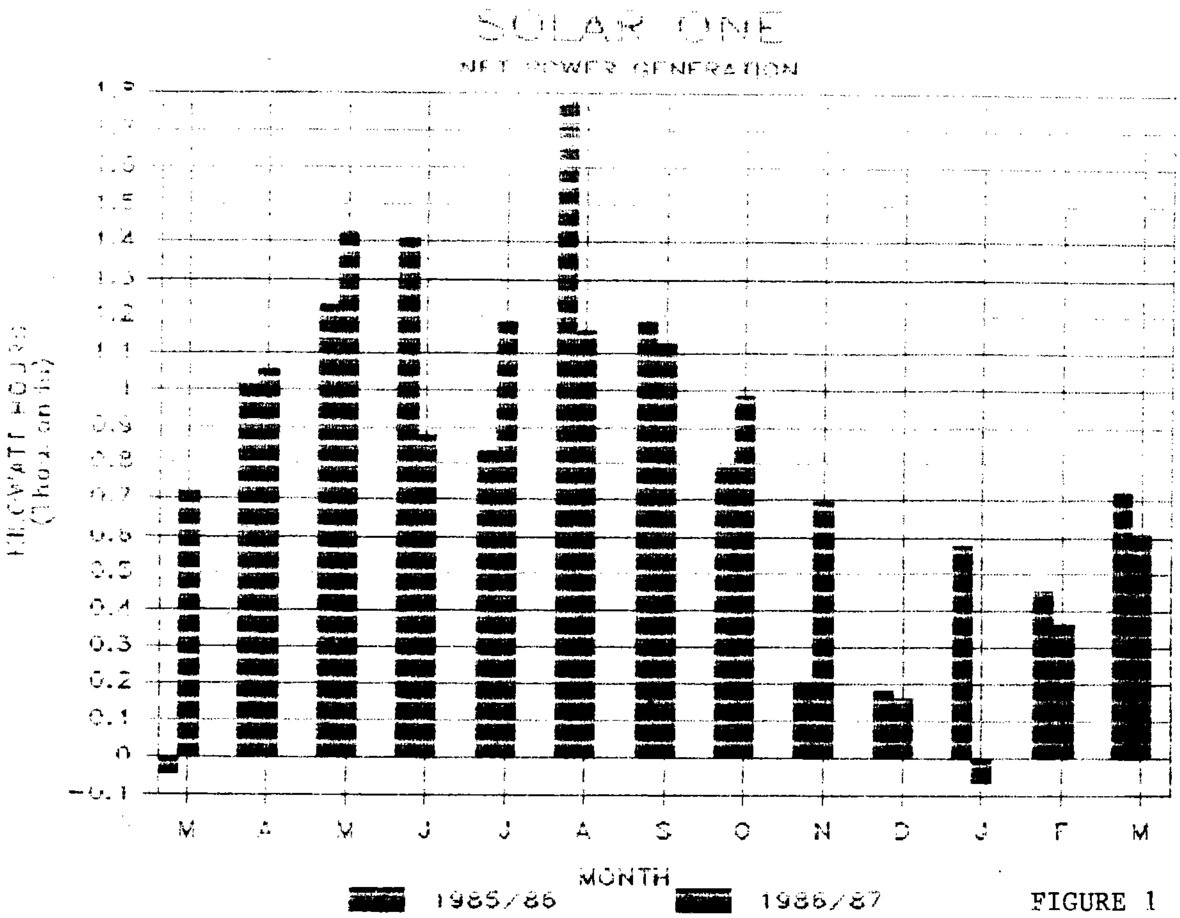


FIGURE 1

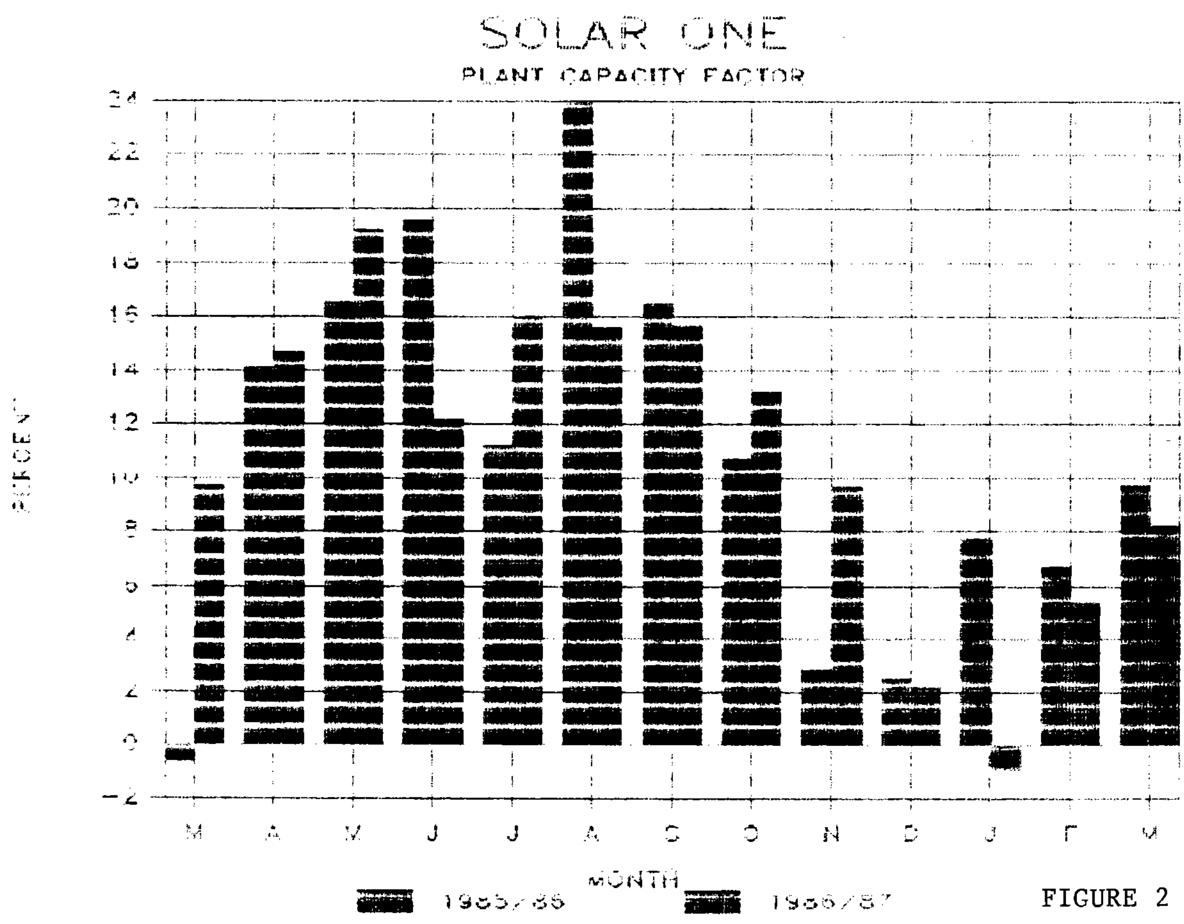


FIGURE 2

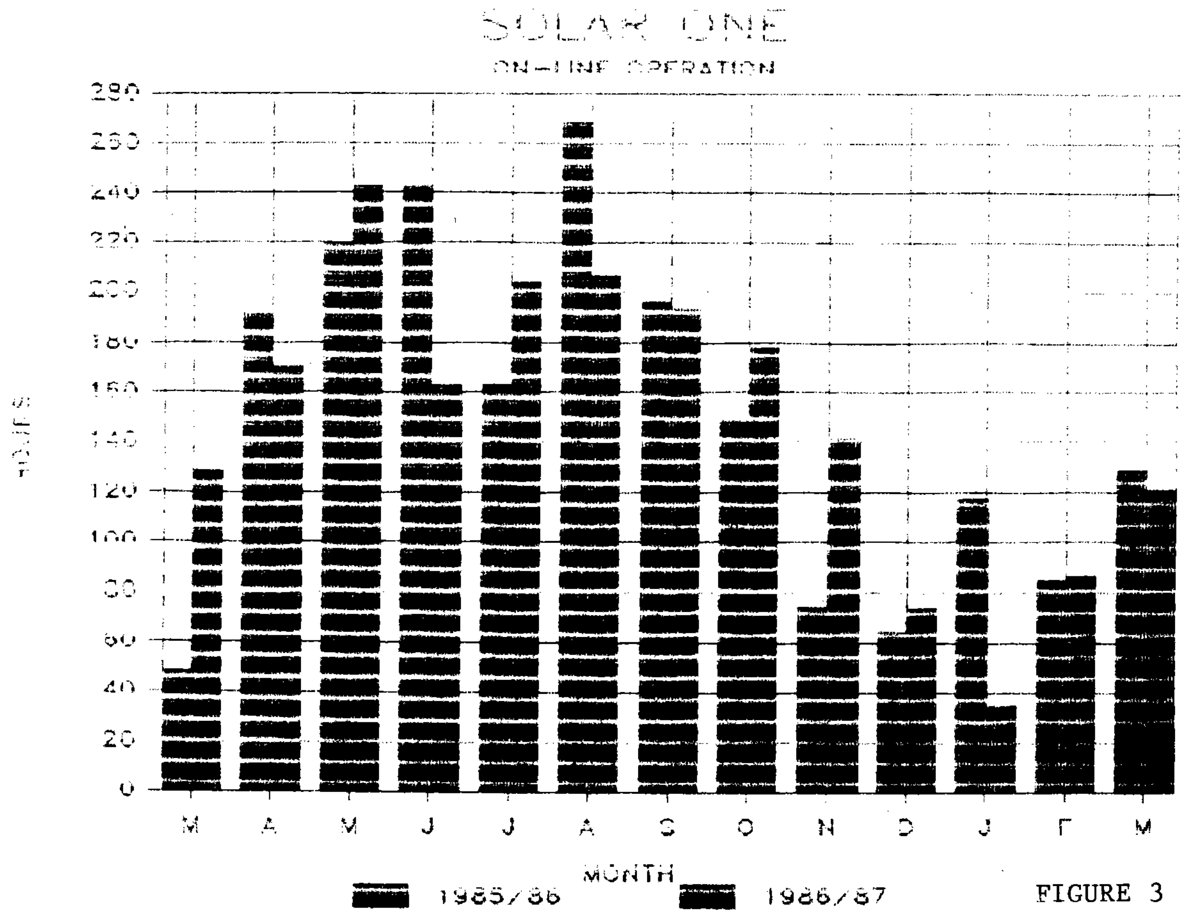


FIGURE 3

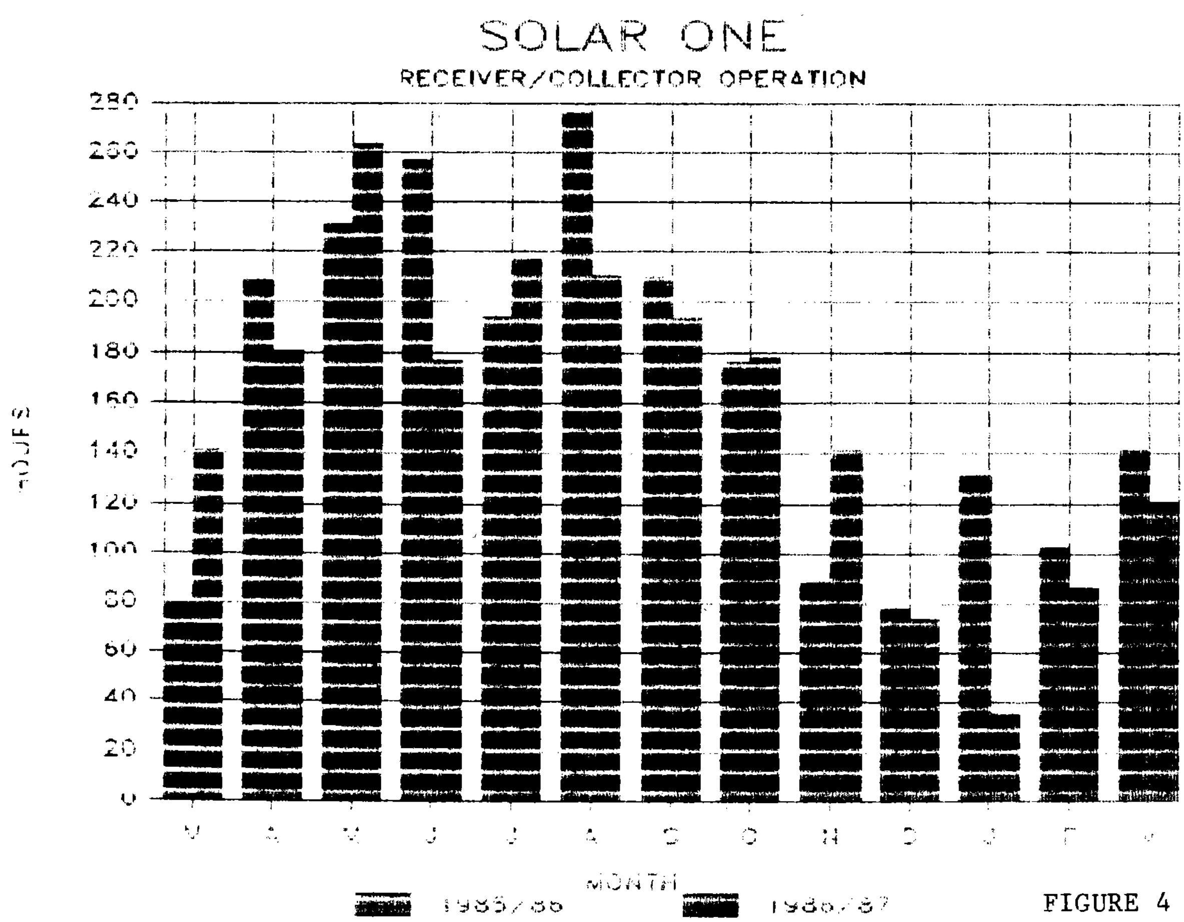


FIGURE 4

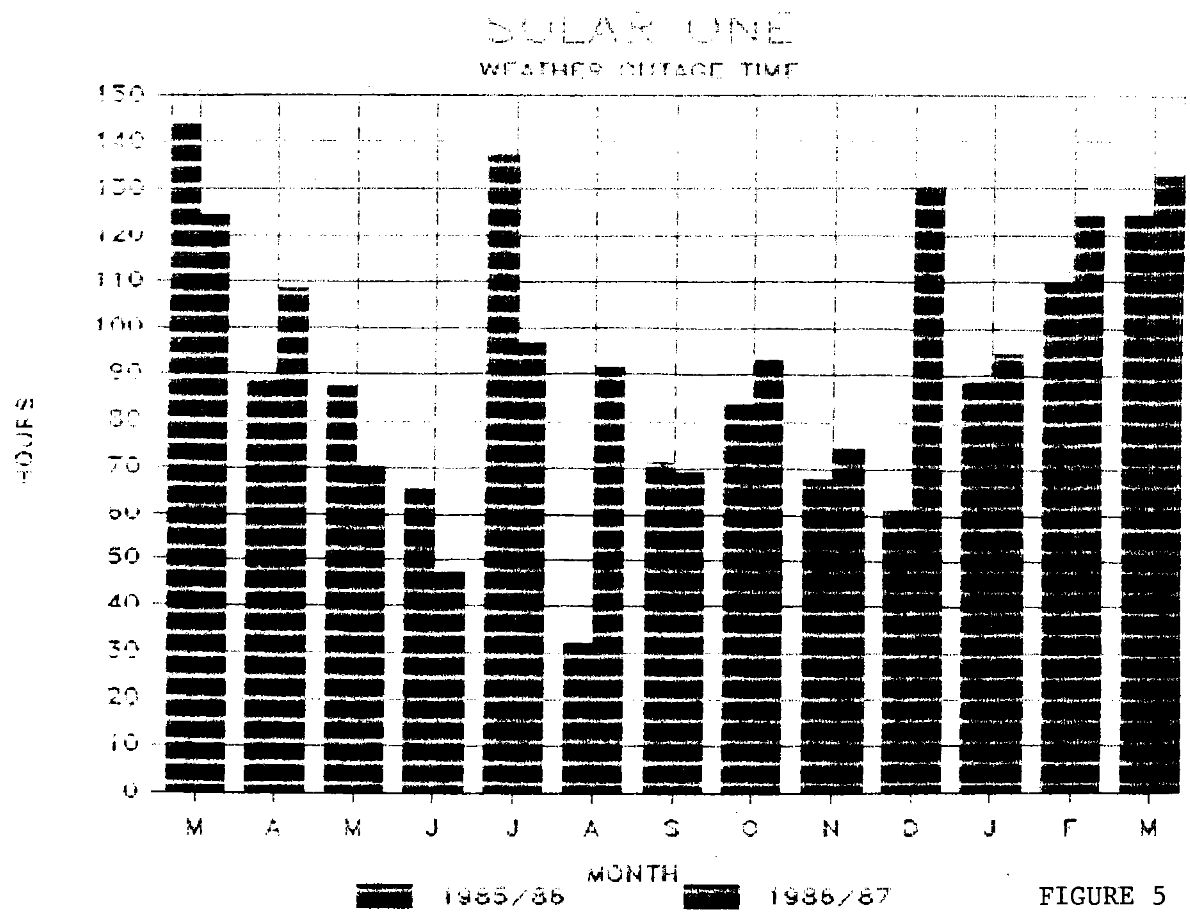


FIGURE 5

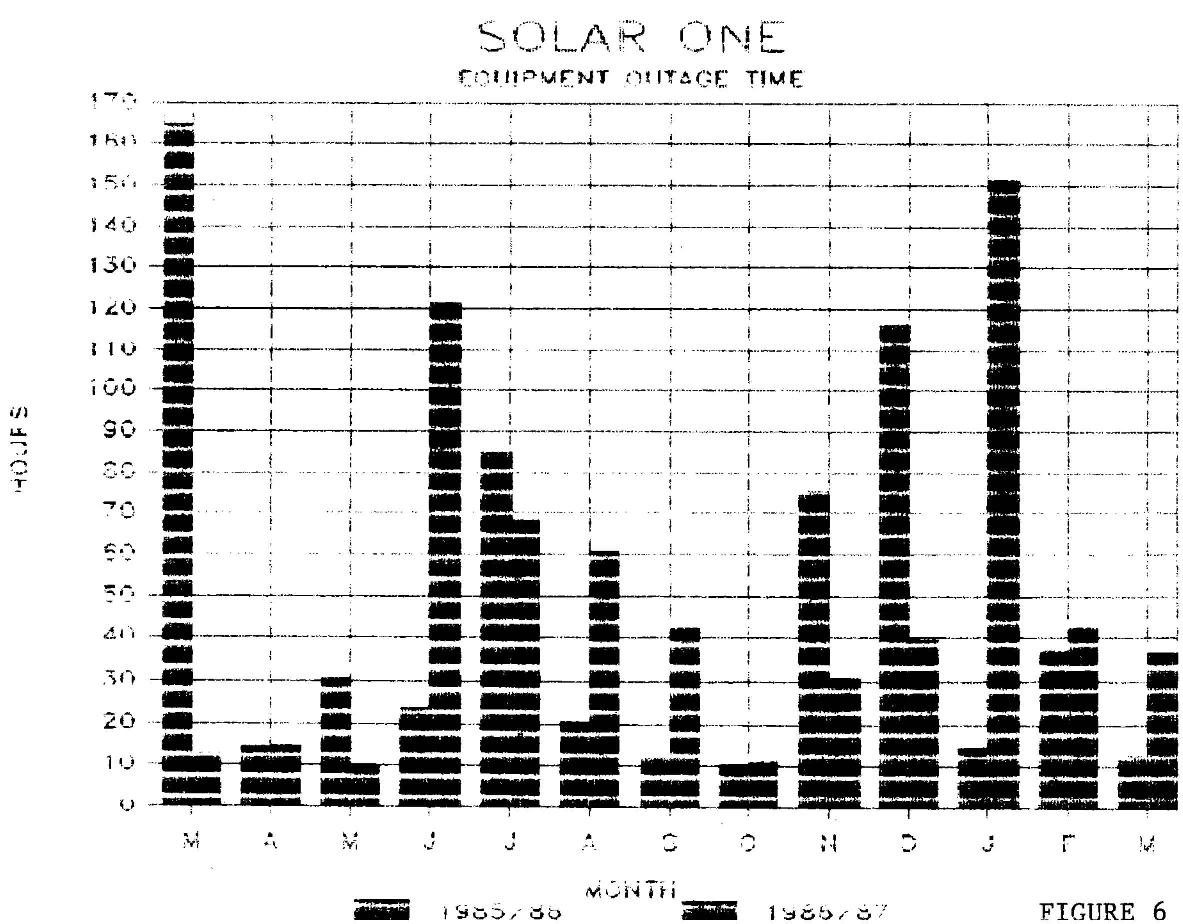


FIGURE 6

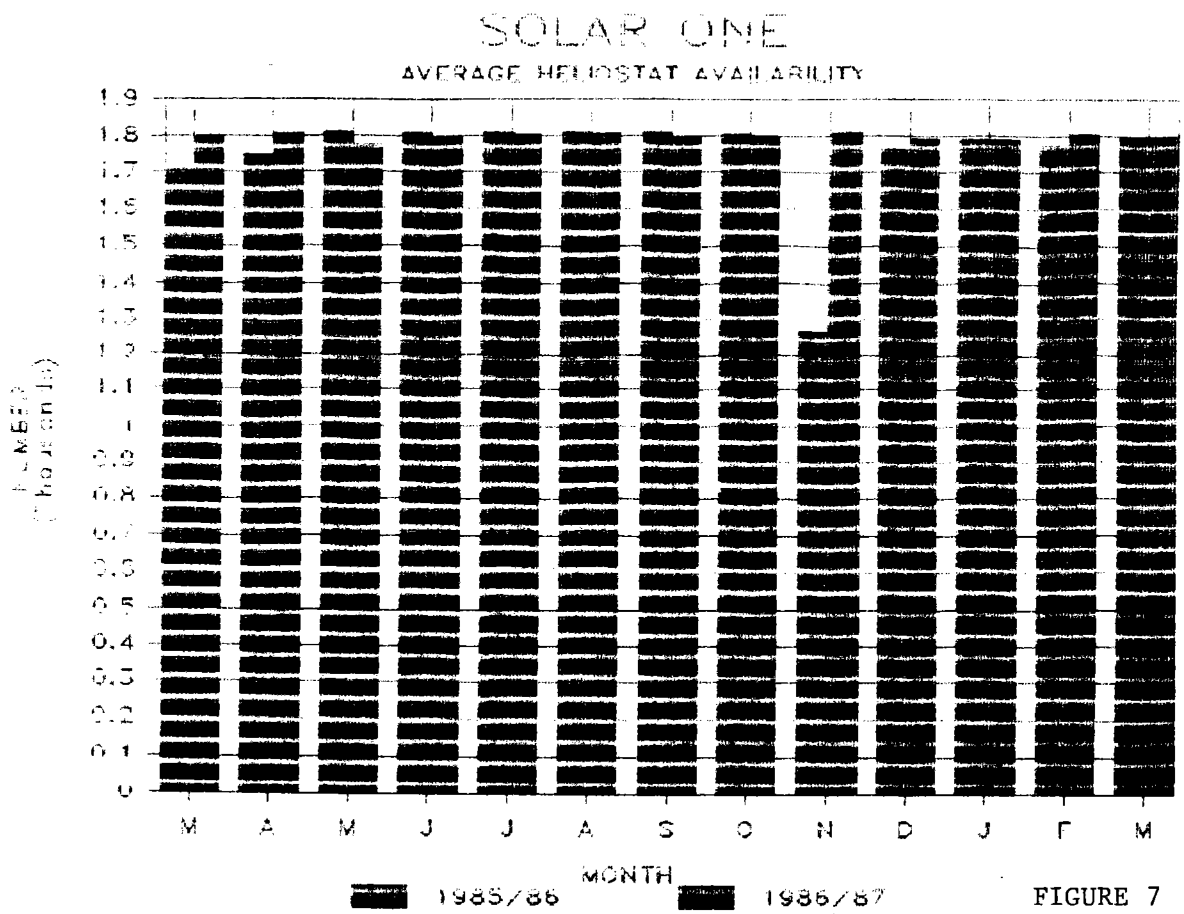


FIGURE 7

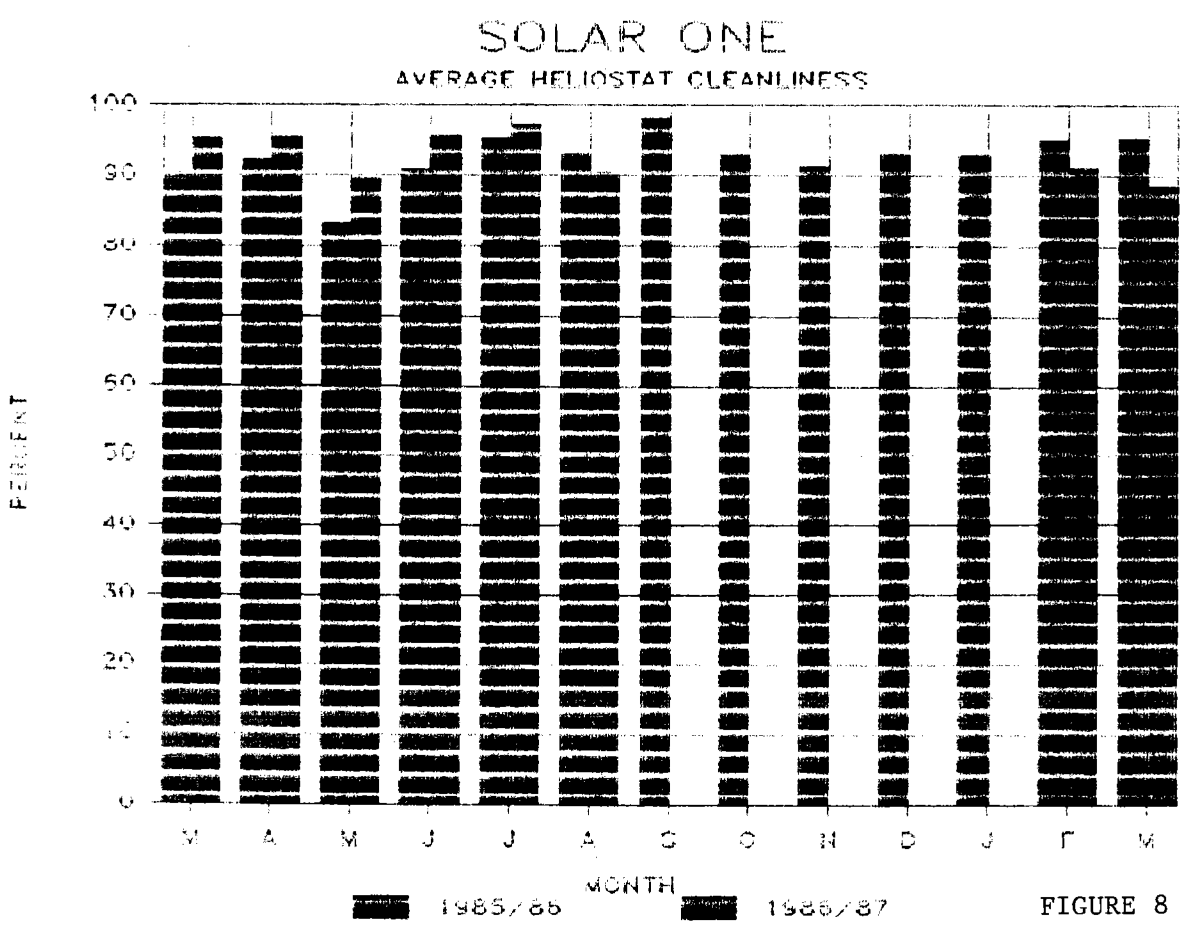


FIGURE 8

DOE/SF/10501-259
(STMPO 259)

SOLAR ONE
OPERATION & MAINTENANCE REPORT #59
February, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One transmitted 731,520 MWh (gross) and 361,920 MWh (net) during 86.35 hours of on-line operation in the month of February 1987. The plant produced 25.25% MWh (net) less than the previous February record. Solar One incurred 123.98 weather outage hours and was down for 92.34 hours for scheduled and unscheduled maintenance.

OPERATIONAL HIGHLIGHTS

- On Sunday, February 1, the receiver auxiliary steam supply valve (PV-1003) failed to open when the steam downcomer was placed into service. This was caused by a thermal storage system controller problem. Replaced the interface card and disk drive on the thermal storage distributed process controller on Monday, February 2, to correct problem.

- A plant start-up attempt was made in the late afternoon on Tuesday, February 3, as clouds dissipated. However, it was necessary to defocus the collector field due to difficulty in establishing proper flow to panel 9 and correction of diagnostic error messages on the receiver distributed process controller.

- The #3 turbine bearing metal temperature high alarm setpoint was reset from 148 to 175 degrees F and the high-high alarm point from 165 to 200 degrees F on Tuesday, February 3.

- Solar One was on-line for power production following a receiver inspection at 1153 hours on February 4. The receiver was inspected by Sandia Labs (Livermore and Albuquerque), Foster Wheeler and Babock & Wilcox representatives. Following completion of the inspection at 1017 hours, the inspection party met with SCE and reviewed the receiver panel operating history as well as ongoing modifications. The boiler manufacturer representatives will submit reliability improvement alternatives by Wednesday, February 8, 1987. During the discussion, several potential alternatives were discussed;

(a.) split receiver panels into subpanels to reduce lateral strain and,

(b.) resize panel orifice to a less than design flow condition.

Following the plants shut-down, the Babcock & Wilcox representatives performed an additional receiver core inspection.

- An early morning inspection on Thursday, February 5, found the receiver temperature control valves on panels 7, 9 and 21 to be leaking.

- The turbine throttle pressure was increased to 1350 psi on Thursday, February 5, because the turbine control valves were at 99% open.

- On Friday, February 6, panel 5 indicated "zero" flow. After tapping on the flowmeter the panel began to indicate flow. Subsequently panel 2 flowmeter indicated "zero" flow. Venting the receiver restored flow indication. On Sunday, February 8, panel 5 again indicated "zero" flow and panel 14 was pegged off scale high. Both flowmeters were tapped and both flowmeters began to indicate normal flow.

- On Thursday, February 12, start-up was aborted due to tube #70 leaks on receiver panels 9 and 10. The tube leaks were repaired early that afternoon.

- The receiver tripped on Saturday, February 14, when panel 9 temperature control was lost. When the panel was placed in manual and more flow established, the temperature increased to 1200 degree F and the receiver tripped. Panel 9 and 14 had to be manually adjusted, then the flow was increased to transition to temperature control. An early morning inspection the following morning found the drain valves to be leaking through. The valve plug and seat rings were subsequently replaced and stroked on Friday, February 20.

- Start-up was delayed on Tuesday, February 17, due to the Red Line Unit (RLU) power supply failure. The power supply was replaced.

- On Tuesday, February 17, the unit tripped when the turbine automatic pressure control (UD-7550) dropped out to a disable mode. The unit was on-line and off-line several times because of pressure control problems. The unit finally remained off-line for the remainder of the day because of a sticking temperature control valve on panel 6 and declining insolation. The valve positioner on panel 6 temperature control valve was replaced.

- The heliostat array controller was rebooted at 0131 hours on February 20, due to continuous error messages and failure of graphic displays. Reboot with McDougal (HAC) as prime was unsuccessful. Reboot with Erin (HAC) at 0158 hours was successful. Unit start-up was delayed due to clouds. The steam downcomer valve (AOV-2905) had to be manually opened at 0943 hours. This same problem was experienced several times in the last month. Heliostat array controller failed at 1750 hours causing loss of chromatics display printer and collector field control. HAC was then rebooted at 2030 hours but failed again at 2134 hours. HAC rebooted at 2155 hours with Erin prime and graphics powered down. This reboot was unsuccessful. Rebooted again at 2330 hours; with both Erin and McDougal with a substitute printer in service.

- The steam downcomer valve (AOV-2905) had to be manually opened on Friday, February 20.

- The thermal storage system controller failed at 0555 hours on February 23, causing loss of associated auxiliary steam data. Controller returned to service after restoring lost data base at 0830 hours. Pressure test of the receiver at 0916 hours found the following new leaks; preheat panel safety valve (PSV-2033) leaking through, pressure differential transmitter (PDT-2332) sensing line leaking, and panel 9 elevations 4 and 6 right-side tube leaks. Start-up was then delayed due to high winds (gusts up to 50 mph) and passing clouds at 0950 hours. The collector field was sent to Alt 2 Stow at 1048 hours. Because of hail and limited snow, the collector field was positioned for a rain wash at 1252 hours. The rain wash was only partially successful, leaving heliostat reflective surfaces streaked with mud. The EPGS report generation processor failed at 1354 and 2030 hours and the TSS controller at 1555 and 1806 hours. The collector field was commanded to stow at 1600 hours at which time a HAC failover was experienced. Start-up delayed the following morning pending repair of the EPGS and TSS controllers. The HAC reboot at 2145 hours was successful.

MAINTENANCE HIGHLIGHTS

- J. Landgraf (CMI) continued his diagnosis of computer problems on Sunday, February 1. He found the BCS computer CPU board to be defective. He replaced the board with one borrowed from the Data Acquisition System (DAS) which disabled that system.

- USA Company completed installation of the weather satellite monitoring equipment on Tuesday, February 3. This system will assist operators in determining propriety of a day's operation, i.e., start-up, restart, or plant shut-down on both general and local weather conditions.

- Taraco Company completed repairs of the TSU tank on February 4. Weather satellite monitor was placed in service. Three tube leaks (left side) and four cracks (right side) on receiver panel 14 elevation 5 were repaired.

- Changed flux gain on panel 21 from 1.187 to 1.30 on Thursday, February 5.

- Repaired tube leaks (3 on left side) and cracks (4 on right side) on panel 14 on Thursday, February 5. Also repaired tube leaks on panel 15, level 5. Reinstalled expansion guides on panels 14 and 15, elevation 5.

- Repacked panel 21 temperature control valve on Friday, February 6. Repaired tube leaks and reinstalled expansion guides on panel 15, elevation 5. Removed panel 21, elevation 5, expansion guides.

- On Monday, February 9, removed expansion guides on receiver panel 5, elevation 3. Replaced memory boards in heliostat array controller (McDougal) and returned it to service.

- On Tuesday, February 10, repaired tube leaks on panels 5 and 6, elevation 5, right side. Reinstalled expansion guides on receiver panels 5 and 6 elevation 5 and removed expansion guides on panel 8 elevation 5.

- Replaced mirror facet #10 on heliostats 0123, 0422 and 0730, on Wednesday, February 10.

- On Wednesday, February 11, panel 8 expansion guide at elevation 5 was reinstalled following repairs of a tube leak at elevation 5.

- Panels 5, 6, 7 and 9 temperature control valve packing leaks were repaired on Friday, February 13. Panels 4, 6, 19 and 20 temperature control valve bonnet gaskets were replaced and repacked on Tuesday, February 24.

- The receiver tube repairs on panels 9 and 10 were at the steam outlet bends. The three cracks; one on panel 9 and two on panel 10, were ground out and weld repaired on February 13. One crack on panel 9 and one crack on panel 10 leaked water during a 500 psi hydrostatic test. The panel 10 leak was severe in that it was issuing an approximate 1/16" diameter jet of water.

TUBE LEAK HISTORY:

Pnl #	2/5/84	4/9/84	9/11/84	7/10/85
9	Internal crack not all the way through	Internal crack not all the way through	Internal crack not all the way through	
10	Internal crack not all the way through	Crack all the way through	Crack all the way through	Crack was observed to be weeping

- Panel 9 tube leaks at elevation 6 (left side) were repaired on Friday, February 20. Repaired three tube leaks and 12 tube cracks on panel 9, level 4, and reinstalled the expansion guide on Saturday, February 21. Three cracks were welded on panel 9, elevation 6, and one crack was repaired on elevation 4 on Tuesday, February 24.

- On Thursday, February 12, insulation was installed on panel 4, elevation 5; panel 9, elevations 3 and 6; panel 12 elevation 6; panel 13, elevation 5; and panel 20, elevation 6, to prevent the solar energy from entering the receiver core.

- The DAS terminal and receiver alarm printer were repowered (power feed fuses were replaced) on February 20. Lube oil pump (west) P-927 pump shaft and coupling were repaired and the pump reinstalled in reservoir. Pump was not available for service at this time. Receiver panel 9 tube leaks elevation #4 left side were repaired.

- Repaired three tube leaks and 12 tube cracks on panel 9 level 4 and reinstalled expansion guides on February 27. Work was performed on Friday swing-shift and continued through Saturday day-shift. Following the repairs, the receiver hydrostatic test at 1325 hours found the following leaks; panel 3 drain valve bonnet, panel 4 temperature control valve bonnet, panel 6 temperature control valve bonnet, panel 19 temperature control valve packing, panel 20 temperature control valve bonnet and panel 22 inspection plugs (2).

- Receiver panel 3 drain valve was repaired on February 23, by replacing the bonnet gasket. Turbine lube oil pump P-927 discharge blank flange was removed and discharge line reconnected, however, due to high pump vibration and amperage demand, the pump was to be operated as the backup pump. TSS SDPC configuration storage module disk was replaced and downloaded disk to CCM.

- West turbine lube oil pump P-927 lift was adjusted and pump returned to normal operation on February 24. TSS RGP power supply was adjusted. EPGS RGP memory board was replaced. Three (3) cracks were welded on receiver panel 9 elevation 6, one (1) crack was repaired on elevation 4. Receiver panels 4, 6, 19 and 20 temperature control valve bonnet gaskets were replaced, all other temperature control valve packing glands were adjusted.

- Receiver panel 9 level 3 left and right tube leaks were repaired on February 26. In removing the elevation 3 expansion guide, it was noted that the panel, although severely distorted, at this elevation did not bow outward. Accordingly, it appears that the panel has deformed permanently to its present configuration. Receiver panels 12-22 inspection plugs were repaired. Receiver panels 9 and 5 drain valve solenoid valves were replaced. TSS communication control processor failed, changed out memory board to correct problem. Extraction train #1 oil inlet valve was removed from service to use its positioner component in repair of the receiver downcomer control valve (UV-2905). The electric boiler was removed from service to repair heater element and contactor on circuit #8. Also investigated the Interlock Logic System (ILS) failure. The cause of failure is unknown, resetting the unit corrected the problem.

APPENDIX

- o Solar One plant statistics and the performance summary for February, 1987 are presented in Table I.

- o A summary of the O&M labor, material, contract, and other costs for the month of February, 1987 is shown in Table II. Expenses are categorized as follows:

Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- o Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	February 1986	February 1987	August 1984 To Date
Net Generation MWh	453.3	361.9	21844.2
Gross Generation MWh	803.3	731.5	34482.3
Mode 1 Peak Output MW	11.7	10.9	11.7
Available Insolation MWh #	8566.0	7718.4	364013.0
Available Insolation Hours	174.3	164.4	7475.5
Power Production Hours	85.2	86.4	4380.3
TSS Charging Hours	17.7	0.0	395.9
Weather Outage Hours	110.2	124.0	2857.1
Scheduled Outage Hours	0.0	17.6	590.9
Unscheduled Outage Hours	37.3	24.7	965.0
Weather Overlap Hours	16.9	25.4	440.7

\# Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 74.3

Subsystem Availability:
Receiver 74.3
Collector 100.0
Turbine 100.0

Utilization Factor % 41.9

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 5.4

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 4.7

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF FEBRUARY 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	7.8	0.9	2.2	0.0	10.9
OPERATIONS	43.5	4.8	0.0	0.1	48.4
MISC. SUPPORT	3.8	0.0	2.7	0.2	6.7
MAINTENANCE:					
Supv/Indirects	5.5	0.0	0.1	0.2	5.8
Control System	4.4	2.4	1.4	1.4	9.6
Receiver System	6.0	3.3	3.5	0.1	12.9
Thermal Str. Sys.	1.0	41.8	0.0	0.8	43.6
Collector System	4.2	2.8	0.0	0.0	7.0
EPGS System	2.9	3.4	0.3	0.0	6.6
Miscellaneous	0.5	0.2	5.4	0.0	6.1
TOTAL MAINTENANCE	24.5	53.9	10.7	2.5	91.6
SUBTOTAL	79.6	59.6	15.6	2.8	157.6
Division O.H.					17.8
TOTAL DIRECT:					175.4
Workman's Compensation					0.5
Payroll Tax					6.3
Pension & Benefits					19.6
Administration & General					29.3

GRAND TOTAL.. 231.1

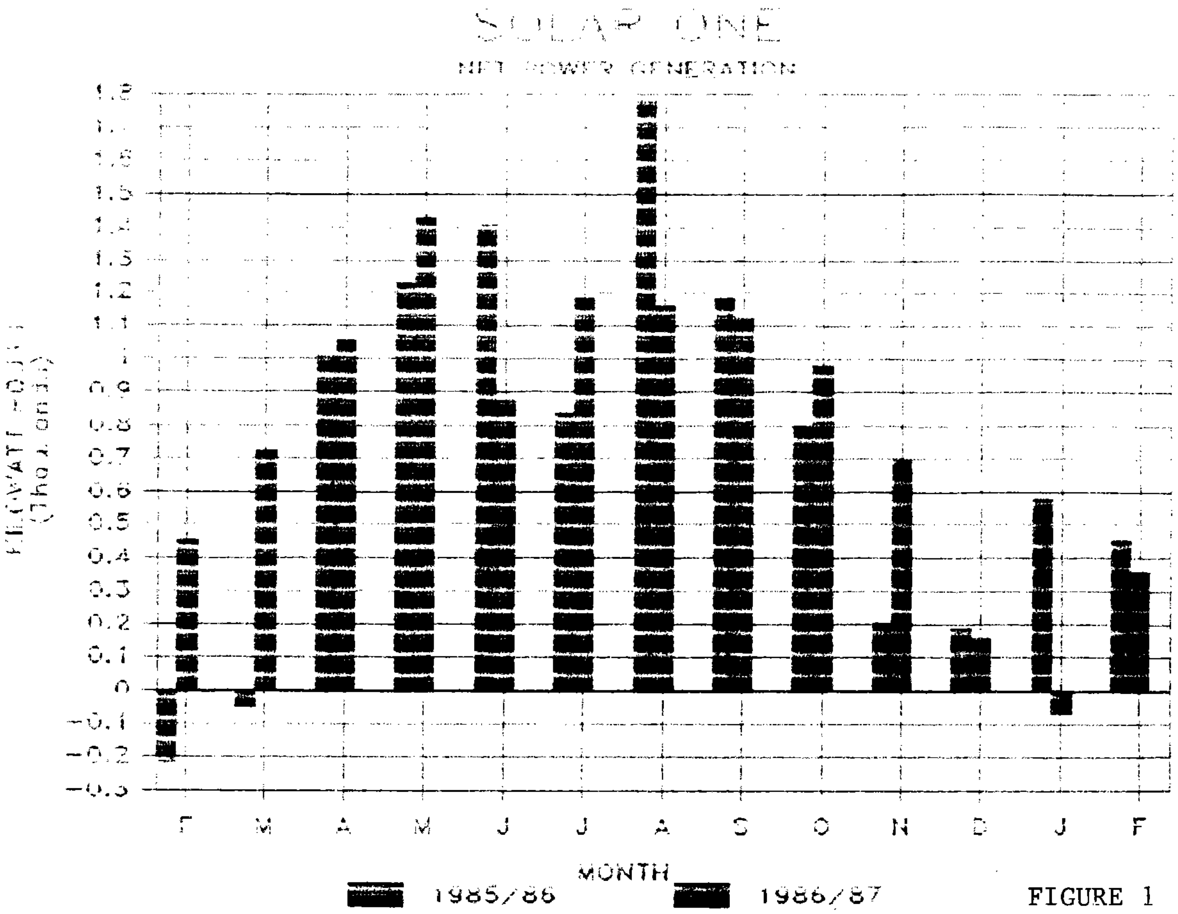


FIGURE 1

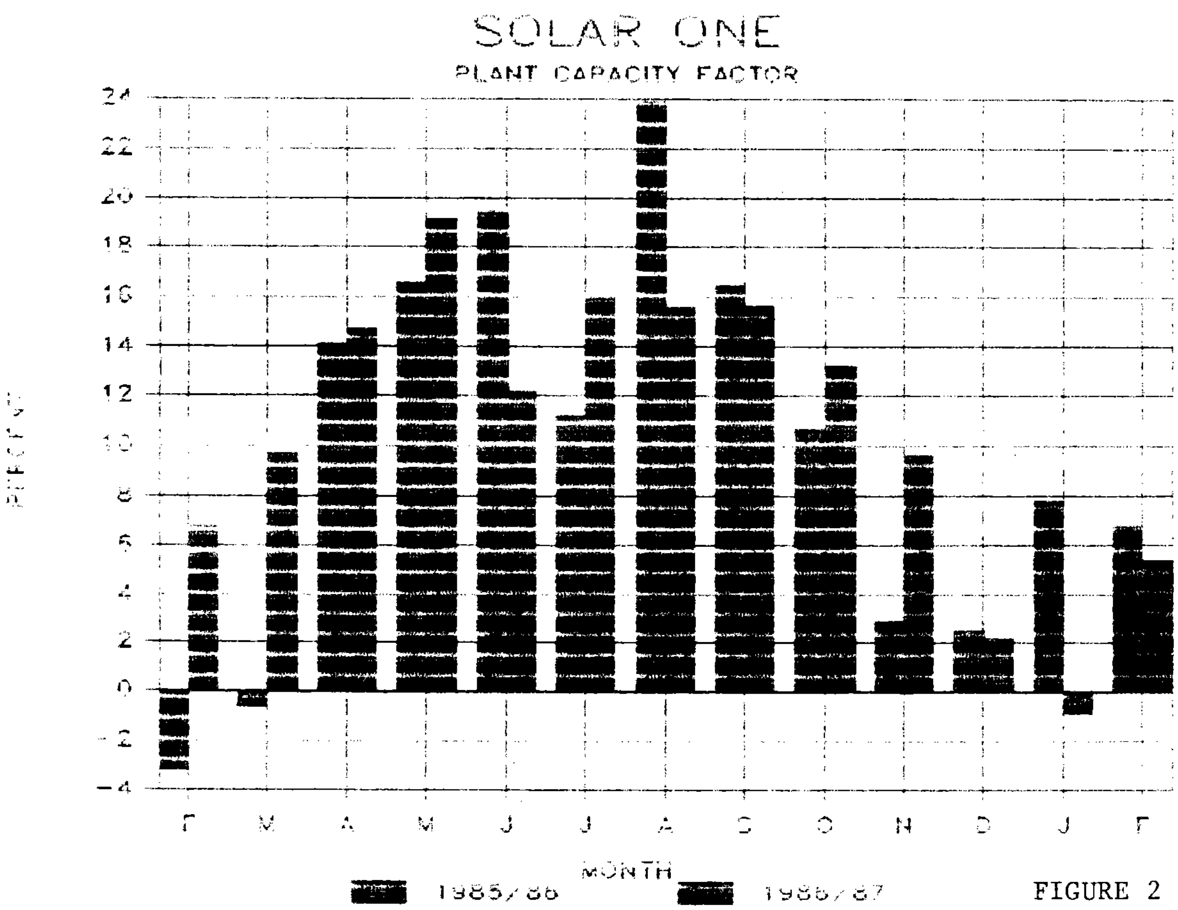


FIGURE 2

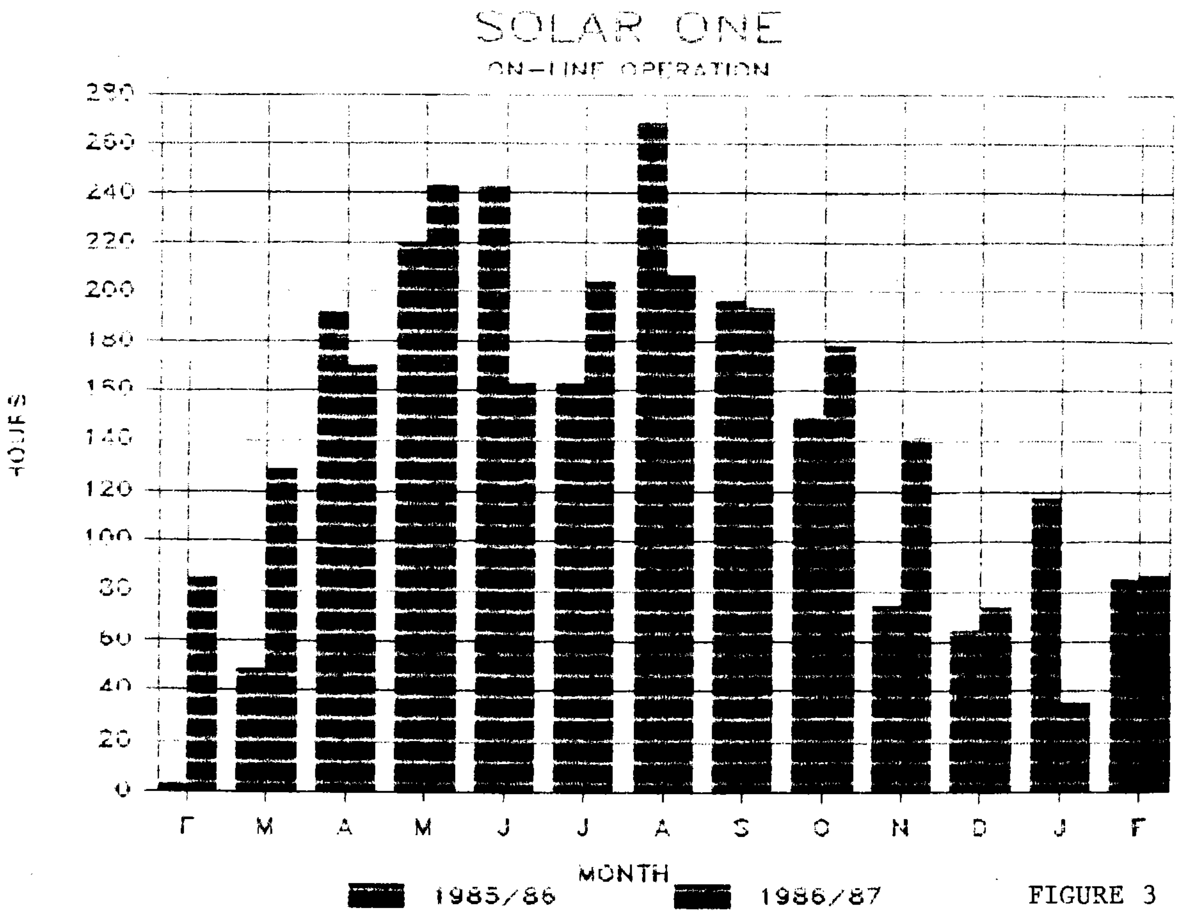
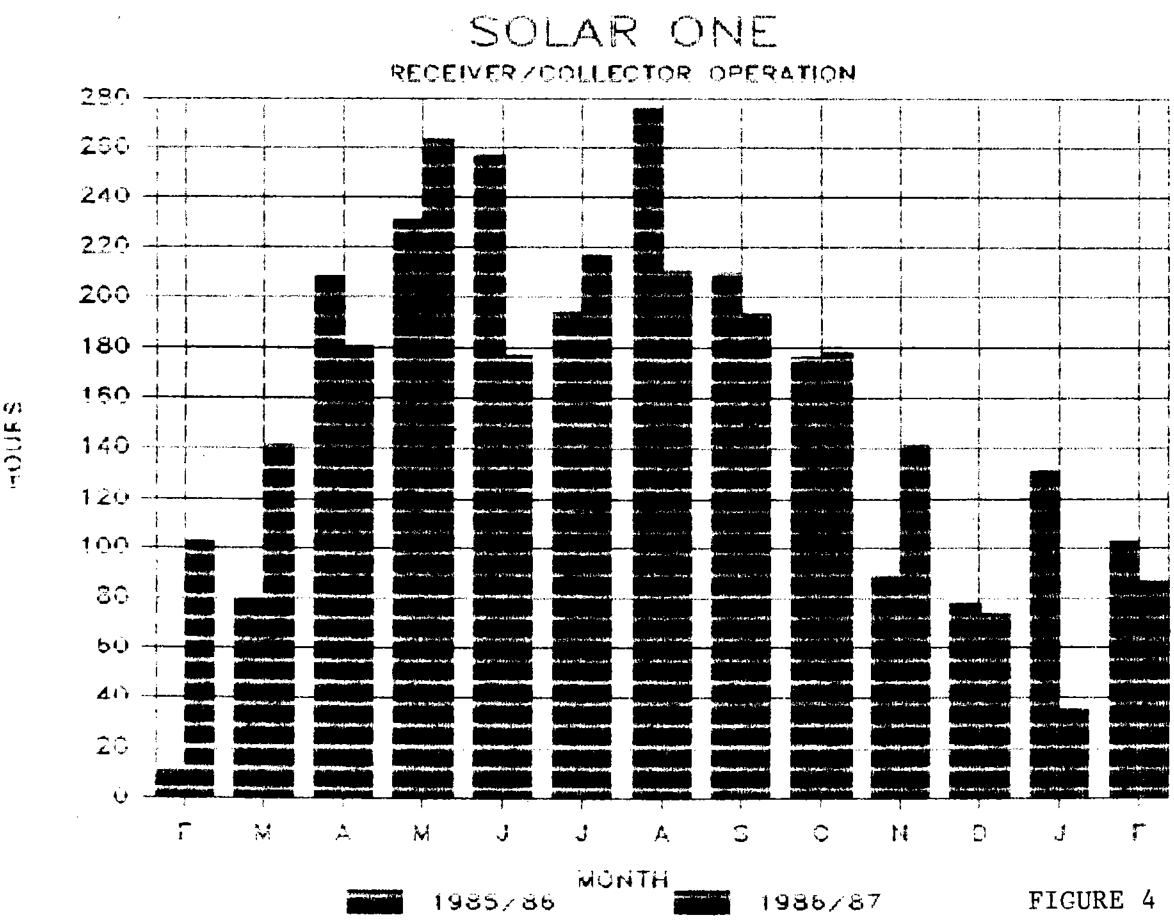


FIGURE 3



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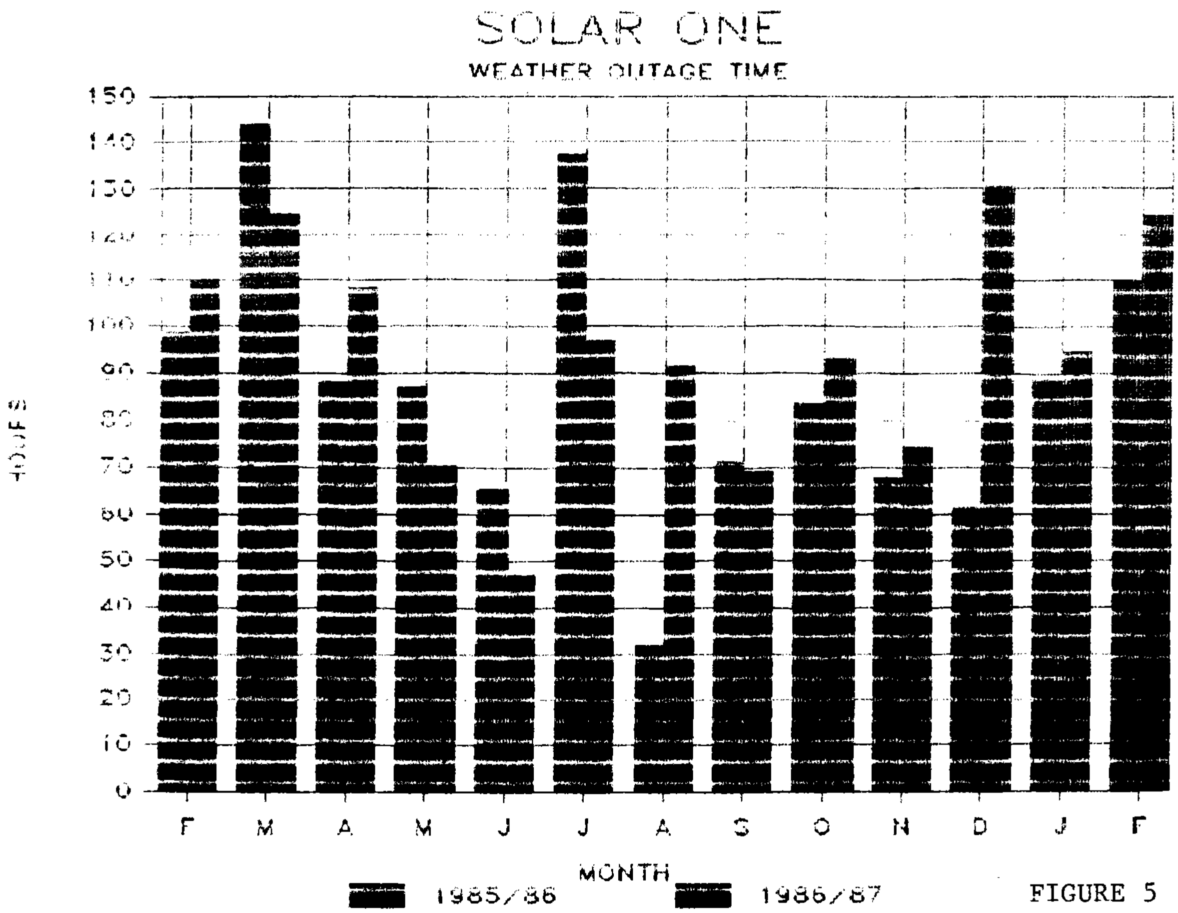
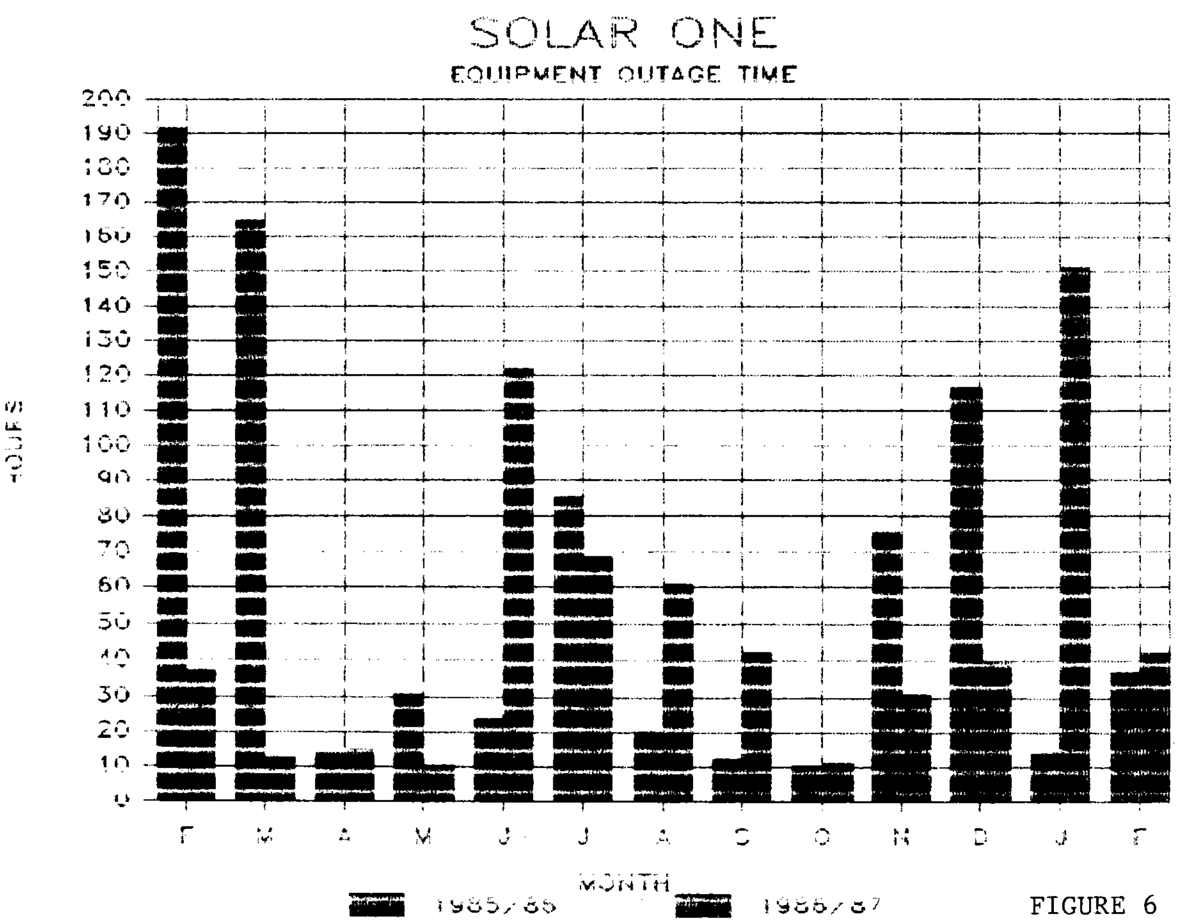


FIGURE 5



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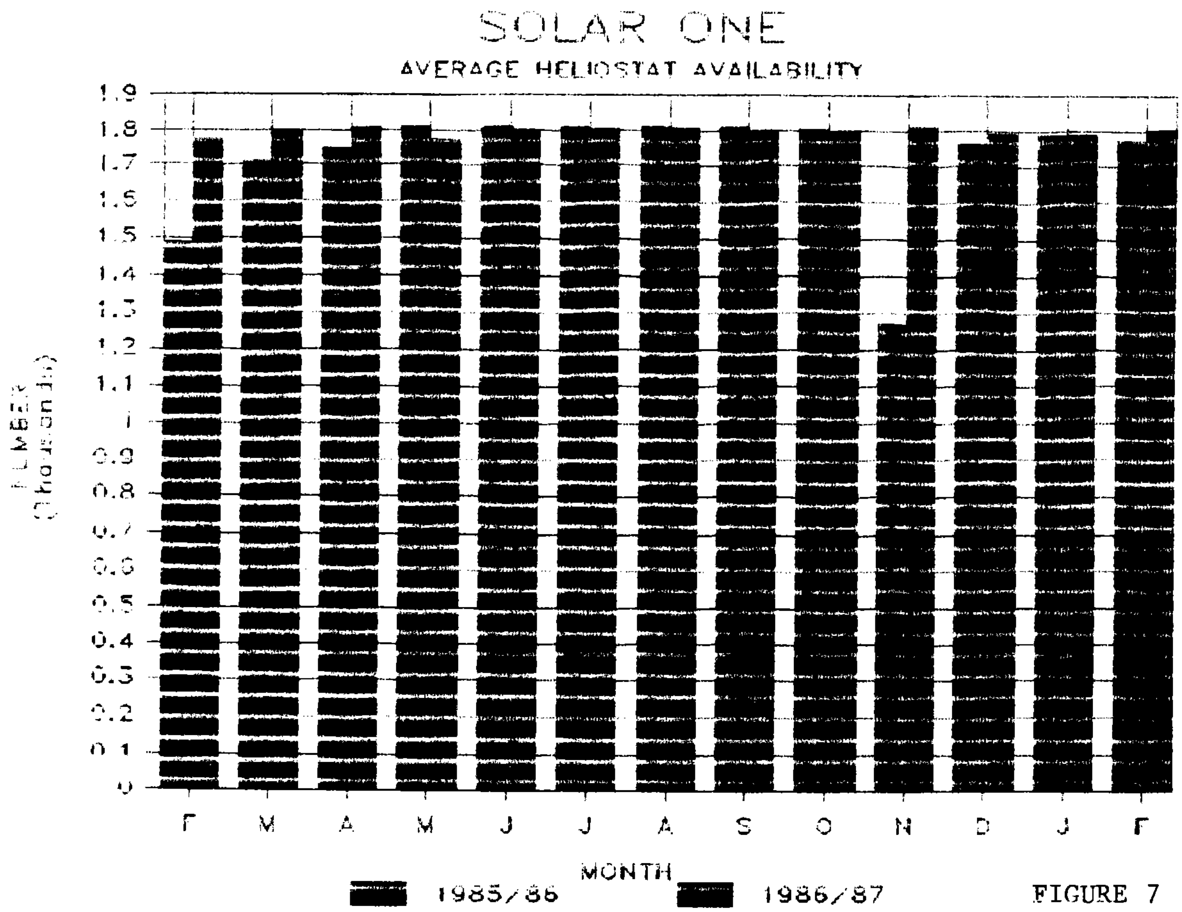

FIGURE 7

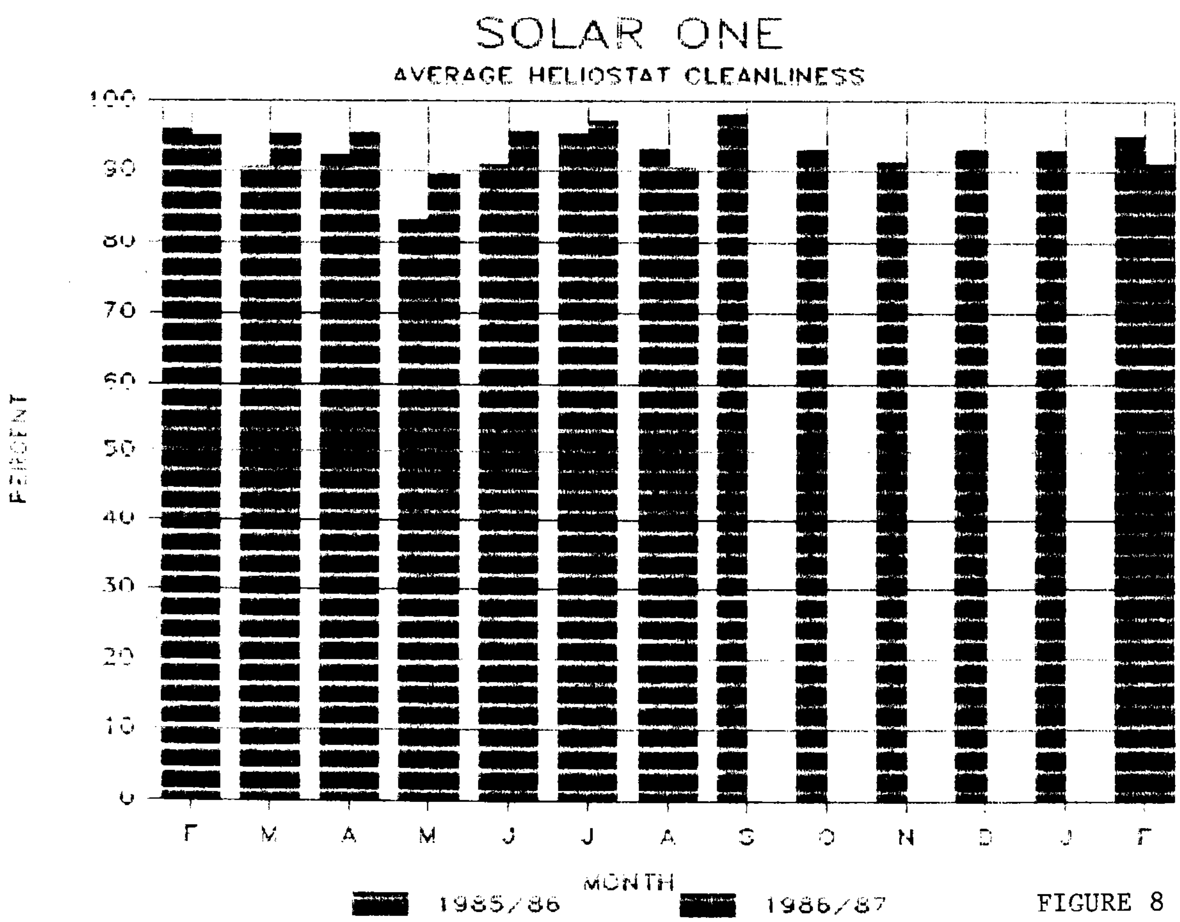

FIGURE 8

DOE/SF/10501-258
(STMPO 258)

SOLAR ONE
OPERATION & MAINTENANCE REPORT #58
January, 1987

THIS REPORT PRESENTS HIGHLIGHTS OF THE OPERATIONAL AND MAINTENANCE ACCOMPLISHMENTS FOR THE MONTH. IN ADDITION, IT PROVIDES A SYNOPSIS OF MONTHLY OPERATION COSTS, MAINTENANCE COSTS, AND PLANT STATISTICS.

ABSTRACT

- Solar One generated 295,680 MWh (gross) and -65,800 MWh (net) during 35.57 hours of on-line operation in the month of January 1987. The plant produced 111.40% MWh (net) less than the previous January record. Solar One incurred 94.63 weather outage hours and was down for 151.22 hours for scheduled and unscheduled maintenance. It should be noted that the plant was on an extended outage January 2-19, due to the receiver panel 9 warpage problem.

OPERATIONAL HIGHLIGHTS

- The receiver tripped on January 1 and 2 due to high receiver panel 9 metal temperature. Also prior to going on-line on December 2 the unit tripped on high thermal storage flash tank pressure. The thermal storage system was, at this time, out of service.

- An inspection on receiver panel 9 on Thursday, January 2, revealed that the south side of the panel, at elevation 3, was "bowed-out" about 14 inches, exposing the receiver core internal structural members. At this time, it was determined that the receiver could not be operated safely. The pin that connects panel 9 to its roller assembly was found to be missing. The receiver was drained under a nitrogen blanket and a forced outage was incurred. A joint receiver inspection with McDonnell Douglas, Sandia Labs and SCE, was conducted on Tuesday, January 6. At the conclusion of the inspection, a tentative decision to replace panels 9 and 16 with spare receiver panels was made.

- The collector field was rain washed on January 4.

- On January 7, a receiver panel flow test was performed. The test found that panel 9 flow indication to be relatively accurate and the temperature control valve flow coefficient to be consistent with past records. The test also verified the recently measured high panel 9 flow to be correct. An inspection of the drain valve on Thursday, January 8, found its plug and seat to be scoured which was the cause of the high flow and pressure differential. On Friday, January 9, panel 14 drain valve and plug and seat were also found to be scoured. Both inlet header drain valves on panels 9 and 14 were repaired and reinstalled on Thursday, January 15. Inspection of the remaining receiver panel drain valves found them to be in good condition. Calibration check of receiver pressure and pressure differential transmitter found them to be properly calibrated.

- Inspected selected receiver panel expansion guides to determine their condition and to evaluate the relationship between the deformed panels and the relatively good panels. The survey was completed on Friday, January 9.

- Operators restarted all plant systems on January 18 in preparation for plant power generation on the following day. It was determined at this time to proceed with normal plant operation and to plan replacement of receiver panels 9 and 16 during the winter months.

- The plant underwent normal start-up for power production and tests on January 19. During the start-up, it was necessary to blow down the condenser hot well to deconcentrate feedwater iron particulates. An early morning receiver inspection found the receiver panels 6 and 8 to have moderated leakage near the bottom of the panels and panels 14 and 15 to have significant leakage at elevation 5. Also during the start-up, it was necessary to tighten bonnet bolting on receiver panel drain valves 9, 12 and 14 which were leaking severely. In addition, the turbine lube oil was cold (72-74 degrees F) and the turbine lube oil reservoir heaters indicated a 100% electrical ground. The plant then continued with start-up activities. The start-up and shutdown heliostat aimpoints were not utilized at this time so that panel 9's erratic control problems could be evaluated. The receiver tripped at 1045 hours, shortly after transitioning to the steam downcomer due to high metal temperature. The plant then proceeded with a second start-up attempt, and in the process, determined that the receiver panel 14 drain valve was leaking excessively. Further start-up effort was aborted due to the low turbine lube oil temperature (84 degrees F).

- An early morning receiver inspection on January 20, found valve bonnet leakage on the steam down comer to flash tank control valve (AOV-2915) and receiver panel drain valves 3 and 23. Solar One was on-line for power production at 0901 hours and off-line at 1628 hours because of declining insolation. Steam flow at midday was 110,000 + LB/HR causing a high receiver feedpump speed (insolation at 1000 + watts per square meter). At this time, it was also necessary to increase to 1325 psi throttle pressure to insure that the turbine control valves would regulate the turbine generator load.

- The receiver tripped on January 21 when the second point feedwater heater developed a tube leak. The feedwater heater was bypassed until the leak could be repaired.

- The receiver start-up was delayed on January 23, to allow inspection of the receiver expansion guides. The inspection found tube leaks at elevation 5 on panels 5 and 8. Solar One was on-line for power production at 0944 hours and off-line at 1242 hours due to high receiver panel 10 metal temperature on failure of the Beckman (SDPC) communication control module (CCM) disk drive. Replaced the CCM disk drive from similar unit in the thermal storage system controller and reduced controller voltage from 5.26 to 5.0 volts. In attempting a second plant restart, flow in panel 4 dropped and an investigation found a 0 flow bias to this panel. After calibrating the panel 4 flowmeter, the receiver controls were returned to a normal condition. The plant then remained out of service due to low insolation.

- The receiver Beckman controller failed at 0606 hours on January 24. Following performance of receiver controller diagnostics and reseating of controller cards, the receiver was returned to normal operation at 0912 hours. Start-up efforts were then delayed by passing clouds. On the following start-up attempt, it was necessary to change the flow bias on receiver panel 4 temperature control valve to establish the proper minimum flow rate. This second start-up attempt was then aborted due to passing clouds.

- Plant start-up was delayed on January 25 due to flow problems on receiver panels 20 and 21. During the plant start-up, the receiver distributed process controller communication control module required reset because the diagnostic summary indicated many check sum errors and some scramble tags. It was necessary to manually decrease heliostats in service at 0811 hours to reduce high receiver panel flow. Solar One was placed on-line at 0901 hours and off-line at 1030 hours due to overcast skies. Inspection of the receiver core following the plant shut down found elevation 2 receiver panels 9, 10 and 11 expansion guides to be seized or broken, i.e., 9 right, 10 left and right and 11 left. It is significant to note that the panel 10, elevation 2, expansion guides were repaired in the previous week.

- During operation on January 26, it was necessary to throttle the receiver feedpump recirculation valve to 10% open to prevent an overspeed condition and to increase receiver outlet pressure to 1400 psi to insure the turbine valve regulated the generators output. When attempting to update panel 21 flux gain at 1351 hours, it was found that the CCM disk was not receiving updated data.

- Communication between the heliostat controllers (HAC's) and the collector field was lost at 0121 hours on January 30. Efforts to reboot both HAC's were unsuccessful, McDougal failed to respond. Subsequent six efforts to reboot Erin prime without backup using various strategies were also unsuccessful, because each time collector field communication was established all communication lines failed over to backup lines. Following replacement of the Erin (HAC) power supply with the McDougal power supply and exchanging HAC memory boards, Erin was returned to service at 1831 hours. For the present the Data Acquisition System, and the Beam Characterization System Computers are out of service because their components were used to repair HAC's. A plant trip was experienced at 0755 hours due to operation of the thermal storage system Interlock Logic System (ILS). Investigation did not find the cause of the ILS malfunction. The unit was returned to normal operation at 0800 hours. The large nitrogen regulator to the thermal storage tank and the nitrogen supply valve to the thermal storage tank upper manifold were valved out of service to correct high tank pressure. It was suspect that the large nitrogen regulator was leaking through.

MAINTENANCE HIGHLIGHTS

- o Replaced the receiver feedwater pump N/W bearing oil heater and Burke Enterprises completed installation of the weather satellite monitoring station dish receiver. The monitoring station installation was essentially complete on January 5, but was awaiting replacement of a defective cable before being placed into service.

- o Metalclad Corporation crew was on site on January 8 to begin removal and reinstallation of selected thermal storage tank insulation.

- o Inspected the receiver panel 9 strainer on Wednesday, January 9, and found it to be clean. Therefore, it was not causing the high panel differential pressure. The inspection plugs were also removed in order to inspect the orifices. The orifices were found to be in good condition.

- o In the past months, difficulty was experienced in maintaining proper water chemistry (refer to Attachment 1 regarding this subject).

- o During the week of January 12, the inert resin and a portion of the anion resin in the #2 inline demineralizer was replaced. Eight cubic feet of Ambersep 359 inert resin was placed in the bed after removing the old resin. In addition, six cubic feet of new Ambersep 900 anion resin was added to the bed to bring the anion resin to proper level.

  During the week of January 26, the inert and a portion of the anion and cation resins in #1 inline demineralizer bed were replaced. Eight cubic feet of new Ambersep 359 inert resin, eight cubic feet of new Ambersep 900 anion resin, and five cubic feet of Ambersep 132 cation resin were added.

- o The receiver panel 19, elevation 3, south expansion guide was reattached to the panel.

- o An automatic acid feed system for the circulation water system was completed on Tuesday, January 13. A solenoid valve in the acid feed line can be operated from the control room in order to control and maintain proper pH levels. On Friday, January 16, heat tracing was installed on the acid day tank and discharge line to prevent freezing.

- o On Friday, January 16, insulation was installed between receiver panels 8 and 9, 9 and 10, 14 and 15, and 16 and 17 to prevent solar energy from entering the receiver core. The work was completed on Saturday, January 17.

- Replaced the receiver distributed process controller communication control module with one borrowed from the thermal storage system to make receiver controls operable. The following day, the thermal storage control module was replaced with a new unit which was received that day. Subsequently, on January 12, the control modules were exchanged between the receiver and thermal storage systems.

- The defective turbine lube oil heater circuit was repaired on Monday, January 19.

- The demineralizer caustic tank was drained and flushed on Monday, January 19. A shipment of caustic intended for Cool Water Generating Station was accidently delivered to Solar One and placed in the demineralizer caustic storage tank. This high chloride caustic was transferred back to Cool Water Generating Station and a fresh load of low-chloride caustic was delivered to Solar One on January 21. Metalclad is continuing repair of thermal storage tank insulation. Inspected receiver panel 14 drain valve and found seat gasket to be misaligned, causing the excessive leakage experienced during the plant's start-up efforts. The valve was repaired and returned to service. Installed temporary heat tracing on the cooling tower acid day tank and discharge line to preclude further freezing of acid.

- Tightened valve bonnet gaskets on receiver panel drain valves 3 and 23 on Tuesday, January 20. Replaced bonnet gaskets on January 23 to correct continuing leakage.

- Metalclad continued repairs of the thermal storage tank insulation on January 22. Repaired the circulating water system pH controller. Replaced the receiver distributed process controller communication control module with the new one that was recently installed in the thermal storage system controller after the plant's shutdown. Began repair of the #2 feedwater heater and found four tube leaks. Since five tubes had been previously plugged, the additional plugged tubes may require operator closure of the receiver feedpump recirculation valve during high load generating periods. Barstow Customer Service (SCE) inspected a leaking switch yard transformer and scheduled its replacement. Repaired or realigned receiver panels 9, 10 and 11 elevation 2 expansion guides. During the receiver inspection, it was also noted that the appearance lagging at the receiver tube outlet on panels 4, 13 and 14 was missing. Panel 4 evidenced fatigue failure, while the other failures were due to heavy oxidation. Panel 4 appearance lagging has been missing for the past several months.

- Installed bumpers on panels 4 and 9 on Monday, January 26, which completes the expansion guide modification on these two panels. The remaining panels are scheduled for a similar modification in the near future.

- Metalclad was on station on January 26 to continue tank roof insulation repairs. Tarsco Company repositioned the displaced thermal storage tank roof truss and seal welded the tank roof to tank wall seal weld.

- Repaired receiver panel 11 tube leak on Tuesday, January 27, at the level 6 left expansion guide attachment clip. Metalclad completed insulation work on the thermal storage tank and Tarsco Company began installing the tank roof insulation metal cladding.

December 18, 1986

M. R. White
Generating Station Manager
Cool Water Generating Station

Water Treatment Review
Solar One
November, 1986

CONCLUSIONS

Review of the water treatment records for the month of November revealed one serious chemical problem. The cation conductivity of the in-line demineralizer effluent frequently exceeded the recommended limit of 0.15 μmho/cm. The major contaminant found in the effluent from the in-line demineralizers was sulfate ion. Sulfate concentrations as high as 18 ppb have been found. The turbine manufacturers recommend a maximum sulfate concentration of 2 ppb in the steam cycle.

Several factors are contributing to the poor performance of the in-line demineralizer. Both in-line demineralizer beds are short of inert resin. Analyses of the resin in the demineralizer beds reveal the inert resins are in poor condition and should be replaced. In addition, the caustic soda solution used for regeneration contains 35 times the normal concentration of chloride ion. Our recommendations concerning the in-line demineralizers appear below.

Except for dissolved oxygen, other chemical parameters were controlled within D-E 1 recommended limits. Dissolved oxygen at the condensate pump discharge averaged 9 ppb, and oxygen in the receiver feedwater averaged 4 ppb.

Chemical testing by operators and chemical technicians met the requirements of D-E 1.

RECOMMENDATIONS

1. Replace the inert resin in both in-line demineralizer beds with new Ambersep 359 resin. A procedure for replacing the inert resin is attached. Division Chemical will provide an engineer for assistance, if needed.

2. Transfer the caustic soda solution (containing 0.35% chloride) in the Solar One bulk storage tank to Cool Water Generating Station's

bulk caustic soda storage tank. Replace the caustic soda solution transferred from Solar One with low chloride caustic soda solution.

3. Test all shipments of low chloride caustic received for chloride concentration before transferring to the bulk storage tank. Keep a record of the chloride concentration in all batches of low chloride caustic received.

ACTION ITEMS

1. Solar One

   a. Make modifications to the open circulating water acid feed system to allow automatic operation.

   b. Install a local receiver feedwater sample point to confirm high oxygen reading made in the lab.

   c. Replace the inert resin in in-line demineralizer beds.

   d. Transfer the caustic soda regenerant from Solar One to Cool Water Generating Station and replace with low chloride caustic soda.

2. Division Chemical

   a. Analyze in-line demineralizer resin samples collected October 23, 1986.

      Status: Complete, report forthcoming.

K B Henderson / Jnc

K. B. Henderson
Supervising Engineer 1
Division Chemical

121886-6DJC:rjd1222
Attachment

cc: J. H. Fuller
C. Inouye
C. W. Lopez

PROCEDURE FOR REPLACING SOLAR ONE INERT RESIN

1. Transfer the resin bed from the in-line demineralizer service vessel to the regeneration vessel.

2. Separate the resin in the regeneration vessel by backwashing.

3. Open the vent on the regeneration vessel and drain the water down to the top of the resin bed.

4. Open the manways on the empty service vessel and regeneration vessel. Using an eductor (provided by Division Chemical), transfer the anion resin from the top of the separated resin bed into the empty service bed. Open the drain valve on the bottom of the service vessel to drain transferred water from the service vessel. Use deionized water (60 psi, minimum) for the transfer. Leave six inches of anion resin behind in the regeneration vessel.

5. Using the eductor, remove and discard the remaining six inches of anion resin, the inert resin, and the top six inches of cation resin from the regeneration vessel.

6. Add new cation resin (Ambersep IR132--hydrogen or ammonium-form) until the cation bed depth is 58 inches.

7. Close the manway on the regeneration vessel and backwash the cation resin. Monitor the color of the backwash effluent. Continue backwashing until the backwash effluent is clear. Backwash for a minimum of 15 minutes.

8. Reopen the manway on the regeneration tank and add 7 ft^3 of inert resin (Ambersep 359) to the regeneration vessel.

9. Close the manway on the regeneration tank and backwash the bed. Monitor the color of the backwash effluent. Continue backwashing until the backwash effluent is colorless. Backwash for a minimum of 15 minutes.

10. Using the sluice pump, transfer the anion removed in Step 4 from the service vessel back into the regeneration vessel.

11. Reopen the manway on the regeneration vessel, and add anion resin (Ambersep 900-hydroxide or carbonate-form) to the regeneration tank as needed to give an anion bed depth of 29 inches.

12. Regenerate the resin in the normal fashion.

DJC:12/22/86

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Field Office	- Includes plant supervision, engineering, accounting, clerical, office supplies, and miscellaneous indirect expenses.
Operations	- Includes total cost of operating staff and expenses.
Misc. Support	- Includes station supplies and rentals, safety and job training, and site security.
Maintenance	- Includes total cost of maintenance staff and expenses allocated to major plant subsystems.
Overheads	- Includes cost associated with the direct labor plus company administrative and general expenses.

- Additional Solar One operational information is provided in the following:

  - Power Generation, Figure 1.
  - Plant Capacity Factor, Figure 2.
  - On-line Operation, Figure 3.
  - Receiver Collector Operation, Figure 4.
  - Weather Outage Time, Figure 5.
  - Equipment Outage Time, Figure 6.
  - Average Heliostat Availability, Figure 7.
  - Average Heliostat Cleanliness, Figure 8.

TABLE I

PLANT STATISTICS	January 1986	January 1987	August 1984 To Date
Net Generation MWh	577.4	-65.8	21482.3
Gross Generation MWh	971.0	295.7	33750.8
Mode 1 Peak Output MW	10.9	10.7	11.7
Available Insolation MWh #	9158.6	8977.9	356294.6
Available Insolation Hours	192.1	188.1	7311.1
Power Production Hours	116.9	35.6	4293.9
TSS Charging Hours	14.3	0.0	395.6
Weather Outage Hours	89.0	94.6	2733.1
Scheduled Outage Hours	0.6	5.2	573.3
Unscheduled Outage Hours	14.1	146.0	940.3
Weather Overlap Hours	2.0	44.4	415.3

Useable NIP Energy Collector Field Surface Area of 71095 m2

Station Availability % 26.4

Subsystem Availability:
Receiver 29.1
Collector 97.3
Turbine 100.0

Utilization Factor % 0

(Net Generation) / (On-line Hours * 10 MW net)

Capacity Factor % 0

(Net Generation / (Period Hours * 10 MW net)

Solar Capacity Factor % 0

(Net Generation / Available Insolation)

TABLE II

MONTHLY O&M COST SUMMARY
($ x 1000)

MONTH OF JANUARY, 1987

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	4.3	0.1	1.2	0.7	6.3
OPERATIONS	26.1	21.7	0.0	0.2	48.0
MISC. SUPPORT	1.1	0.0	2.8	-0.2	3.7
MAINTENANCE:					
Supv/Indirects	6.1	3.0	0.0	11.7	20.8
Control System	0.8	6.2	3.7	0.9	11.6
Receiver System	3.6	0.6	0.0	1.0	5.2
Thermal Str. Sys.	2.0	0.0	0.0	0.1	2.1
Collector System	2.0	0.0	0.0	0.1	2.1
EPGS System	2.4	7.4	0.3	0.0	10.1
Miscellaneous	0.6	0.4	0.8	0.0	1.8
TOTAL MAINTENANCE	17.5	17.6	4.8	13.8	53.7
SUBTOTAL	49.0	39.4	8.8	14.5	111.7
Division O.H.					9.7
TOTAL DIRECT:					121.4
Workman's Compensation					0.4
Payroll Tax					4.0
Pension & Benefits					12.5
Administration & General					20.2
GRAND TOTAL					158.5

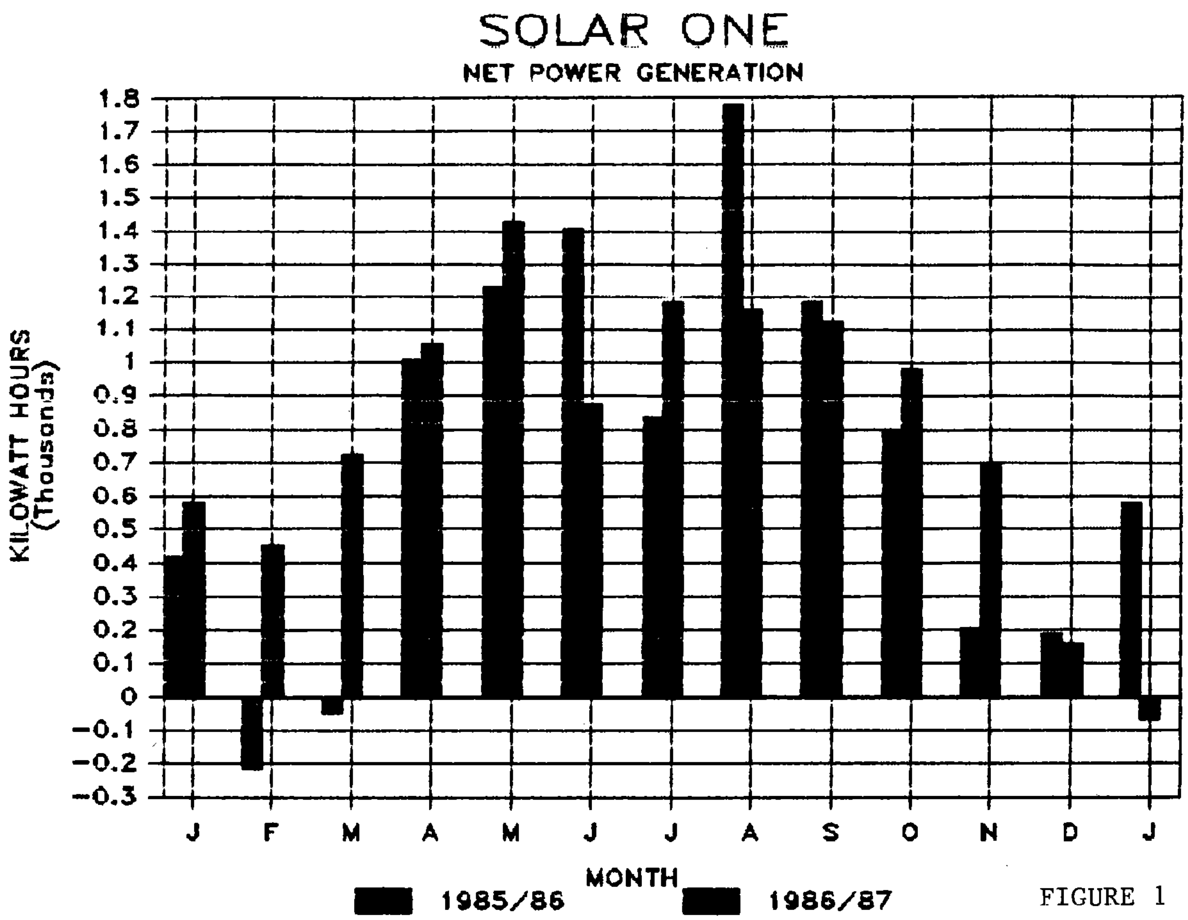


FIGURE 1

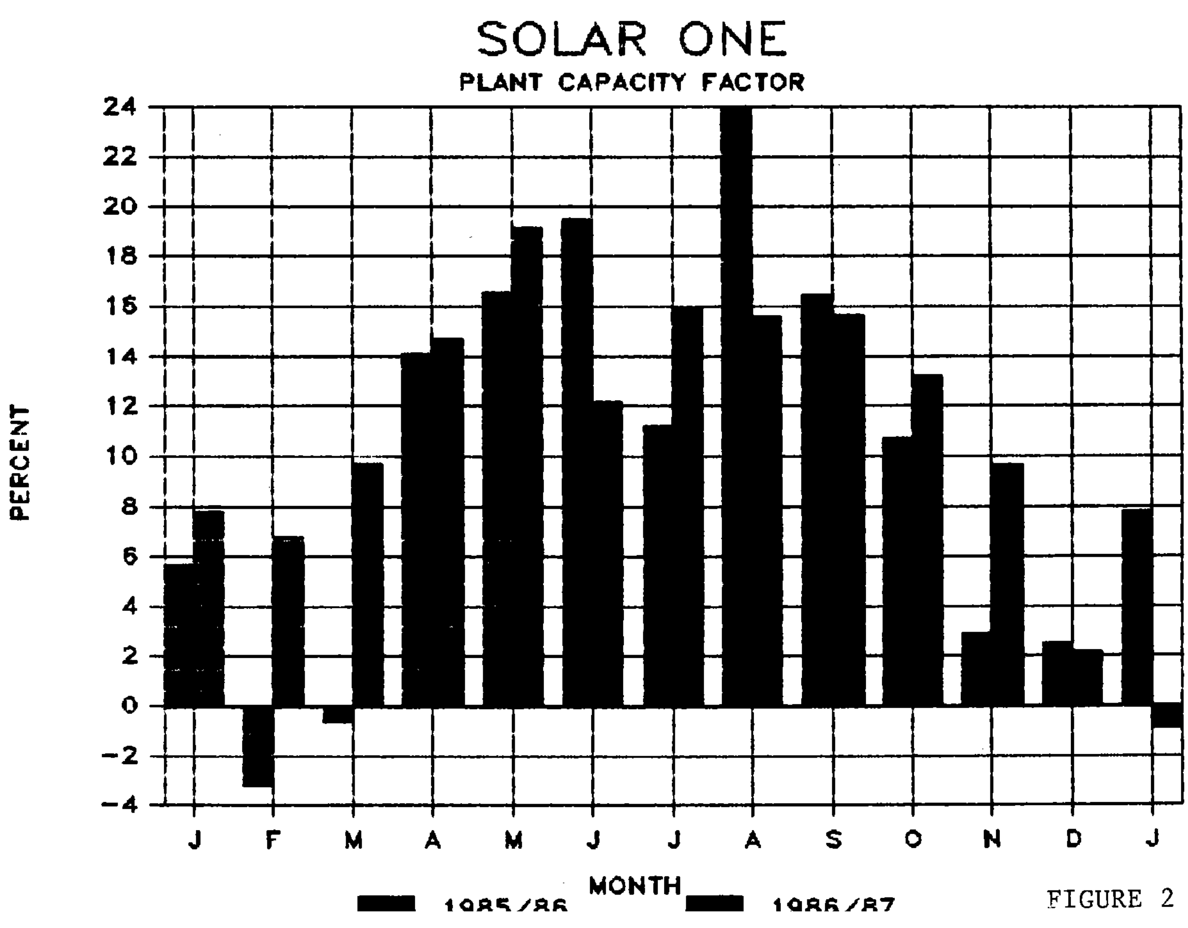


FIGURE 2

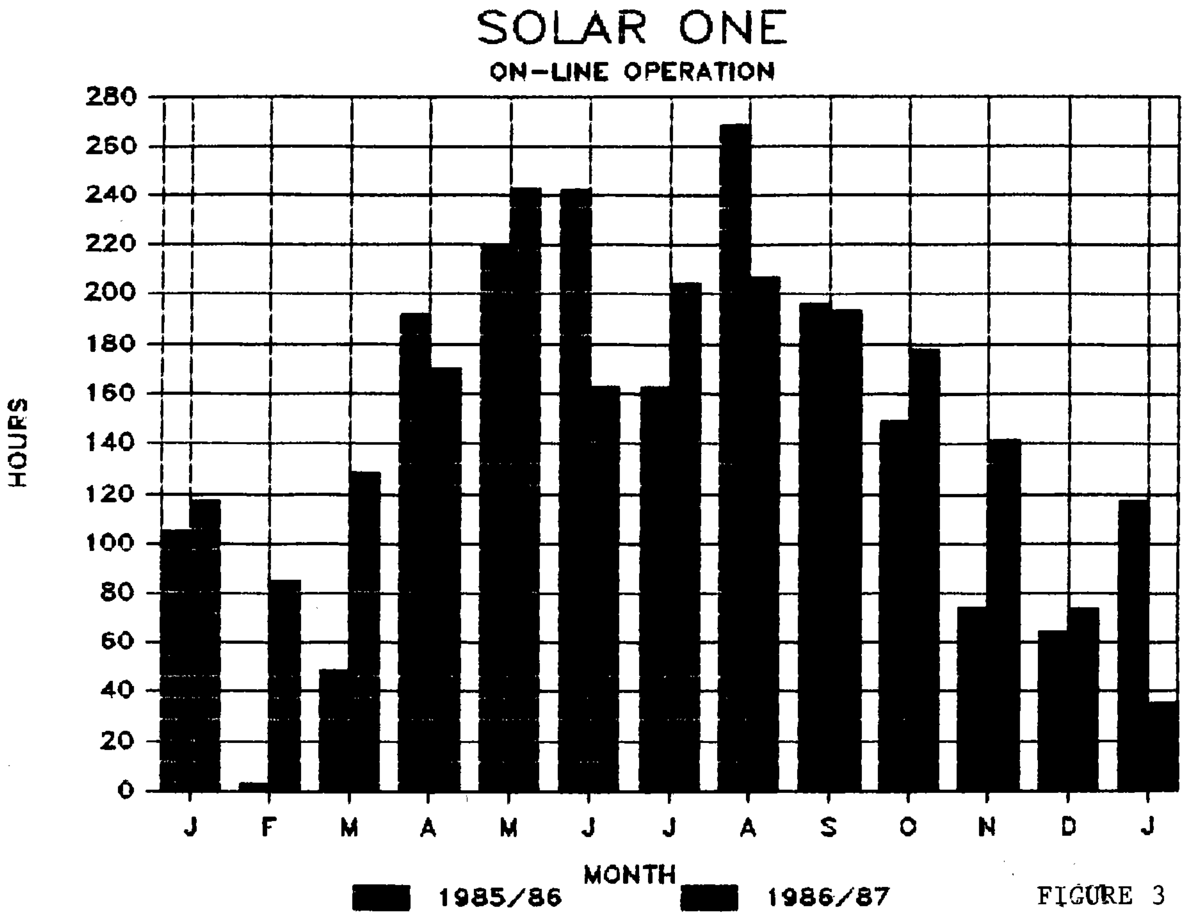
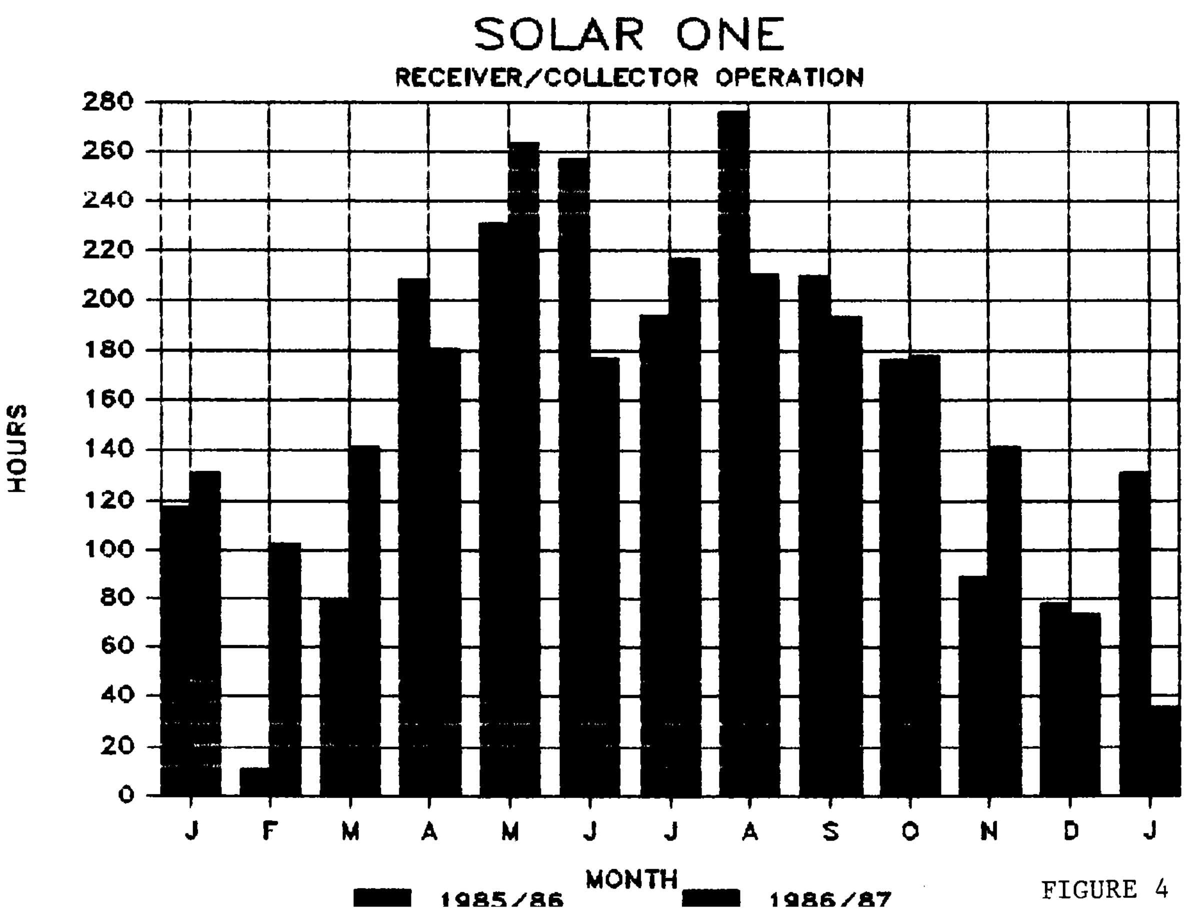


FIGURE 3



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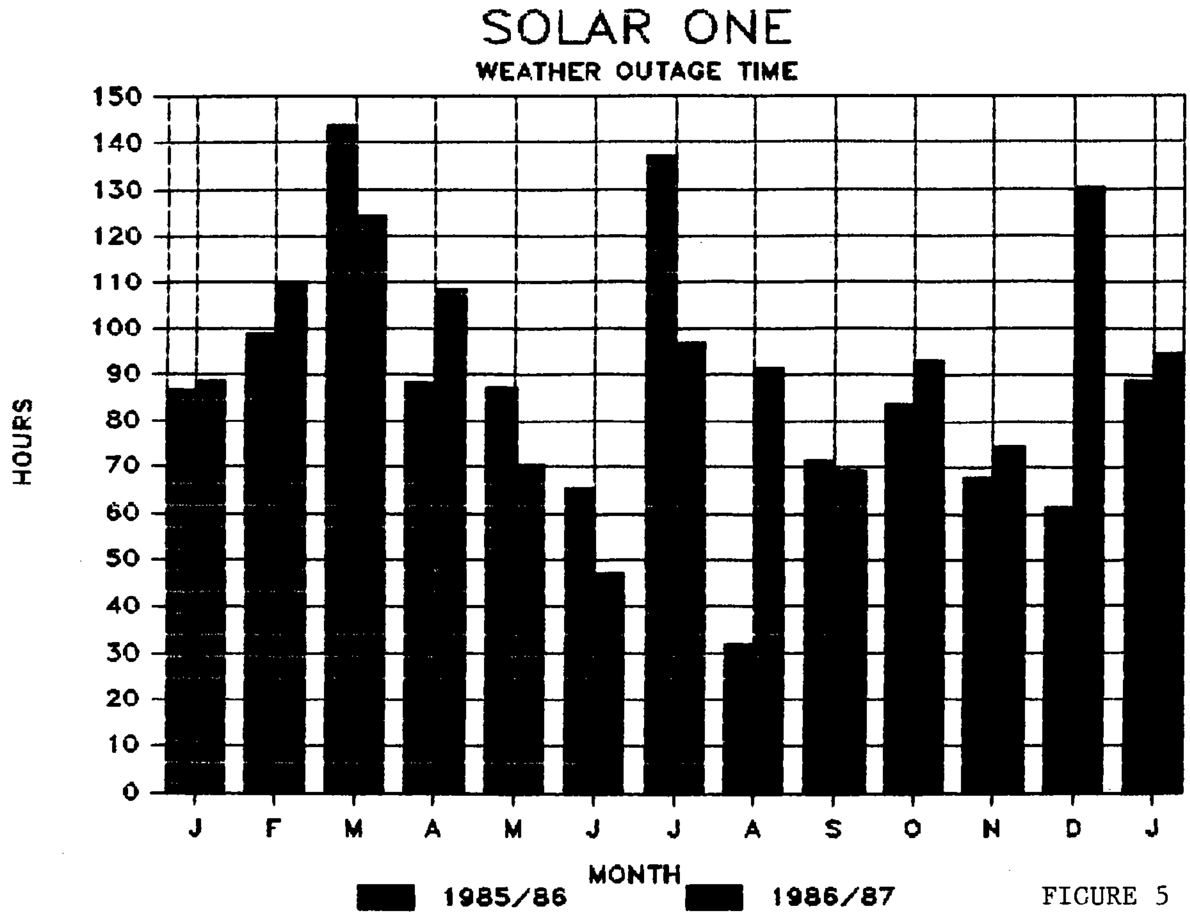
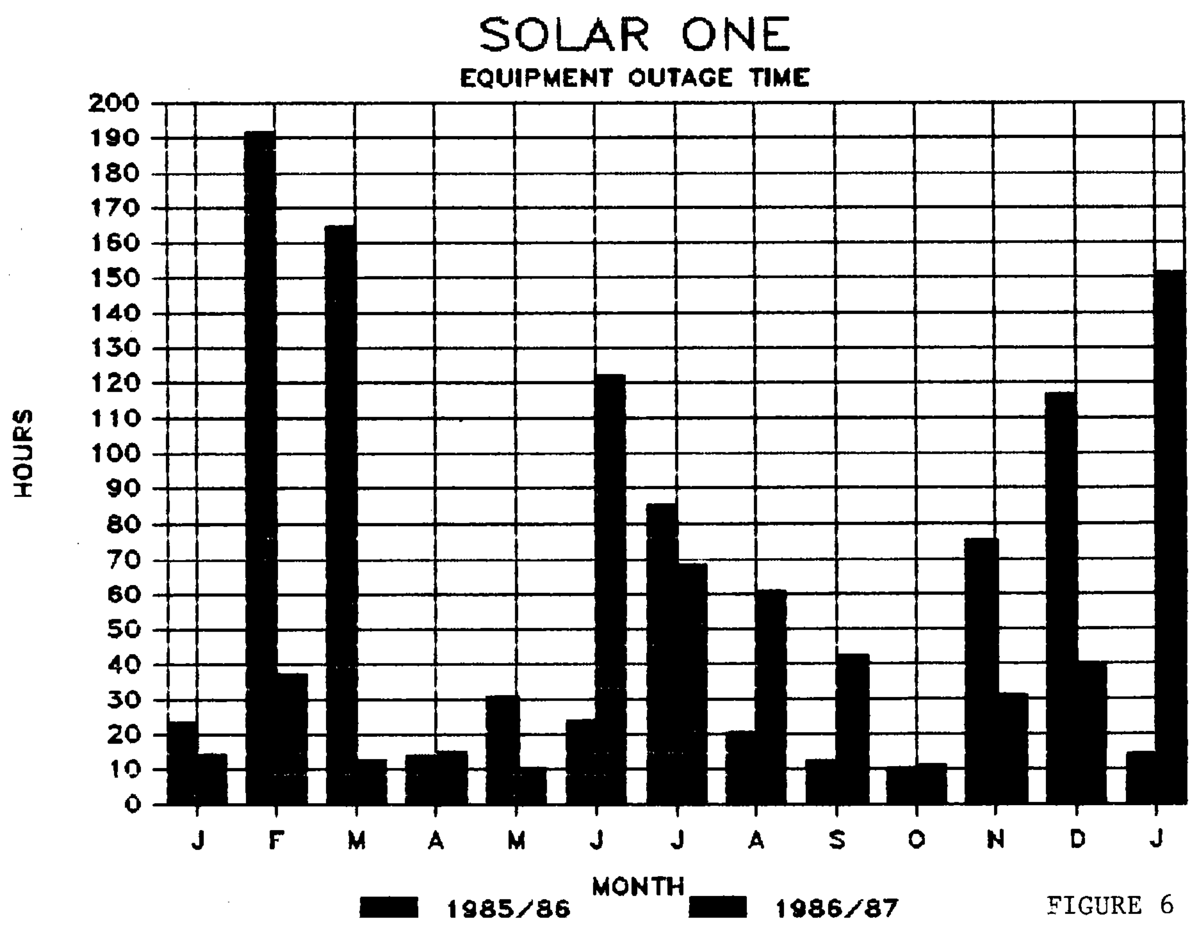


FIGURE 5



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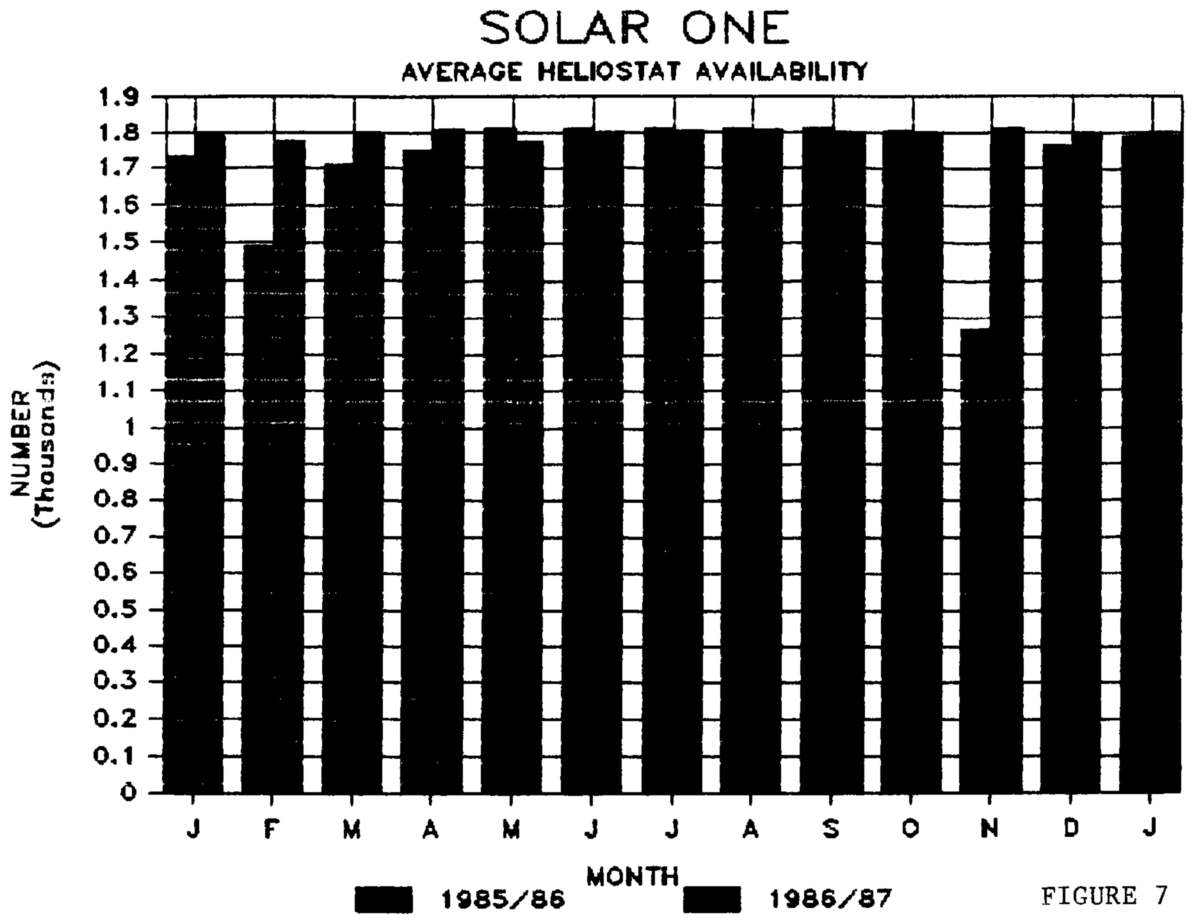

FIGURE 7

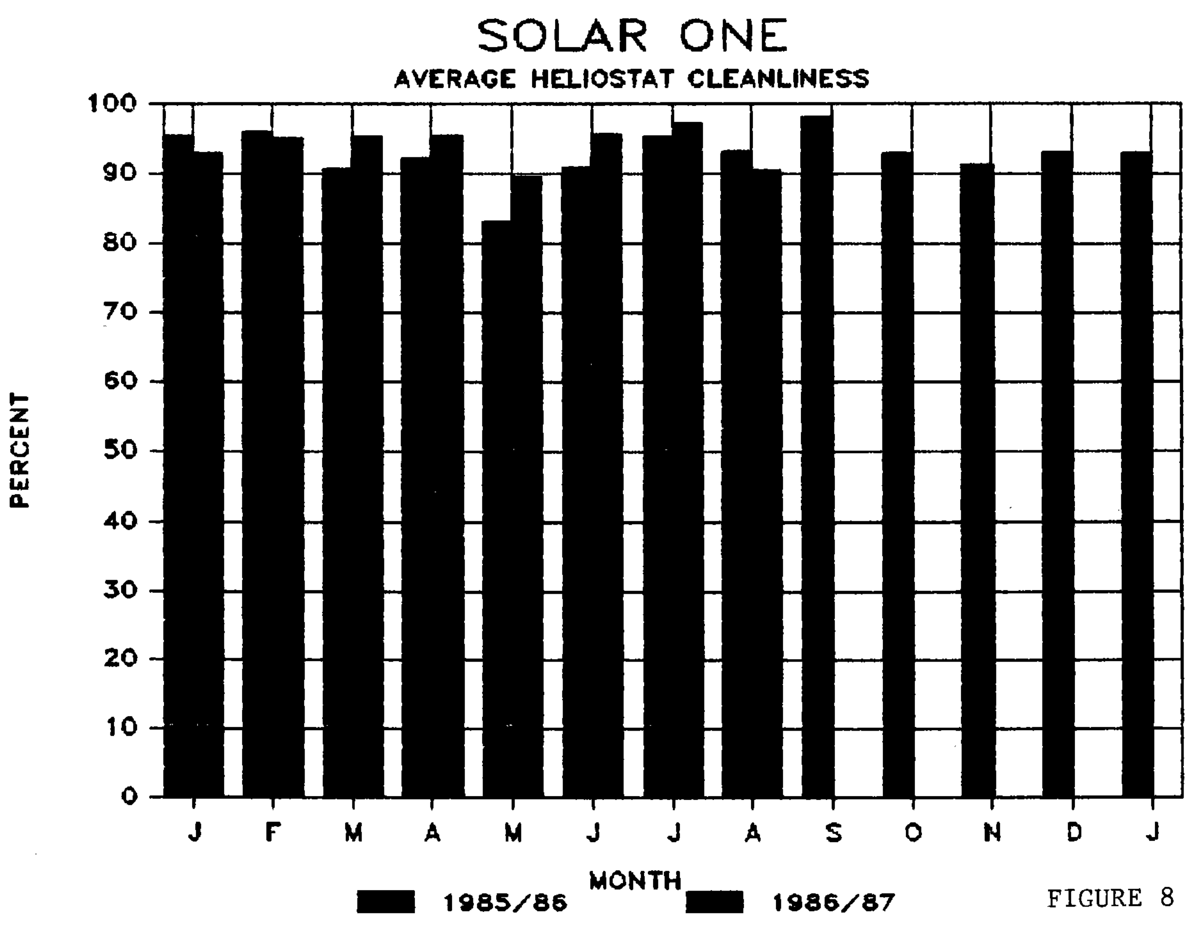

FIGURE 8