DOE/SF/10501-213
(STMPO-813)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #13
APRIL 1983

This report summarizes the operational activities and highlights maintenance work that was required during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

April was the anniversary month for Solar One. The turbine/generator was synchronized to SCE System for the first time on April 12, 1982.

April, also, was the first month since operations began that Solar One generated a net positive output (transmitted 107.8 MWhrs). Energy production while connected to the SCE System was 528 MWhrs. net.

Operational Highlights

- On two occasions during April, 1805 of 1818 heliostats were available for service. The significantly improved collector system reliability was the result of software revisions, replacement of defective motor/gear drives, installation of heliostat controller protective fuses, and routine servicing of limit switches.

- To reduce auxiliary power consumption and because of the demonstrated high reliability of the collector system, the collector field is now being operated only to support energy production, testing and rain washing rather than on a continuous basis.

- During Mode 5, TSS Charging Operation, it was noted that Solar One could operate for prolonged intervals with insolation values below 400 watts/m^2. This indicates that the plant is operative in Mode 5 at below the minimum design criterion of 450 watts/m^2.

- Receiver trips on false indications of low superheat temperature have sporadically been experienced. Investigation revealed that the trips occurred during the activation of the receiver moisture separators. A new operating procedure was instituted to enable moisture separators to be activated as soon as the receiver panels controlled by any two Multivariable Control Units (MVCU's) go into temperature control. The moisture separators disable after the last pair of receiver panels goes off temperature control. Previously, the moisture separators would activate at the operators discretion through the operation of an enable/disable switch. The automated procedure has solved the problem.

- Receiver flowmeters from panels 7, 18, 20 and 21 were replaced with meters having greater sensitivity at low flows to ensure accurate flow measurements during early morning start-ups. Other panel flowmeters may be changed in the future, if a significant improvement in operation during start-ups results.

- The Thermal Storage Extraction Auxiliary Steam Subsystem was automated and released to SCE operations. This automation transitions the auxiliary steam source of generation from the electric boiler to a TSS extraction boiler through the operation of a single switch.

- In the continuing effort to automate plant functions, tests were performed to refine the cooling tower fan start-up sequence, whereby all three fans are started sequentially and transferred from the low speed to the high speed setting through a single keystroke. Following the completion of the tests, the system was released to operations for service.

Maintenance Highlights

- A faulty receiver (panel #5) flowmeter caused a plant shutdown on April 27th. The flowmeter electronics were damaged due to water intrusion, resulting in erroneous readings which prevented the panel from going into flow and temperature control. The necessary repairs on seals were made and the meter was reinstalled. Similar problems were also experienced with several other flow-meters and corrected.

- New valve trim was installed in the receiver bypass valve (PV-2002). Inspection of the valve after the trim installation revealed damage in valve body allowing leakage. Temporary repairs were made to permit continued operations. Final repairs will be made at a later date.

- Small caloria oil leaks were experienced in Thermal Storage System (TSS) charging train #1 condenser and extraction train #1 super-heater. The leaks were temporarily repaired by tightening the flange bolts. Final repairs will be made during the next maintenance outage scheduled for early June.

- The bearings of the anemometers and wind direction sensors on all Special Heliostat Instrumentation and Meteorological Measurements System (SHIMMS) stations and towers were replaced per McDonnell Douglas and the manufacturer's (CLIMET) recommendation. Replacement of the bearings annually will guarantee reliable measurements.

- Two more incidents of plant waste water line failures were experienced in April. Studies for line replacement have been completed, and purchase of materials and installation will begin soon. This line has been a source of great frustration for the maintenance staff and everyone looks forward to its replacement.

- Failure of the Thermal Storage System flash tank steam side rupture disk was experienced again. Investigation determined that the rupture disk currently in use does not meet the design specifications. A rupture disk of different material and which meets the design requirements will be installed to replace the existing one.

- A complete reevaluation of the regeneration process of the inline demineralizers is near completion. The evaluation update includes resin capacity testing, calibration of the chemical dilution and

rinsing water flowmeters, sluice pump capacity testing, caustic dilution water temperature regulator repairs and chemical pump adjustments to ensure correct concentrations of caustic and sulfuric acid. The sluice pump capacity testing revealed inadequate flow rates for resin rinsing and backwash. Inspection of the pump internals did not indicate any damage. Pump suction piping modifications have been initiated to minimize flow restrictions due to improper valving and the excessive number of pipe fittings. Final modifications will take place during the next maintenance outage. This will result in longer bed service runs.

- The Gland Seal Steam Condenser was recently chemically cleaned to remove service water deposits from the system's pipe walls. Service water was originally used as a quenching medium. Piping modifications were completed to replace service water with condensate. However, contamination in the system due to the service water deposits precluded routing of the gland steam condenser drains into the main condenser, resulting in waste of condensate at an approximate rate of 4.5 gpm.

  The chemical cleaning (at an estimated cost of $250) effectively removed all deposits and allowed recovery of 4.5 gpm or 2,430 gallons per day of condensate as well as the condensed steam leak-off. Assuming daily operation and a nine-hour day, for a period of one month, this amounts to 72,900 gallons. The savings resulted from the above activity, including water and pumping costs, are approximately $1,063 per month or $12,756 per year.

Plant Statistics

- Attachment 1 shows the daily and cumulative power production for the three previous months.

- During this reporting period Solar One was on-line for approximately 114 hours (See Attachment 2), the longest period since operations began. The previous record was 66 hours. Weather and maintenance outages have started declining, allowing for more power production and testing activities.

- The energy figures represent net kilowatt hours produced while the generator was synchronized to the electric grid.

Plant Statistics	April	Turbine Roll To Date
Energy production (KWH net)	528,400	2,438,300
Peak MW (net)	9.4	10.4
On-Line Hours	114.1*	572.4
Test Hours	86.3	769.5
Total Plant Outage Hours	35.5	857.3
Scheduled	22.0	362.5
Unscheduled	13.5	484.8
Weather Outage Hours	129.3	1,182.4

*New Record

Operation and Maintenance Costs

- A summary of the O&M labor, material, contract, and other costs for the month of April 1983, is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

- The total FY83 O&M Budget as shown in Attachment 3 is estimated at $3.3 million and reflects all the expenses categorized above. As of the end of April actual total expenses were running within approximately 1% of the budget and it is expected that this trend will continue. The budget breakdown in the pie-chart on Attachment 3 shows that most categories are within what was reasonably expected. However, one pleasant surprise is in the maintenance required for the collector field which was estimated at 3% of the budget and is now running at considerably less than 1%.

SOLAR ONE

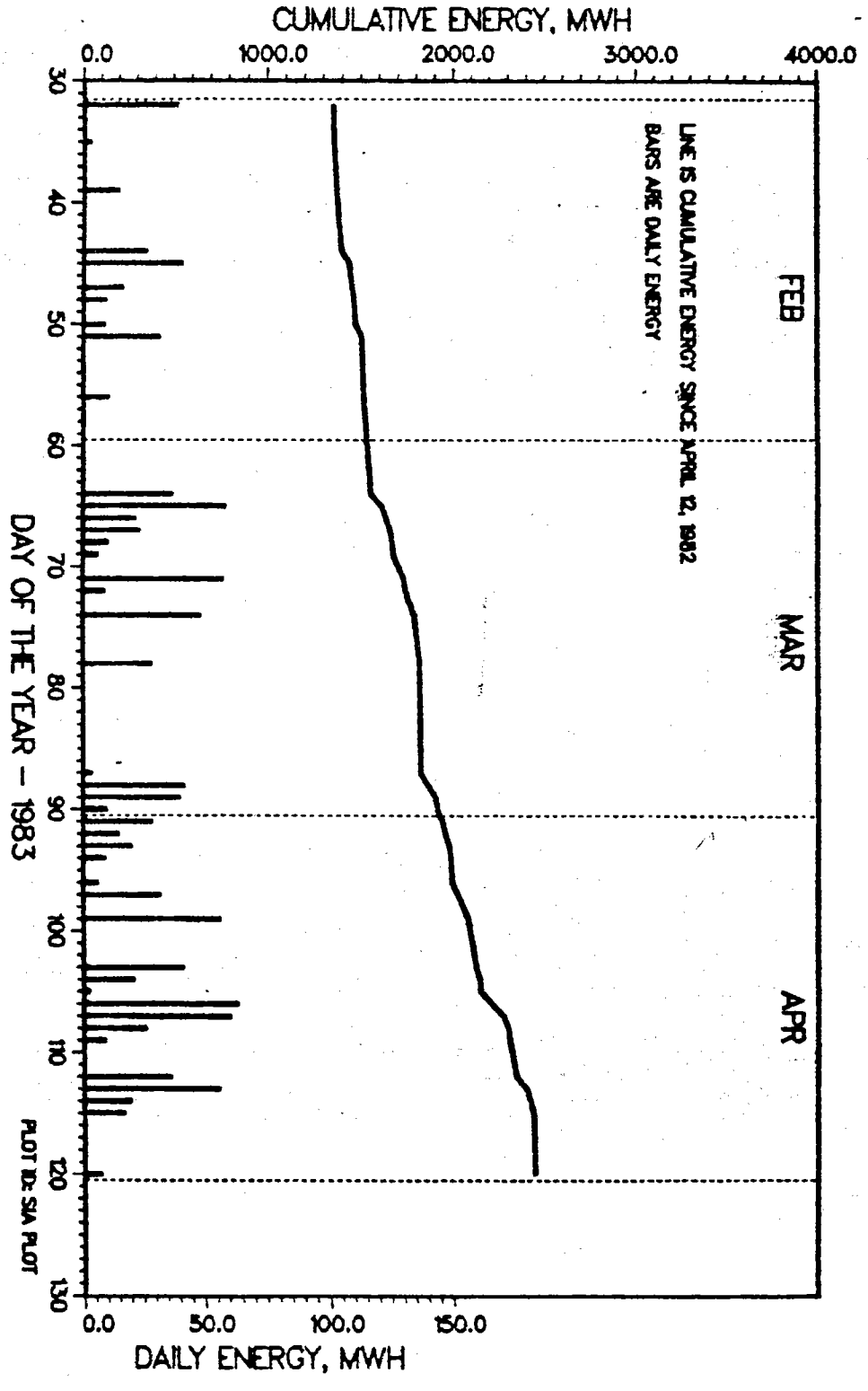
MONTHLY O&M COST SUMMARY
($ X 1000)

MONTH OF APRIL 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	16.8	.3	-	1.3	18.4
OPERATIONS	53.0	11.4	-	1.1	65.5
MISCELLANEOUS SUPPORT	.9	.1	4.5	3.1	8.6
MAINTENANCE					
Supervision/Indirects	9.1	3.5	1.6	.1	14.3
Control System	8.3	6.7	2.8	-	17.8
Receiver System	2.4	-	-	-	2.4
Thermal Storage System	1.7	2.1	6.8	.1	10.7
Collector System	1.9	.1	.2	-	2.2
EPGS System	5.5	1.7	.2	.3	7.7
Misc.	4.0	1.1	6.1	1.8	13.0
Total Maintenance	32.9	15.2	17.7	2.3	68.1
SUB TOTAL	103.6	27.0	22.2	7.8	160.6
Division O.H.					21.6
TOTAL DIRECT					182.2
Workman's Compensation					.9
Payroll Tax					6.9
Pension & Benefits					21.2
Administrative & General					33.1
GRAND TOTAL					244.3

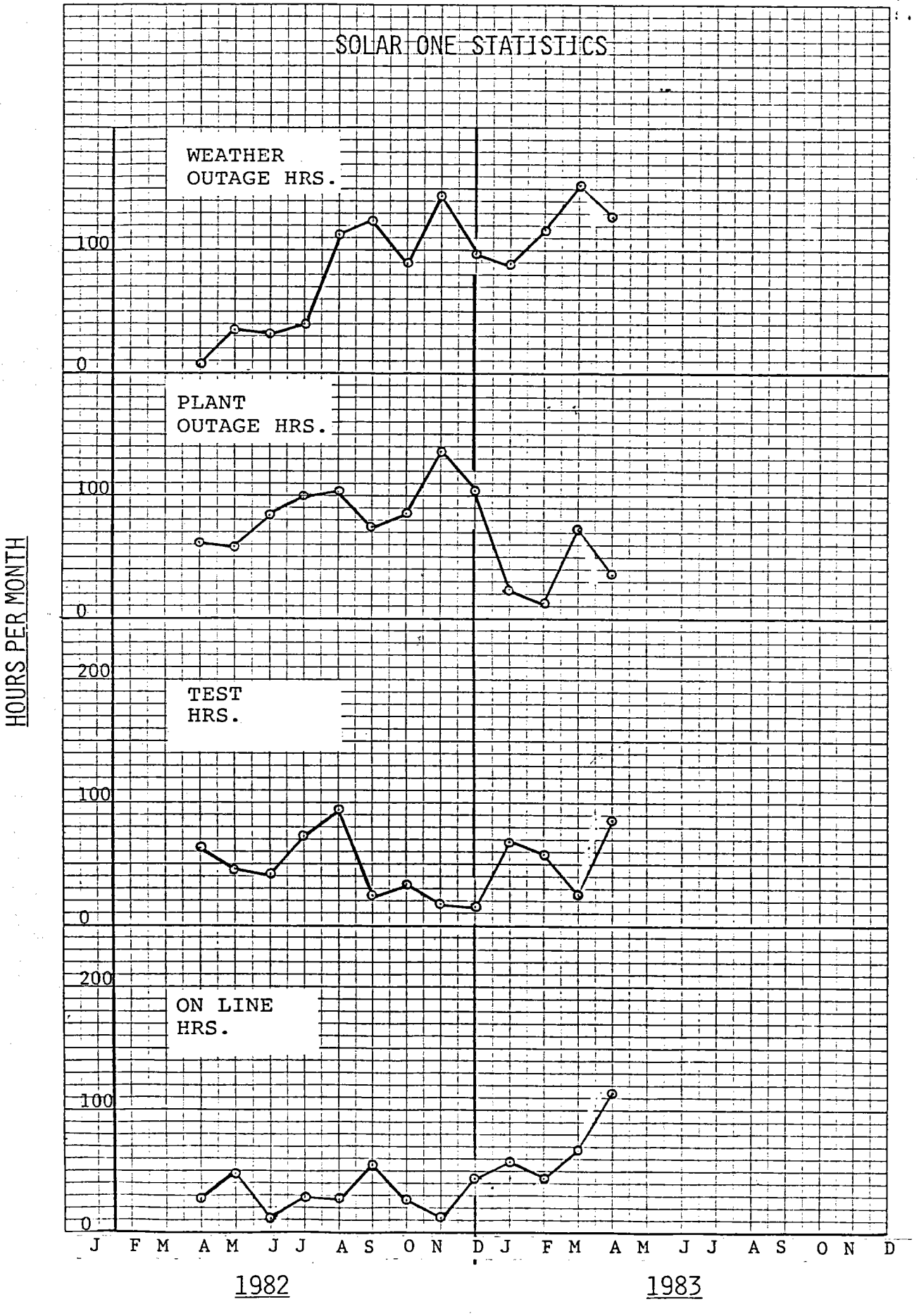
PES/AZK:sw
06/09/83

ATTACHMENT 1



SOLAR ONE NET ELECTRICAL PRODUCTION

ATTACHMENT 2



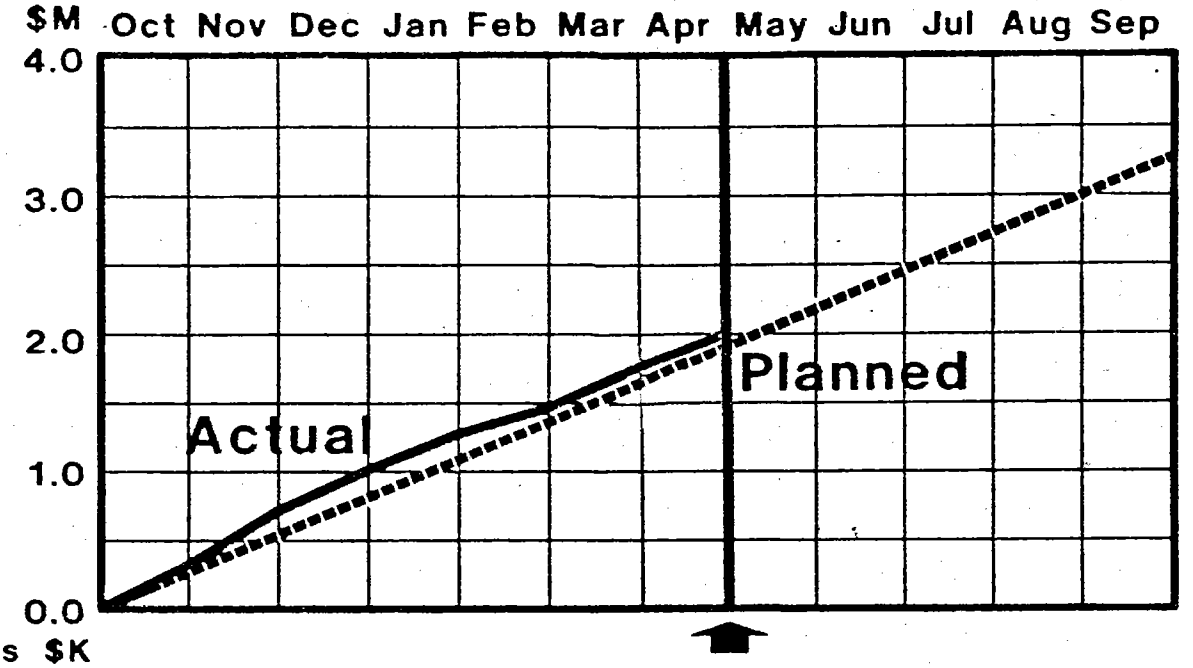
DIETZGEN CORPORATION MADE IN U.S.A.

AZK/03/17/83

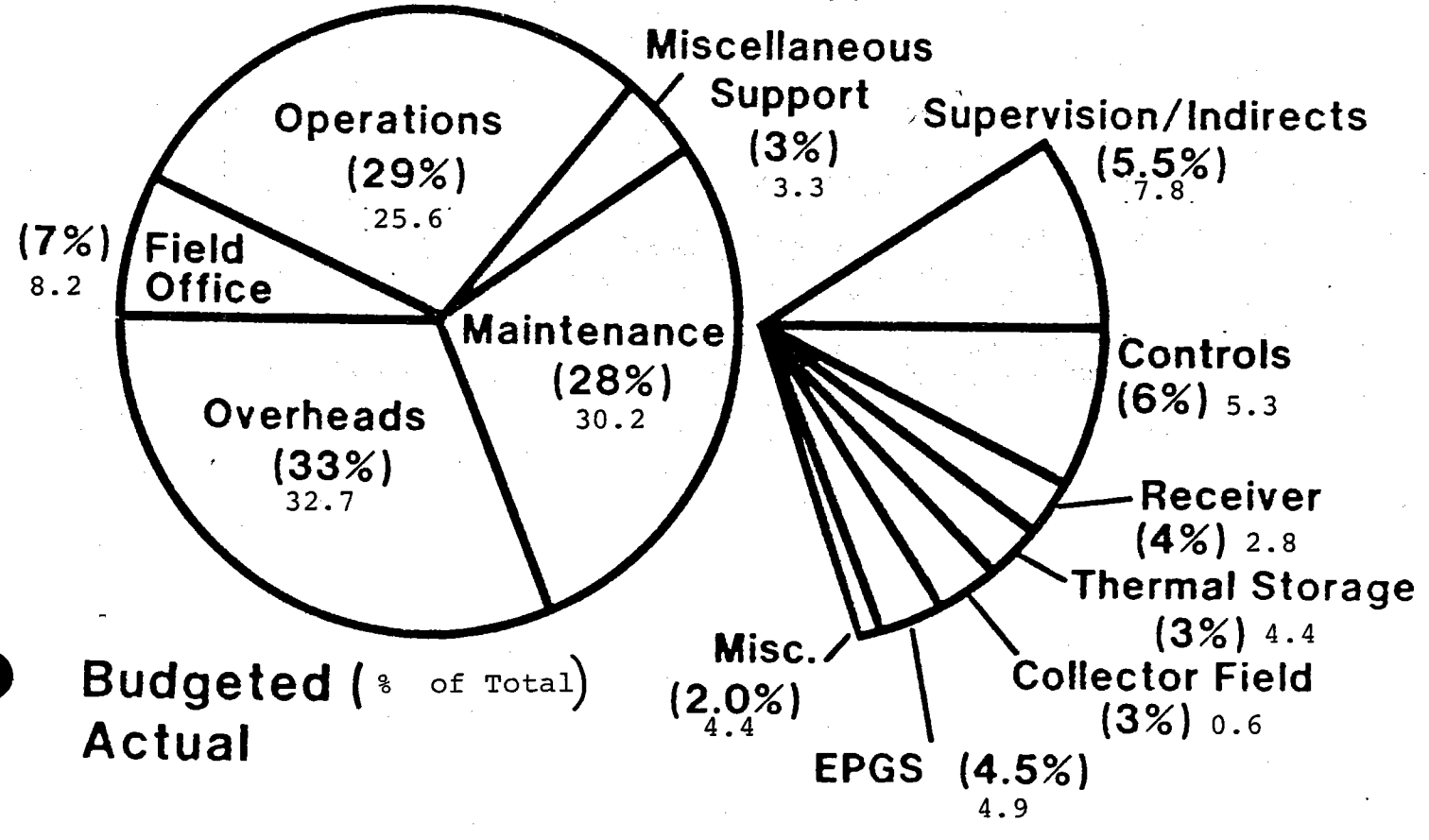
Solar One

ATTACHMENT 3

FY83 Operation & Maintenance Budget Status



Costs $K													
Planned	275	275	275	275	275	275	275	275	275	275	275	275	3.300
Actual	290	381	301	233	267	246	244						
Variance	(15)	(106)	(26)	42	8	29	31						
Cummul.	(15)	(121)	(147)	(105)	(98)	(69)	(38)						



DOE/SF/10501-214
(STMPO-814)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #14
MAY 1983

MHR
TIC

This report summarizes the operational activities and highlights maintenance work that was required during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

May was the second consecutive month since plant start-up that Solar One had a net positive output (transmitted 734.1 MWH). The net energy production while connected to the grid was 1138.8 MWH.

Two new records were achieved on May 30th when Solar One's net positive output while connected to the grid was 78.5 MWH with total on-line time of 11 hours and 22 minutes.

A new milestone was set on May 18th with the design point verification of 28 MWH capacity of the Thermal Storage System.

Operational Highlights

- A 28 MWH Thermal Storage System (TSS) capacity test was conducted on May 18, for design point verification. The design power level of 7 MW for four hours was met and power production on admission steam continued at derated temperature and pressure for a total gross generation of 50 MWH (43.8 MWH net). The turbine/generator was on-line for 8 hours and 5 minutes.

- A new turbine low load shutdown procedure that was developed during the first week of May was verified operational and released to SCE for service. The turbine/generator protective device is enabled when the load reaches 1.0 MW during start-up and removes the unit from service if the load drops to 0.5 MW. This unit shut-down logic is designed to preclude the turbine/generator motoring which had previously been experienced during severe changes in available insolation.

- A larger valve trim was installed in the charging train #1 pressure control valve (PV-3110). This modification improved charging operations, since the time required to charge the Thermal Storage Unit (TSU) with one charging train has been reduced to two-thirds of the original time.

- Significant progress is being made towards process control automation. The following subroutines have been verified operational and released to SCE Operations for service:

    1. Initialization of receiver for start-up.

    2. Transition from receiver flash tank to steam dump.

    3. TSS extraction train #2 operation for auxiliary steam generation.

4. TSS charging operation.

5. TSS extraction train #1 shutdown.

6. Automatic downcomer pressurization.

7. Cooling tower fan start-up sequence.

Additional automation procedures have been developed and tested but have not been released for service.

- A "Baseline" Power Production Engineering Test began on May 21st and will continue through June 19th. During this period, Mode 1 (Receiver/Turbine Direct) will be the primary mode of operation and data will be collected to determine the plant's potential capacity factor and to establish a reference standard for: a) Future system performance comparison and b) Future plant betterment evaluations. The Thermal Storage Unit (TSU) was fully charged prior to starting the test and it is anticipated that extraction system generated steam will meet the sealing and auxiliary steam requirements throughout the energy production period. Instrumentation calibration was also previously performed to improve data accuracy. Data evaluation will be made after the completion of the test and the results and the milestones achieved will be published as a supplement to the June '83 Solar One Operation and Maintenance Report.

Maintenance Highlights

- A maintenance outage began on May 31st, for Thermal Storage System heat exchanger repairs. The outage will last until late June and will not require complete plant shutdown. Charging train #1 will be available for charging operations except for a one week period when flange bolts will be retorqued. The major maintenance activities during the TSS outage will be:

  a. Removal of charging train #2 subcooler tube bundle and shippment to the manufacture for grinding and re-welding of the tubes to obtain an effective tube to tube sheet seal.

  b. Split all vessel annuli, i.e., separate heat exchanger oil and water/steam tube sheets by cutting their common cylindrical attachment.

  c. Repair of all heat exchanger oil flange leaks.

- Three of four second generation heliostats (McDonnell Douglas, Arco, and Boeing) to be tested at the Solar One site were installed at the beginning of the month.

- The Thermal Storage flash tank drain pump (P-307) has never been placed in service. Pressure differential between the main condenser and the TSS flash tank provides sufficient driving force for the flash tank draining process.

Retirement of the redundant pump is under consideration.

- An equal percentage trim was installed in the Thermal Storage Charging System main steam inlet valve (UV-3102) to replace the original linear trim. This modification allows better charging process control during low steam flows.

- After investigation of the receiver heat flux sensor output gradual degradation problem, it was decided that any sensor malfunctions should be considered failures and the questionable flux sensors will be subjected to replacement.

- Routine inspection and calibration of all Thermal Storage System thermocouples was performed. The inspection did not reveal any problems.

- Receiver panel #5 flowmeter (Ramapo 12 gpm) developed seal leaks and was removed and shipped to the manufacturer for repairs. It was replaced with a 20 gpm flowmeter from panel #4 while a new, 10 gpm, flowmeter was installed in #4 panel. Low capacity flowmeters have recently been installed on selected panels in an effort to improve flow measurement accuracy during early morning start-ups.

- The Thermal Storage Charging System flowmeters, FE-3102 and FE-3205, which had previously been removed and shipped to the manufacturer for repairs were reinstalled and now function properly after minor pressure and temperature compensation adjustments.

Plant Statistics

- Attachments #1 and #2 show the daily and cumulative net energy production while Solar One was connected to the grid for the three previous months and year-to-date respectively.

- Attachment #3 and the following chart shows new records for test and on-line hours was achieved during May. The test hours were utilized for part of the Baseline Power Production Engineering Test, the 28 MWH capacity test on Thermal Storage System generated steam, plant automation procedure development and testing, and miscellaneous Thermal Storage System controls testing.

- Solar One's monthly energy production, auxiliary power usage and the net output for 1982 and 1983 to date are plotted on Attachment #4. The auxiliary power consumption indicates a slow but steady decrease, resulting from a continuing effort to minimize the use of auxiliary equipment during shutdown periods.

Plant Statistics	May	Turbine Roll To Date
Energy Production (KWH net while connected to the grid)	1,138,700	3,577,000
Peak MW (net)	10.2	10.4
On-Line Hours	213.6*	786.0
Test Hours	118.8*	888.3
Total Plant Outage Hours	26.5	883.6
Scheduled	0.0	362.5
Unscheduled	26.5	521.1
Weather Outage Hours	67.0	1,249.4

Operation and Maintenance Costs

- A summary of the O&M labor, material, contract, and other costs for the month of May 1983, is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

- In the attached Monthly O&M Cost Summary, the labor expenses for May are high because they reflect three pay periods rather than the normal two and a slight increase in overtime over previous months.

* New Record

SOLAR ONE

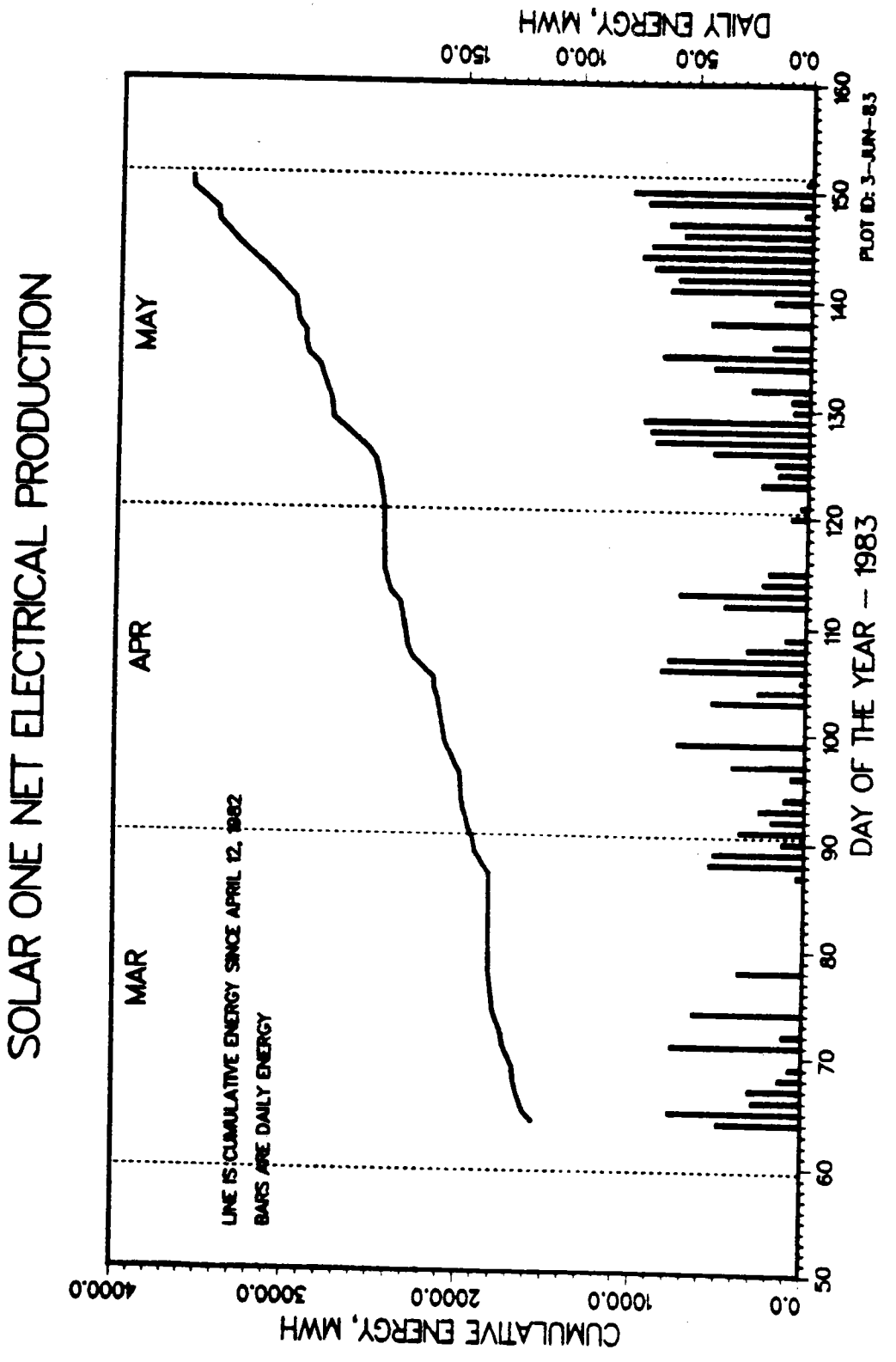
MONTHLY O&M COST SUMMARY
($ X 1000)

MONTH OF MAY, 1983

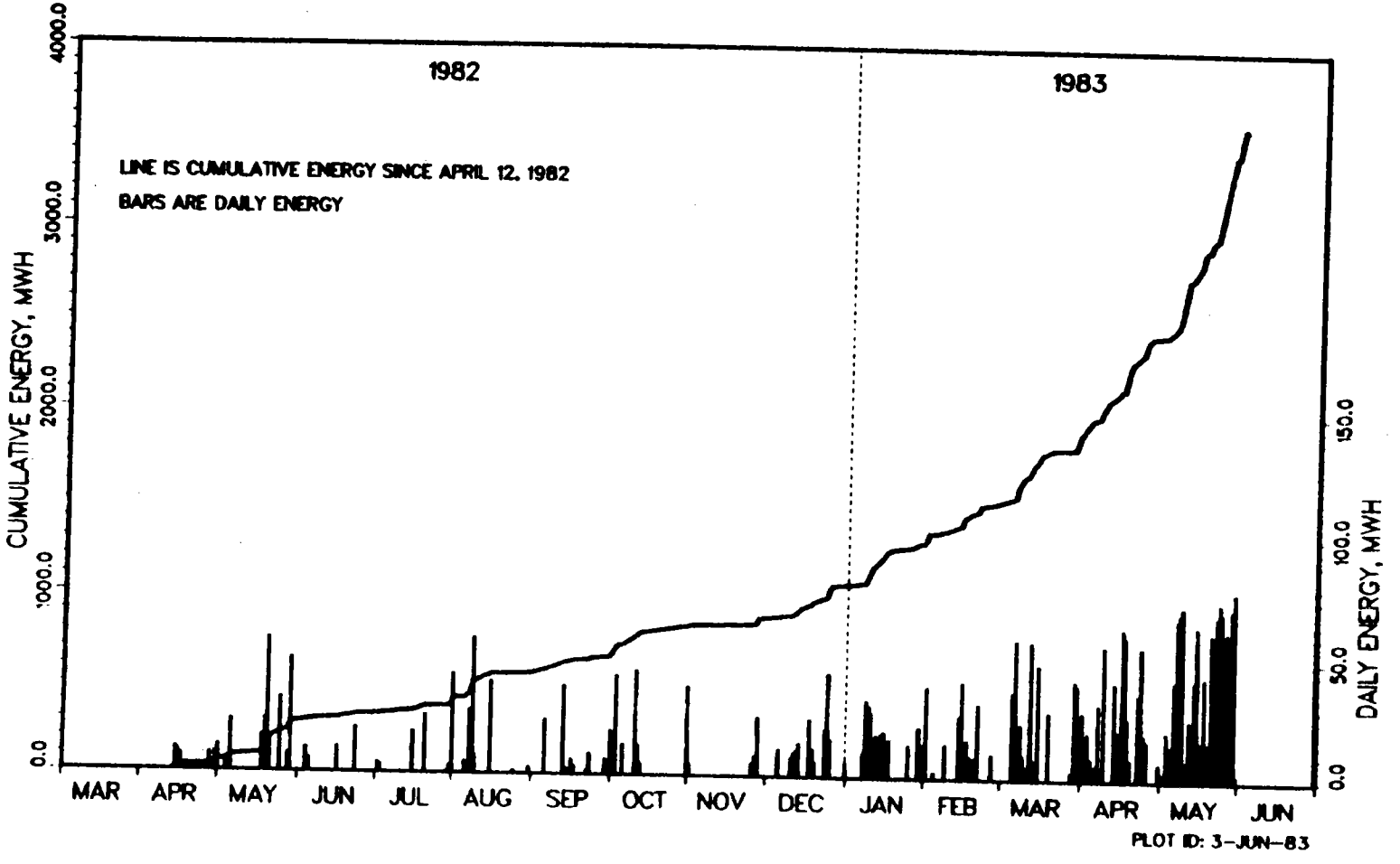
	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	30.5	-	.1	.3	30.9
OPERATIONS	84.7	2.7	-	1.1	88.5
MISC. NON-PRODUCTIVE COSTS	8.5	-	3.6	1.5	13.6
MAINTENANCE					
Supervision/Indirects	17.1	1.7	1.6	.1	20.5
Control System	10.5	1.9	2.2	-	14.6
Receiver System	3.6	-	2.7	-	6.3
Thermal Storage System	3.4	.2	.1	.2	3.9
Collector System	3.8	-	-	-	3.8
EPGS System	7.4	.1	-	-	7.5
Misc.	3.1	2.0	.2	-	5.3
Total Maintenance	48.9	5.9	6.8	.3	61.9
SUB TOTAL	172.6	8.6	10.5	3.2	194.9
Division O. H.					34.9
TOTAL DIRECT					229.8
Workman's Compensation					1.5
Payroll Tax					11.8
Pension & Benefits					36.0
Administrative & General					42.9
GRAND TOTAL					322.0

PES/AZK:dlg

ATTACHMENT #1

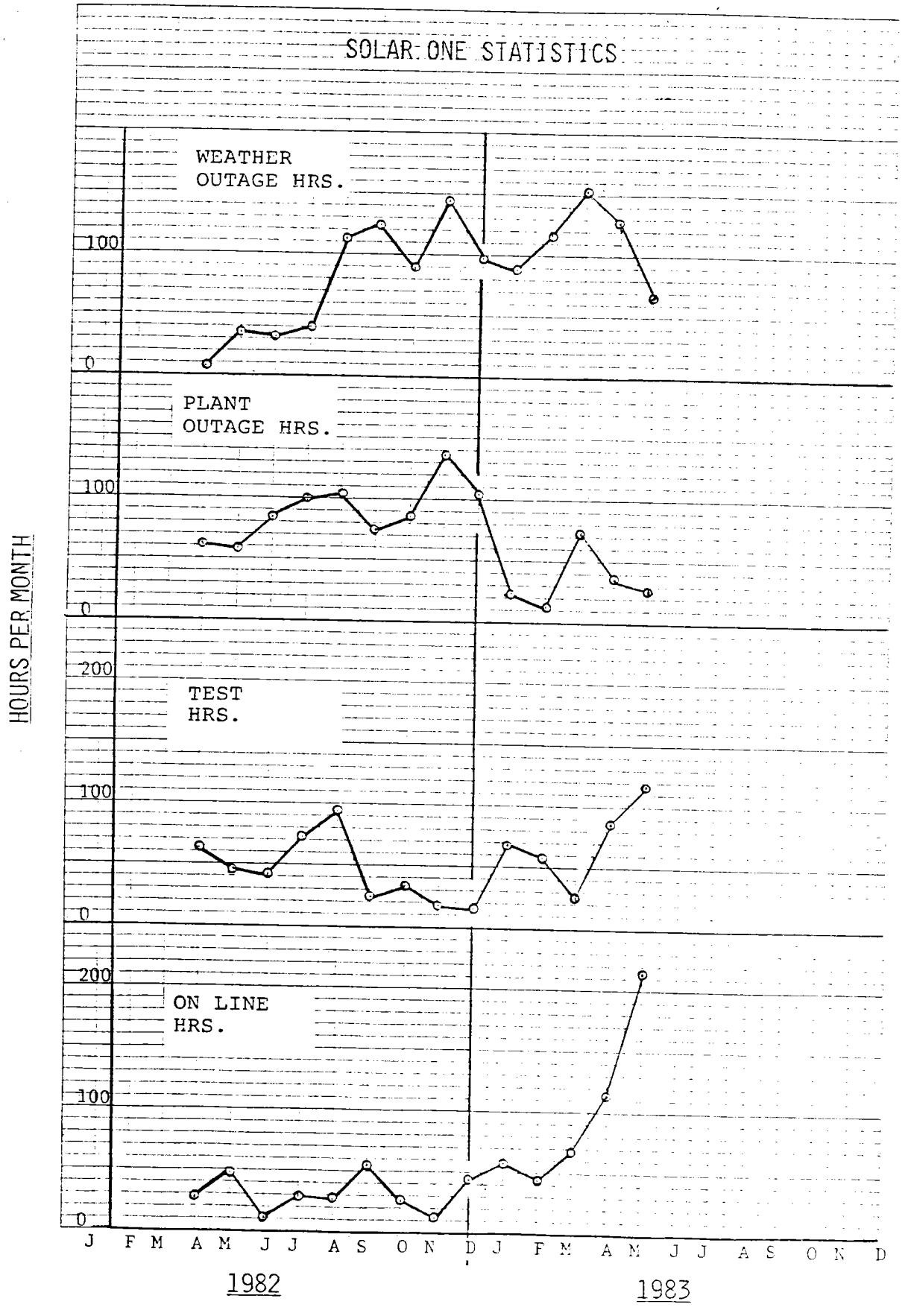


SOLAR ONE NET ELECTRICAL PRODUCTION



ATTACHMENT #2

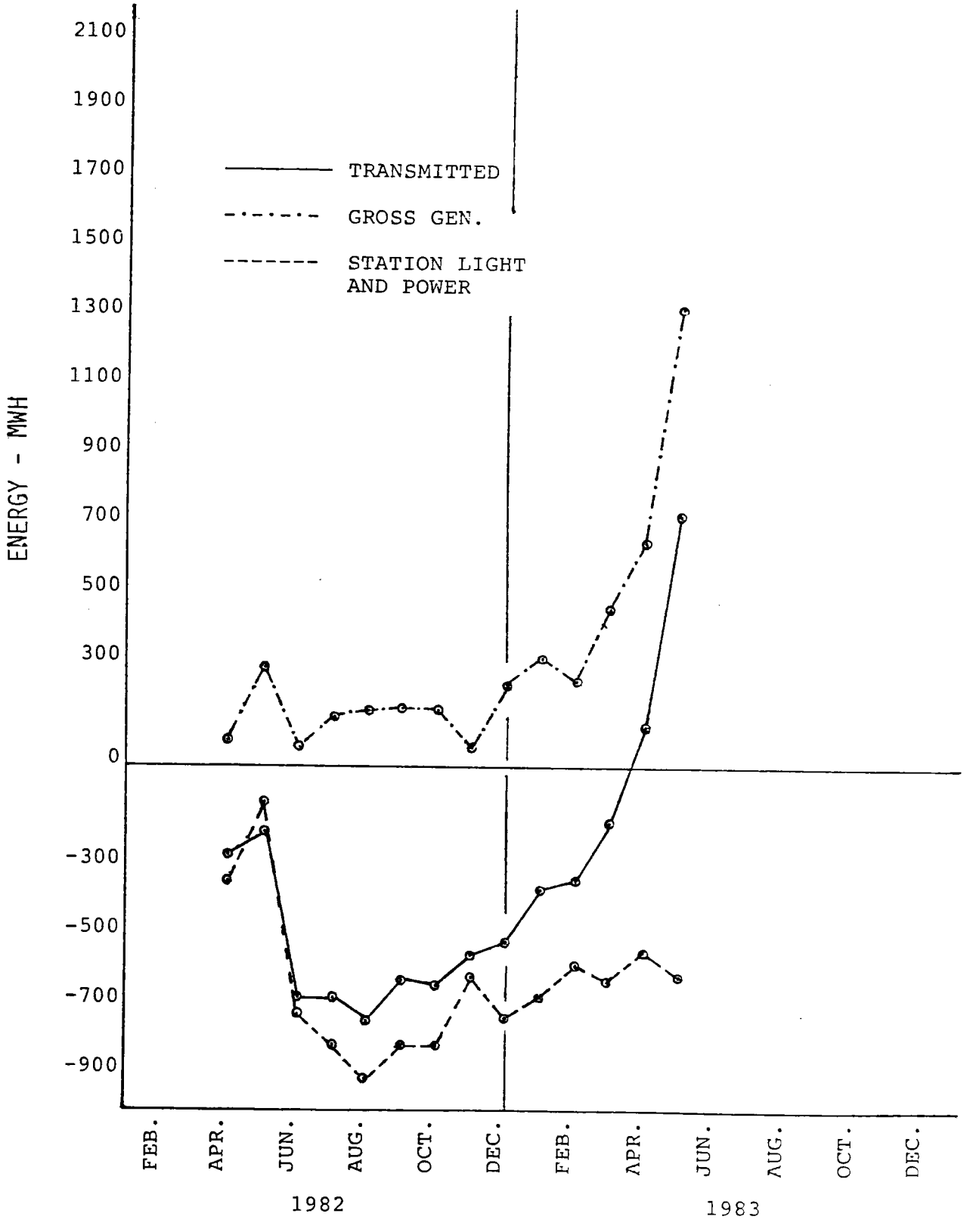
ATTACHMENT #3



AZK/03/17/83

ATTACHMENT #4

SOLAR ONE
MONTHLY METER REPORT SUMMARY



DOE/SF/10501-215
(STMPO-815)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #15
JUNE 1983

M402
TIC

This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

In June, Solar One had a net positive output of 561.8 MWH. The net energy production while connected to the grid was 956.9 MWH.

Three power production tests demonstrated once more the design validity and the capabilities of Solar One:

- Peak Power/Energy Test (12.1 MW net, 104 MWH net, 15 consecutive on-line hours).
- Extended Duration Test (33.6 consecutive hours of operation).
- Preoperational Power Production Test (729.9 MWH net for 23 days of operation).

Operational Highlights

- The General Electric admission steam stop valve internal bypass was replaced with a full arc admission internal bypass valve to allow better turbine speed control during start-ups on admission steam. Previously, throttling was achieved by operating the admission steam stop valve main plug resulting in poor turbine speed control. The modified valve was tested during start-up at low admission steam pressure and it was proven functional. However, adjustment of the turbine speed control is still sensitive.

- A new milestone was set during the Peak Power and Energy Test performed at Solar One on Tuesday, June 21, 1983 (summer solstice). The turbine/generator attained a net peak of 12.1 MW (13.1 MW gross) and generated 104.3 MWH. The unit was on-line for 15 consecutive hours operating in Mode 3, receiver/turbine direct and thermal storage system generated steam. The receiver steam conditions were 900°F, 1400 psi and 105,000 lb/hr and admission steam (from one extraction train only) 541°F, 412 psi and 31,000 lb/hr. 1792 recently washed heliostats were in service with insolation of 910 watt/m^2. The limited factor on the maximum power generation was the steam capacity of turbine control valves and air temperature of the generator.

- An Extended Duration and Performance Test was conducted on June 27th. Solar One was on-line for 33.6 consecutive hours - the longest on-line time since start-up - and generated 127 MWH net (171 MWH gross). The Thermal Storage Unit (TSU) was completely charged prior to testing. This test as well as the Peak Power/Energy Test verified once more the design validity of the Solar One Plant.

- During an attempt to start-up Solar One, a transformer differential relay operation caused auxiliary power loss. A broken wire to the 13.8 KV breaker current transformer (CT) roto switch on "C" phase of the differential relay was found to have caused the relay operation. Transfer to the emergency 4KV well line took place approximately 10 minutes after identification of the problem and notification of the adjacent SCE Cool Water Generating Station.

- Panel distortion measurements on selected receiver panels (11, 12, 19, 20, and 21) were taken to establish a reference for further studies on Incoloy 800, the tube material, thermal stress behavior. A laser beam was utilized to provide the measurement reference point to the distorted tube panel. Measurements will be repeated in the near future.

- X-ray test on selected heliostat mirrors was performed, under the direction of Sandia National Laboratories, as a part of the mirror corrosion monitoring program to determine the amount of water present in the mirror modules. A survey of total mirror surface corrosion was taken and evaluation is in progress. Conclusions to this date indicate that 50% of the mirrors evidence silver corrosion spots. In addition, the corrosion increased from 0.006% last year to 0.015% of the total plant mirror reflective area. Apparently, at this corrosion rate the mirrors will not meet the design requirements of 30 years life.

- Preliminary tests on receiver convective heat loss flow patterns (smoke test) and receiver tube overheat detection using an infrared camera were successfully conducted by Sandia engineers. The test results are under evaluation and more testing of the same type will be performed at later dates.

Maintenance Highlights

- The frequently failing section of the plant effluent water line was replaced during June. The new fiberglass line has higher heat resistant properties than the original PVC. Small longitudinal cracks were discovered in parts of the new line's plastic liner during installation; however, according to the manufacturer, these cracks are results of heat stress during fabrication and are not critical since the fibercast fiber is protected by an internal epoxy resin. An attemperation system, which will operate to reduce the temperature of the hot blowdown water, is being installed to protect the remaining PVC section of the line from similar past failures.

- Numerous valve positioner failures resulted from oil/desiccant contamination of the instrument air system. During a two-day plant outage, the instrument air system was effectively cleaned by blowing down all system headers. The air dryers were repacked with fresh desiccant and all pre and after filters were replaced. The following preventive measures have since been taken to avoid future similar incidents:

a. A differential pressure gage will be installed across each afterfilter to detect pluggage.

b. Preventive maintenance for routine dryer and filter inspection has been instituted.

c. Only one of the two filter trains will be in service at a time, thus providing one primary and one back up system.

- The thermal storage system outage initiated on May 31, was completed in late June. All heat exchanger oil flange leaks were repaired. The charging train #2 subcooler tube bundle was shipped to the manufacturer for grinding, rewelding, and rerolling of the tubes to improve the tube to tube sheet seal. All vessel annuli were split, i.e., the oil and water/steam tube sheets of all heat exchangers were separated by cutting their common attachment to minimize thermal stress. Miscellaneous work at the TSS area accomplished during the outage includes:

  a. Replacement of the bonnet gasket of the charging train #1 steam inlet valve (AOV-3206).

  b. Replacement of three leaky drain valves.

  c. Repair of the seat and plug of the TSS charging train #2 steam header relief valve (PSV-3321).

- A heliostat in the south east quadrant (#0730) was discovered to have all azimuth gear motor mounting bolts missing. Investigation indicated that these bolts had never been installed.

- All heliostat mirrors (excepting 10 test heliostats) were mechanically washed utilizing an SCE insulator wash truck. The average rate that washing was accomplished was 63 heliostats per hour which includes the time required for refilling and travel to the deminerlized water tank.

- The receiver tower elevator power cable was replaced due to twisting of the cable as per manufacturer's recommendation.

- The following is a list of receiver repairs accomplished during June:

  1. Weld repaired a pinhole leak in receiver panel #5 inlet filter body.

  2. Replaced the trim in receiver vent valves (AOV-2902 and AOV-2007).

  3. Replaced leaky bonnet gaskets in preheater inlet valve AOV-2004), panel #15 temperature control valve (TV-2603), preheater angle valve (VFW 200-201) and ring header angle valve (228-203).

  4. Replaced flowmeter flange gaskets in panels #7, #15, #16, and #20.

5. Replaced filter gaskets in panels #10 and #19.

6. Replaced/adjusted packing in receiver panels #5, #7, #10, #14, and #19 temperature control valves.

7. The receiver preheat safety valve (PSV-2021) was rebuilt and reinstalled. The valve nozzle was machined to remove erosion effects and the damaged disk was replaced.

8. Replaced plug and seat in receiver flash tank valve PV-2906).

9. Replaced panel #15 flowmeter with a 30 gpm spare flowmeter.

10. Weld repaired a small body leak on panel #15 temperature control valve.

Plant Statistics

- Attachments 1 and 2 show the Daily and Cumulative Net Energy Production while Solar One was connected to the grid for the three previous months and year-to-date respectively.
- The decrease in power production during June resulted from 69 weather outage hours and 63.5 plant maintenance outage hours.
- All tests conducted (Preoperational Power Production, Peak Power/Energy and Extended Duration) were allocated to energy production. The weather and maintenance outages did not allow any further testing. (See Attachment 3).
- Attachment 4 shows the Monthly Energy Production since start-up.

Plant Statistics	June	Turbine Roll To Date
Energy Production (KWH net while connected to the grid).	956,900	4,533,600
Peak MW (net)	12.1*	10.4**
On-Line Hours	165.9	951.9
Test Hours	Ø	888.3
Total Plant Outage Hours	63.5	947.1
Scheduled	48.5	411.0
Unscheduled	15	536.1
Weather Outage Hours	69	1,318.4

* Combined thermal storage and receiver generated steam.

** Receiver generated steam only.

Operation and Maintenance Costs

- A summary of the O&M labor, material, contract, and other costs for the month of June 1983, is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

SOLAR ONE

MONTHLY O&M COST SUMMARY
($ X 1000)

MONTH OF JUNE 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	19.7	0	0	1.4	21.1
OPERATIONS	66.0	23.0	0	.4	89.4
MISC. NON-PRODUCTIVE COSTS	6.7	1.4	1.7	1.6	11.4
MAINTENANCE					
Supervision/Indirects	13.8	.9	.3	0	15.0
Control System	8.1	6.5	2.6	0	17.2
Receiver System	5.1	0	0	0	5.1
Thermal Storage System	3.4	.5	.9	.6	5.4
Collector System	4.2	.2	0	0	4.4
EPGS System	5.1	.8	0	0	5.9
Misc.	2.6	.7	.5	.3	4.1
Total Maintenance	42.3	9.6	4.3	.9	57.1
SUB TOTAL	134.7	34.0	6.0	4.3	179.0
Division O.H.					21.6
TOTAL DIRECT					200.6
Workman's Compensation					1.1
Payroll Tax					8.8
Pension & Benefits					26.9
Administrative & General					38.1
GRAND TOTAL					275.5

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O&M REPORT #15 SUPPLEMENT

ENERGY PRODUCTION ENGINEERING TEST

The "Baseline" Power Production Engineering Test, initiated on May 21, 1983, was completed on June 12, 1983. During this period, Solar One operated in Mode 1 only (Receiver Steam/Turbine). The Thermal Storage Unit (TSU) was fully charged prior to testing and thermal storage system generated steam was the main source of sealing and auxiliary steam. It was anticipated that the TSU stored heat energy would be sufficient to meet the auxiliary steam demand throughout the Power Production Test. However, the TSU was depleted before the end of the test and consequently one day was dedicated for TSU recharging.

The following chart summarizes the statistical data collected during the test:

Duration	23 days	(5/21 through 6/12)
Period Hours	552	
Usable Energy - NIP Time (Hours)	235.5	
Total On-Line Hours	152.15	
Total Net MWH	729.9	(1,117 MW Gross)
Weather Outage Hours	35	
Equipment Outage Hours	44.5	

Based on the above data the capacity factor for this period $\left[\frac{\text{MWH Net}}{\text{(Period Hrs.) (Peak Power *}} \right]$ was 0.13. The capacity factor based on insolation values greater than 450 watt/m^2 $\left[\frac{\text{MWH Net}}{\text{(Usable Energy) (Peak Power *}} \right]$ was 0.31. The load factor $\left[\frac{\text{Average Power}}{\text{Peak Power}} = \frac{\text{MWH Net/Oper. Hrs.}}{\text{10 MW}} \right]$ for the period was 0.46.

A record daily energy production of 78.4 MWH net was achieved on 05/30/83, while operating at rated pressure (1450 psi) and reduced temperature (850°F). Another record achieved on the same date (05/30/83) was the highest on-line time (11 hours and 22 minutes), since start-up.

* 10 MW Rated Peak Power.

The conditions under which Solar One operated during the Engineering Test period were less than favorable. The heliostat mirrors were only 88% clean, as compared to 98% when freshly washed, and the insolation values were below normal. Numerous valve positioner failures due to oil/desiccant contamination of the instrument air system, and numerous receiver leaks -- angle valves/ filters/vent valves/flowmeters -- resulted in start-up failures and short term outages. High winds and overcast skies accounted for 35 hours of weather outages.

During this period, operators stressed reduction of auxiliary power consumption to include:

a. Selective shut down of cooling tower fans during low load operation.

b. Shut down of cooling tower fans during inactive periods allowing for natural draft cooling.

c. Shut down of non essential air conditioners.

d. Reduce lighting around station.

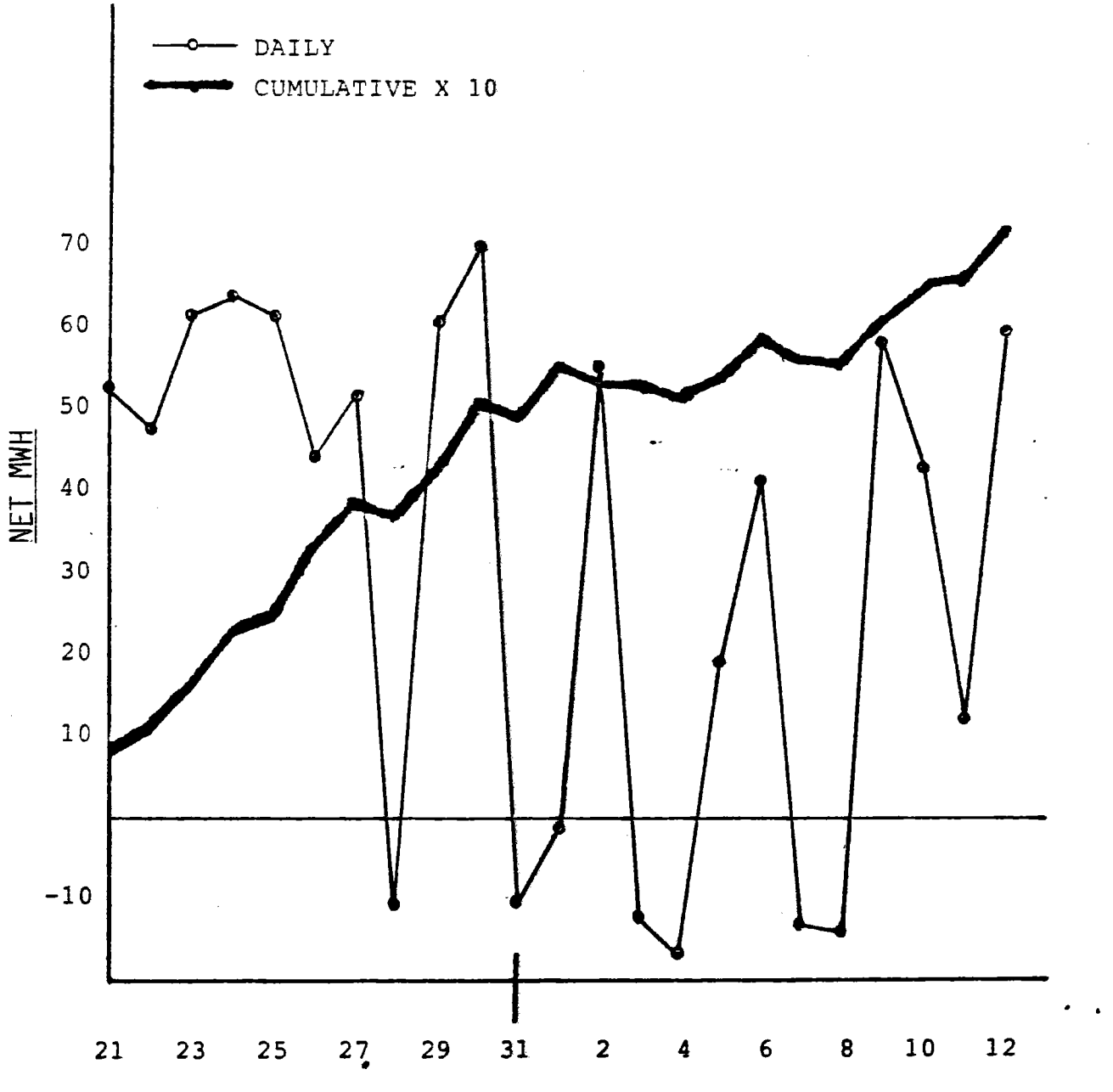
e. Operation of only one circulating water pump during shut down periods (evenings-nights).

In spite of all uncontrollable obstructions, valuable data was collected and observations were made during the Preoperational Power Production Test that provided an insight for future power production and the potential capabilities of Solar One.

The attached graph shows the Daily and Cumulative Energy Production for the test period (page 9).

AZK/dlg

ENERGY PRODUCTION ENGINEERING TEST
DAILY AND CUMULATIVE ENERGY GENERATION



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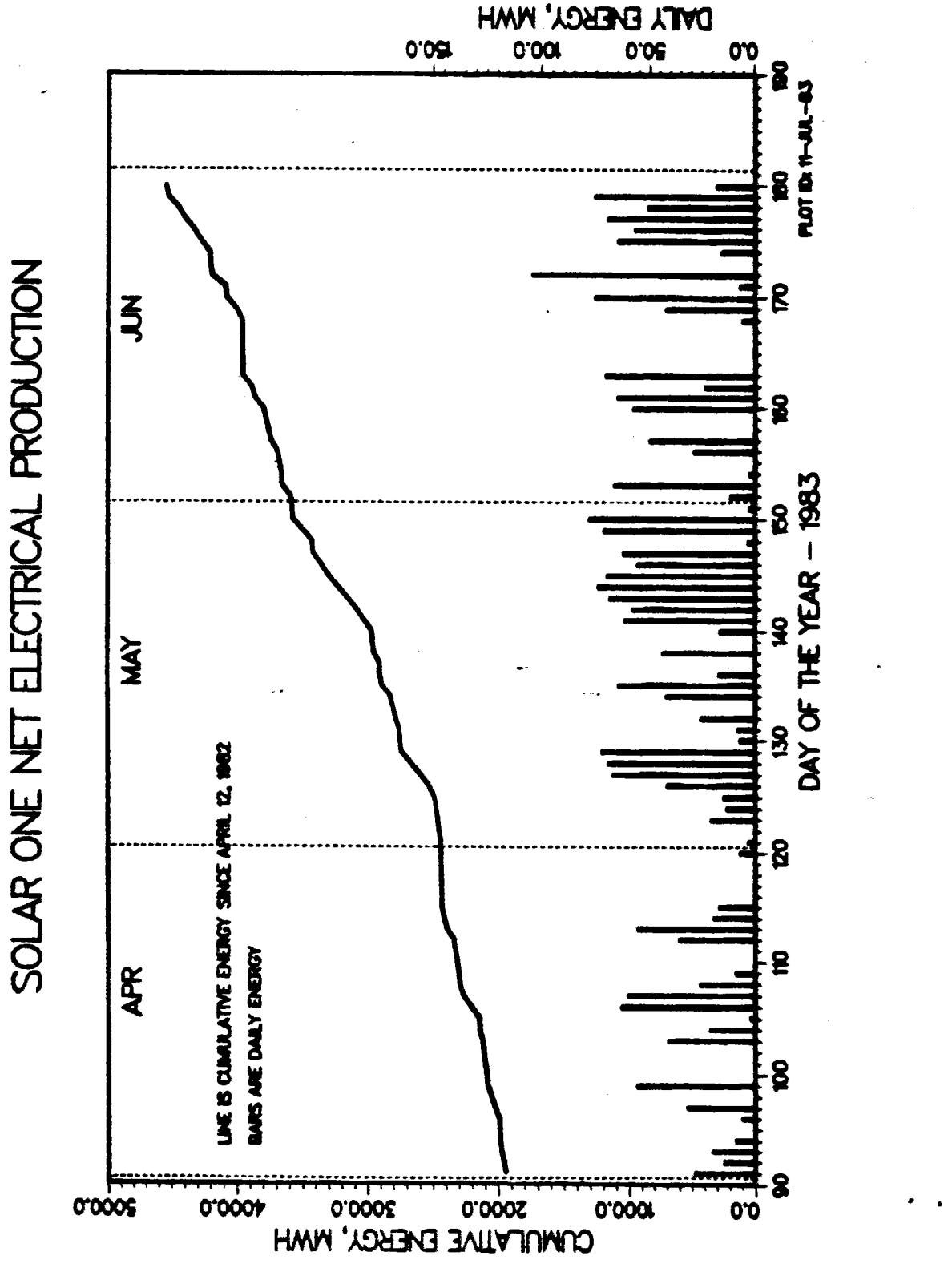
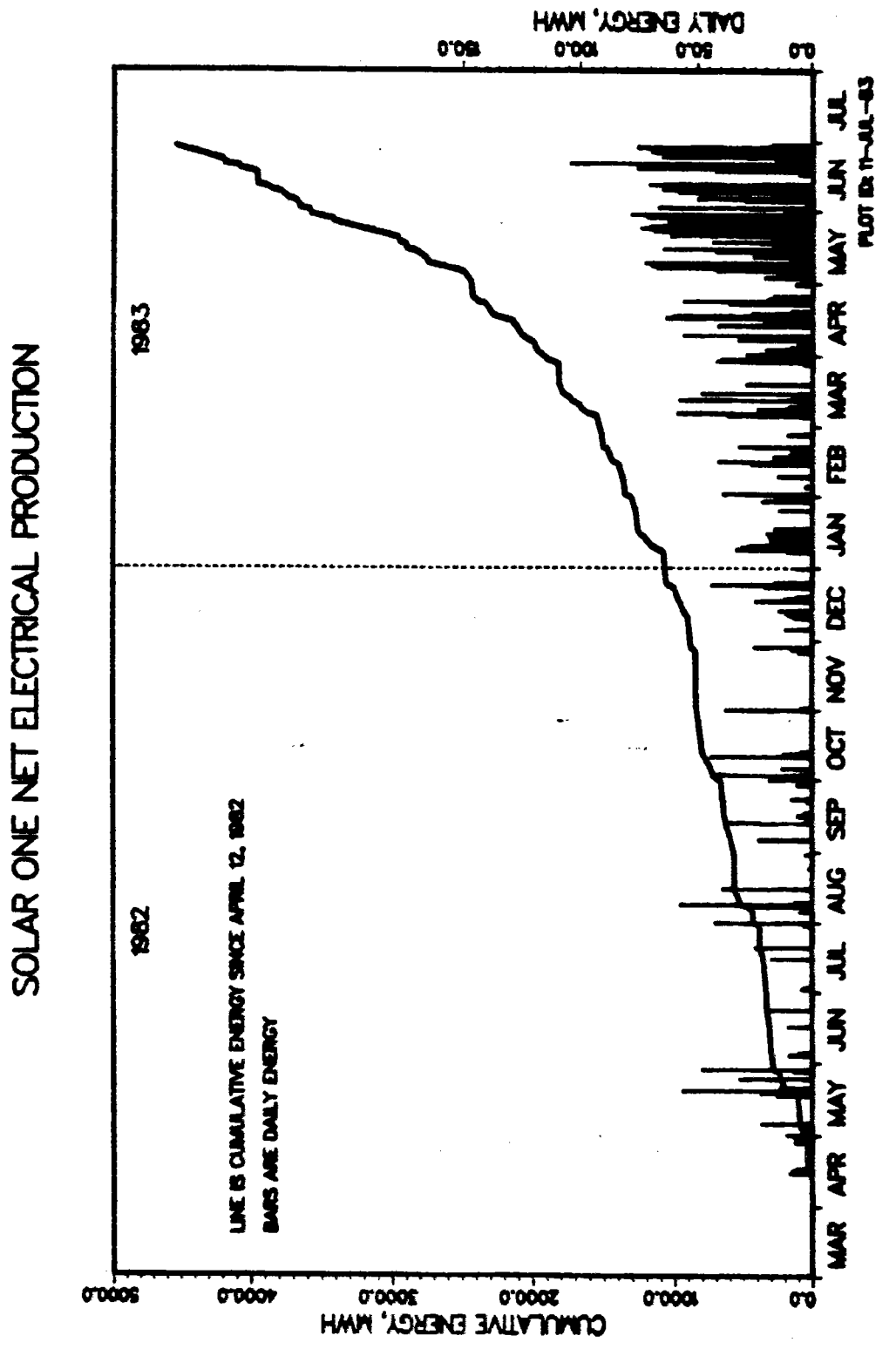

SOLAR ONE NET ELECTRICAL PRODUCTION
APR
MAY
JUN
LINE IS CUMULATIVE ENERGY SINCE APRIL 12, 1982
BARS ARE DAILY ENERGY
CUMULATIVE ENERGY, MWH
0.0
1000.0
2000.0
3000.0
4000.0
5000.0
DAILY ENERGY, MWH
0.0
50.0
100.0
150.0
DAY OF THE YEAR – 1983
90
100
110
120
130
140
150
160
170
180
190
PLOT ID: 11-JUL-83


SOLAR ONE NET ELECTRICAL PRODUCTION
DAILY ENERGY, MWH
0.0
50.0
100.0
150.0
1983
1982
LINE IS CUMULATIVE ENERGY SINCE APRIL 12, 1982
BARS ARE DAILY ENERGY
CUMULATIVE ENERGY, MWH
0.0
1000.0
2000.0
3000.0
4000.0
5000.0
MAR
APR
MAY
JUN
JUL
AUG
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NOV
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MAR
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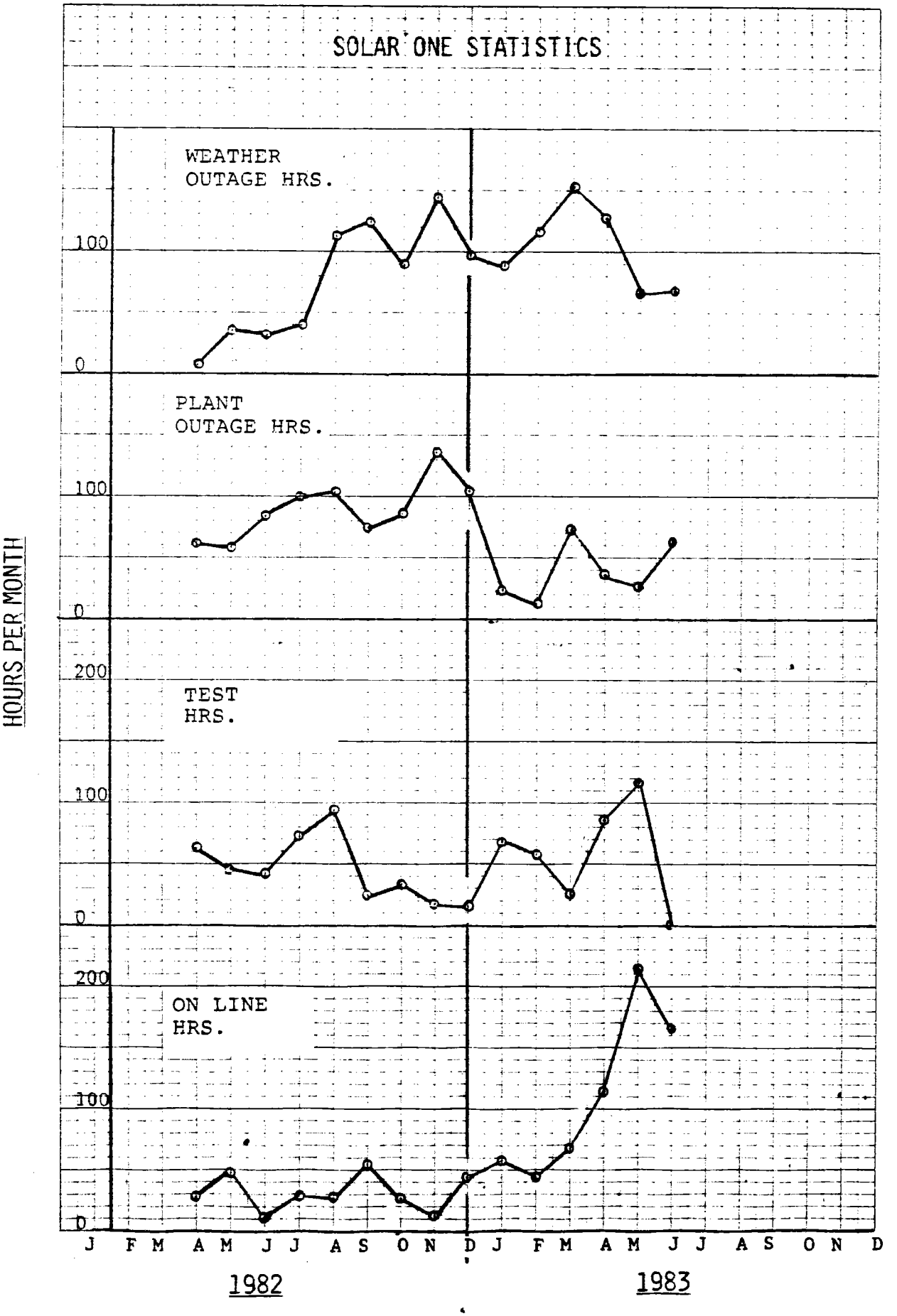
MAY
JUN
JUL
PLOT ID: 11-JUL-83



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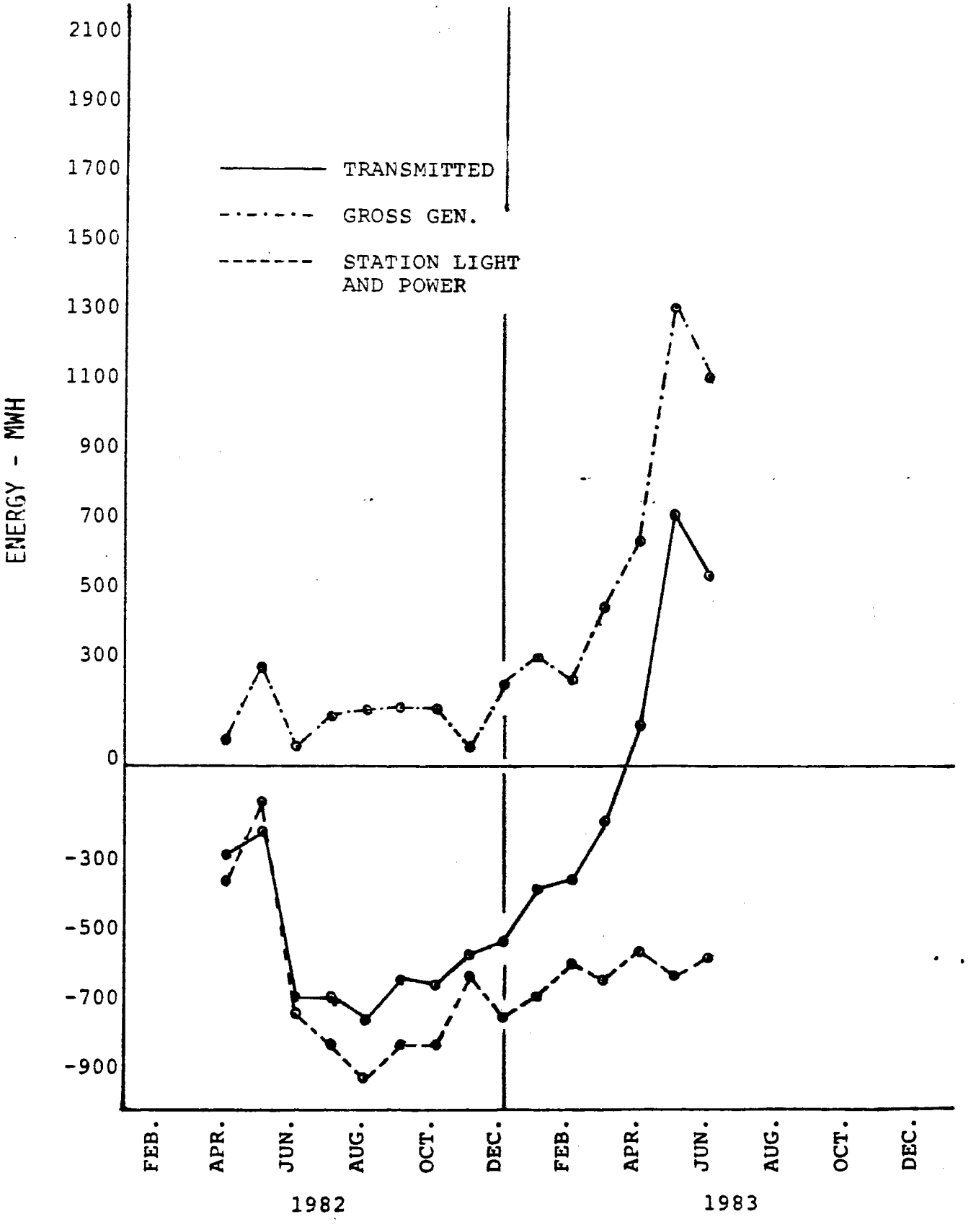
SOLAR ONE
MONTHLY METER REPORT SUMMARY



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SOLAR ONE
OPERATION AND MAINTENANCE REPORT #16
JULY 1983

M+R
TICC

This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and a monthly operation and maintenance cost summary.

Two tube cracks in receiver panel #18 along with several other equipment failures and scheduled outages -- synchronizing potential transformer failure, HAC Shadow Memory installation and receiver panel #15 temperature control valve leak resulted in an extended plant outage. However, July was another positive output energy production month of 271.4 MWH. The net energy production while connected to the grid was 654.6 MWH, which is the third highest monthly production since turbine roll.

Operational Highlights

- Following additional modifications the turbine admission stop valve underwent testing again at rated admission steam pressure (300 psi); previous testing at reduced pressure took place during June. Due to the turbine speed sensitivity using manual valve controller adjustment, turbine start-up on admission steam for the present is operated at reduced pressure conditions. Data collected during the test will be forwarded to General Electric Company for their evaluation.

- The cooling tower fan automation procedure was developed and tested. With this procedure the circulating water temperature will be maintained so that 1) maximum turbine efficiency is obtained, 2) maximum Thermal Storage System (TSS) charging operation (Mode 5) efficiency and auxiliary load reduction is achieved, since experience to date shows that operation of the condenser at higher back pressure does not materially affect plant efficiency during TSS charging operation.

- The TSS desuperheater (DS-902) spray water is currently being supplied by the condensate pump. The existing system does not provide protection of the feedwater and receiver systems in the event of hot well water contamination due to condenser leakage. Consequently, the system is being modified so that demineralized water (drawn at the polishing demineralizer outlet) rather than condensate is used as the desuperheater water supply.

- A new valve trim will replace the original trim in PV-1005, which is the cross tie between thermal storage steam and auxiliary steam systems. The new valve trim will allow adequate steam flow from TSS to auxiliary steam system when the TSS steam pressure is below 385 psi (shut-down or start-up periods).

- A receiver trip was experienced on July 5th due to failure of the local receiver system Uninterruptible Power Supply (UPS). The UPS failure caused a trip of the circuit breaker common to both the receiver main control and back-up power resulting in receiver valve failure to a safe condition.

- Major steps were taken towards plant automation. OCS (Operational Control System), HAC (Heliostat Array Controller) and Beckman computer links have been established and the OCS/HAC testing program began with the automatic start-up of the collector field.

Maintenance Highlights

- A number of receiver control problems resulted from water intrusion into the remote station one (receiver electronics room) because of damaged roof seals. Presently, rain water and water resulting from receiver venting during start-ups cascade onto the remote station one (RS #1) roof. To avoid similar future occurrences, the receiver vent will be relocated and the receiver tower level #15 floor (located immediately above RS #1) will be modified to provide rain water drainage. In addition, the roof seal failure is under investigation and repairs and recoating of the roof will be effected as soon as practicable.

- The hot well make-up line (fiberglass) was partially replaced to remove a small crack which contributed to the hot well high dissolved oxygen concentration.

- Failure of the generator 13.8KV line side metering and synchronizing potential transformer, experienced on 07/11/83, precluded energy production for three days. The faulty potential transformer was replaced with a new one manufactured by General Electric allowing the plant to return to normal operation.

- The Heliostat Array Controller (HAC) Shadow Memory Controller was installed on July 14th and 15th. The Shadow Memory Controller, installed in both HAC computers (the prime and the back-up) provides the hardware means to automatically copy information from the prime to the back-up HAC thus greatly reducing the software communications. This will solve the intercomputer communications problems that have been experienced due to communications overload following the addition of the Beam Characterization software to the HAC computer.

- Three efforts to weld repair a crack in the temperature control valve body of receiver panel #15 were unsuccessful. The valve body was subsequently replaced.

- Plant effluent water line failure was experienced in its original (PVC) portion. The line was repaired promptly. It is expected that similar future failures will be avoided after the installation of the attemperation system which will operate to reduce the temperature of the hot blowdown water in the PVC section of the line.

- Miscellaneous receiver repairs performed in July included:

  a. Replacement of temperature control valve bonnet gaskets in panels #5, #6, #11, and #19.

  b. Repacking of all temperature control valves.

  c. Replacement of prefilter flange gaskets in panels #5, #10, and #20.

  d. Repair of body leaks in panels #5 and #10 prefilters.

- A summary of the receiver panel #18 tube failures is given in Attachment 1.

Plant Statistics

- Attachments 2 and 3 show the Daily and Cumulative Net Energy Production while Solar One was connected to the grid for the three previous months and year-to-date respectively.

- Receiver tube leaks, HAC Shadow Memory installation, synchronizing potential transformer failure and other miscellaneous equipment failures are accounted for in the 205.4 hours of plant outage, the longest outage period in a single month since turbine roll. Consequent to the long outage there was a significant decrease in test activities and the on-line time. (Attachment 4).

- A decrease of power production also resulted from the plant outages (Attachment 5). Noticeable, however, is the steady decline in the auxiliary power consumption.

Plant Statistics	July	Turbine Roll To Date
Energy Production (KWH net while connected to the grid)	654,600	5,188,200
Peak MW (net)	9.6	10.4
On-Line Hours	111.7	1,063.6
Test Hours	28.2	982.7
Total Plant Outage Hours	205.4	1,152.5
Scheduled	36.0	447.0
Unscheduled	169.4	705.5
Weather Outage Hours	27.0	1,345.4

Operation and Maintenance Costs

- A summary of the O&M labor, material, contract, and other costs for the month of July 1983, is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

SOLAR ONE

MONTHLY O&M COST SUMMARY
($ X 1000)

MONTH OF JULY 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	16.8	.3	.3	.1	17.5
OPERATIONS	52.2	7.7	--	.1	60.0
MISC. SUPPORT	6.2	.5	1.6	2.6	10.9
MAINTENANCE					
Supervision/Indirects	10.1	1.5	.3	--	11.9
Control System	8.2	1.9	--	.1	10.2
Receiver System	1.8	--	.8	.1	2.7
Thermal Storage System	2.9	.1	.8	--	3.8
Collector System	1.2	--	--	--	1.2
EPGS System	4.8	1.2	--	--	6.0
Miscellaneous	4.5	1.8	1.5	.3	8.1
Total Maintenance	33.5	6.5	3.4	.5	43.9
SUB TOTAL	108.7	15.0	5.3	3.3	132.3
Division O.H.					17.8
TOTAL DIRECT					150.1
Workman's Compensation					.9
Payroll Tax					7.3
Pension & Benefits					22.2
Administrative & General					28.7
GRAND TOTAL					209.2

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ATTACHMENT 1

SOLAR ONE GENERATING STATION

RECEIVER BOILER PANEL #18 TUBE LEAKS

July 29, 1983

On July 15th, a small leak was discovered at the top bend of tube #30 of receiver panel #18. The specific location of the leak is shown in the attached sketch.

A second leak was discovered on July 26, in tube #41 while a hydrostatic test was in progress to check a weld repair on receiver panel #15 temperature control valve. The leak in tube #41 appears to be the mirror image of the original failure. Both leaks are located at the top of the interstitial weld (light seal). Because the leaks are similar, it was decided to place the plant in Mode 8 (inactive) until a good understanding of the failure cause is obtained. McDonnell Douglas Corp. has assembled an investigative team to:

1. Effect a tube repair.

2. Inspect all receiver panels for similar occurrences.

3. Provide support to expedite returning the unit to service.

In addition, Sandia has formed a task force to investigate the cause of the tube failures.

A hydrostatic test followed by dye penetrant inspection is planned for the following week to determine the existence of other potential tube failures.

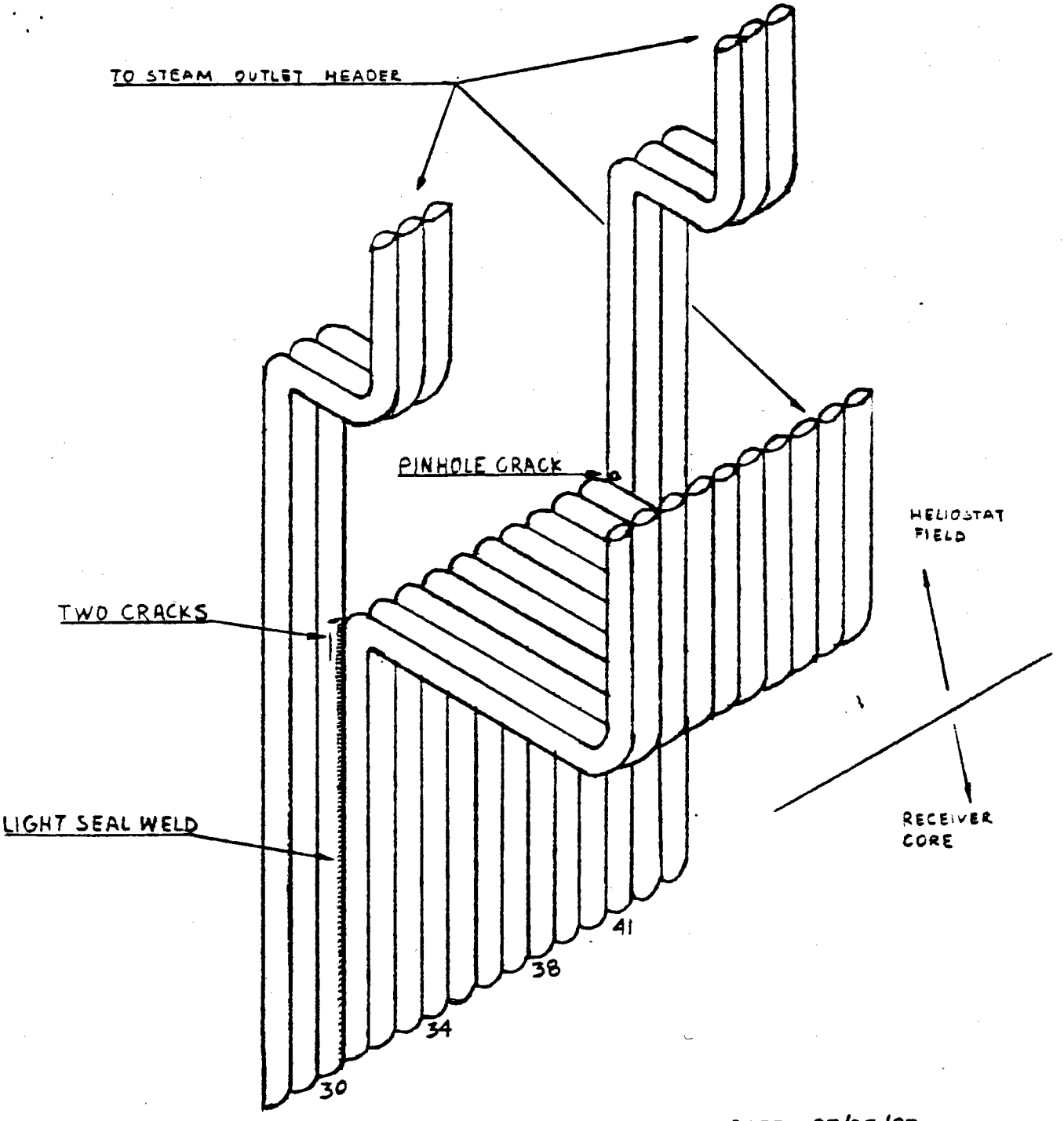
The failed tube sections will be removed for failure analysis. Repairs will be accomplished per repair procedure being developed jointly by McDonnell Douglas and Rocketdyne.

It is anticipated that the plant will be in Mode 8 for three weeks. During this period, additional receiver maintenance will be implemented to correct receiver flowmeter flange and receiver temperature control valve bonnet leakage, software development, and miscellaneous plant maintenance.

NOTE: The plant went back on-line on August 23, 1983.

SOLAR ONE GENERATING STATION

RECEIVER PANEL # 18 SECTION



DATE: 07/28/83
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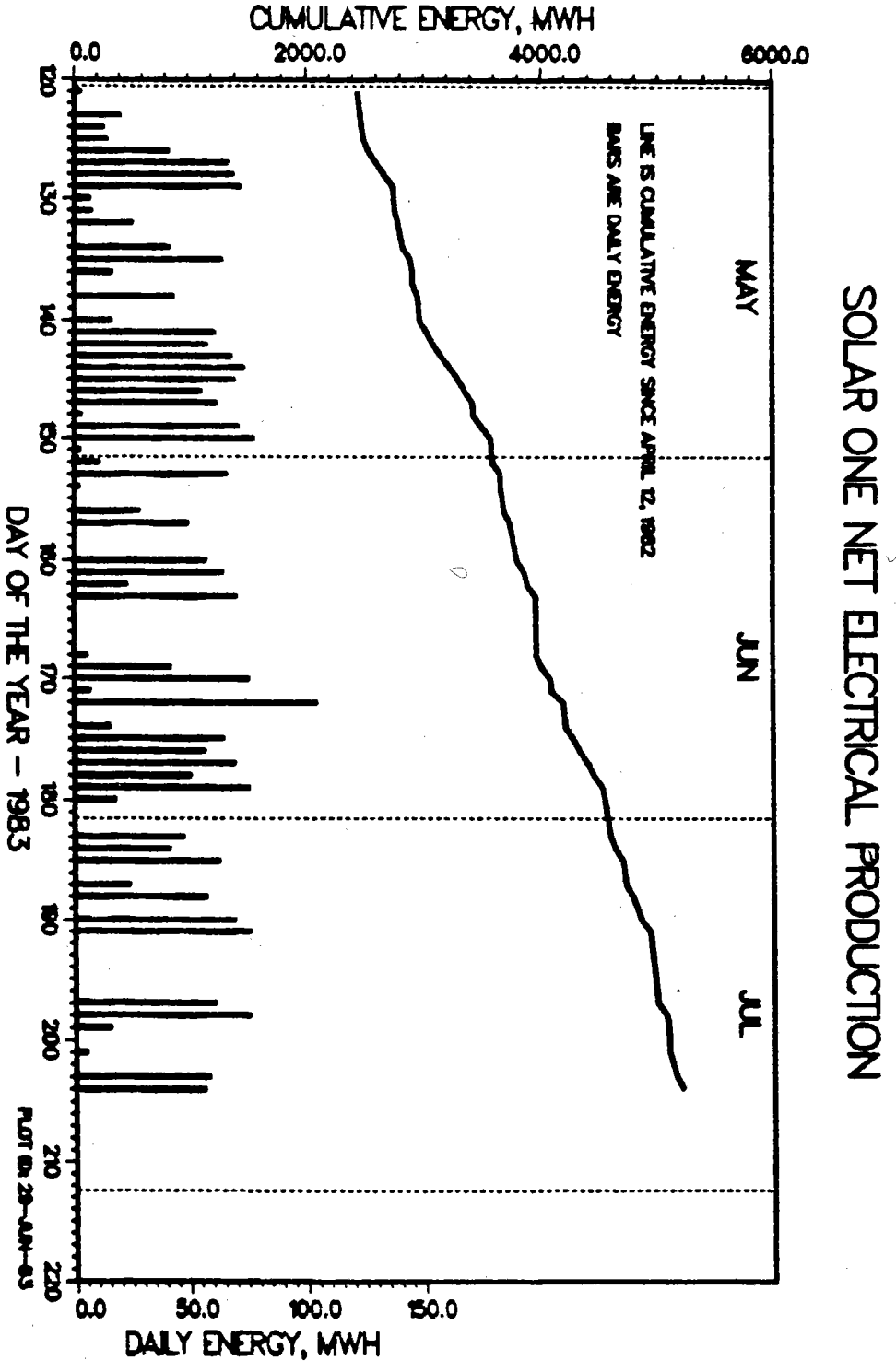
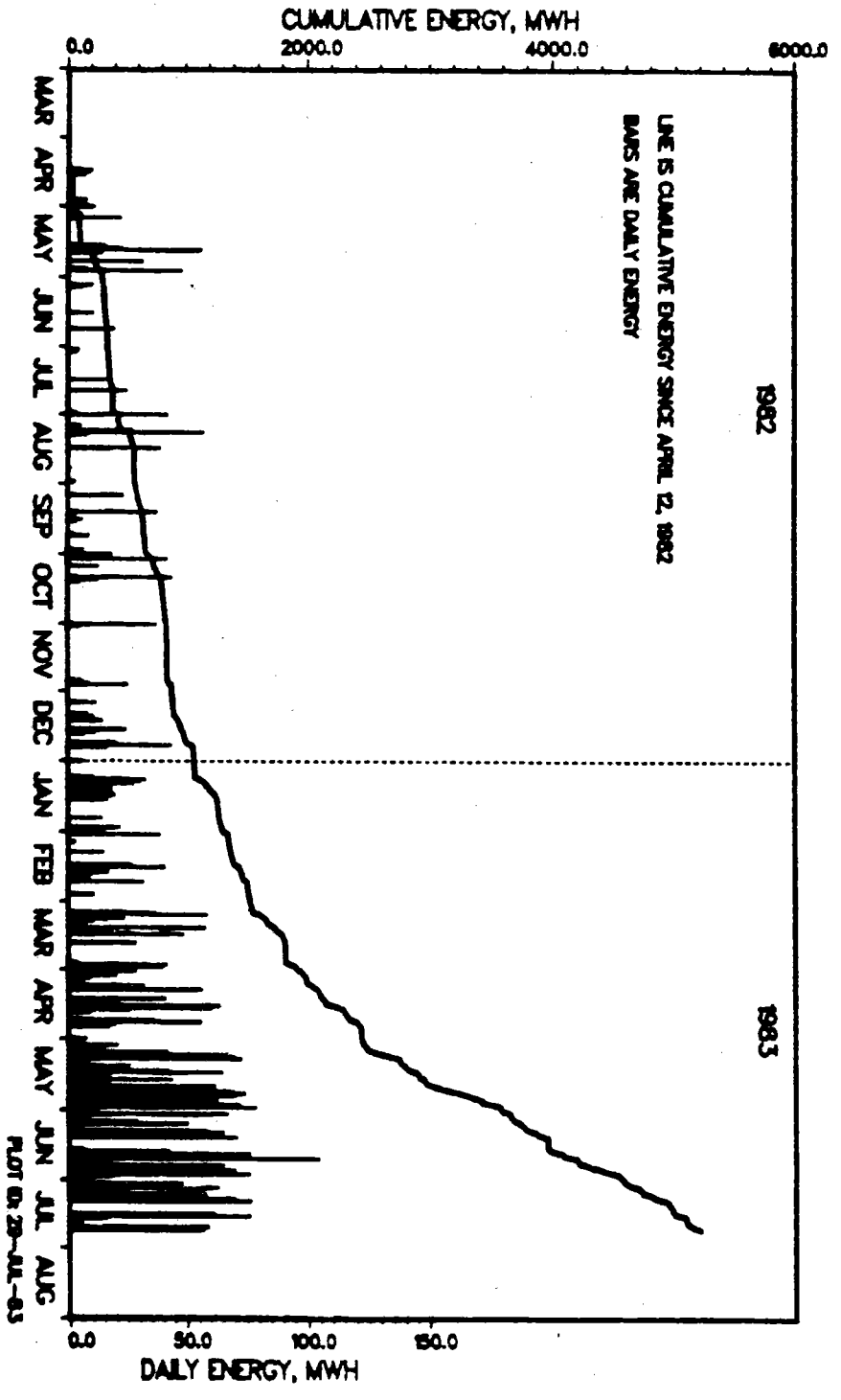
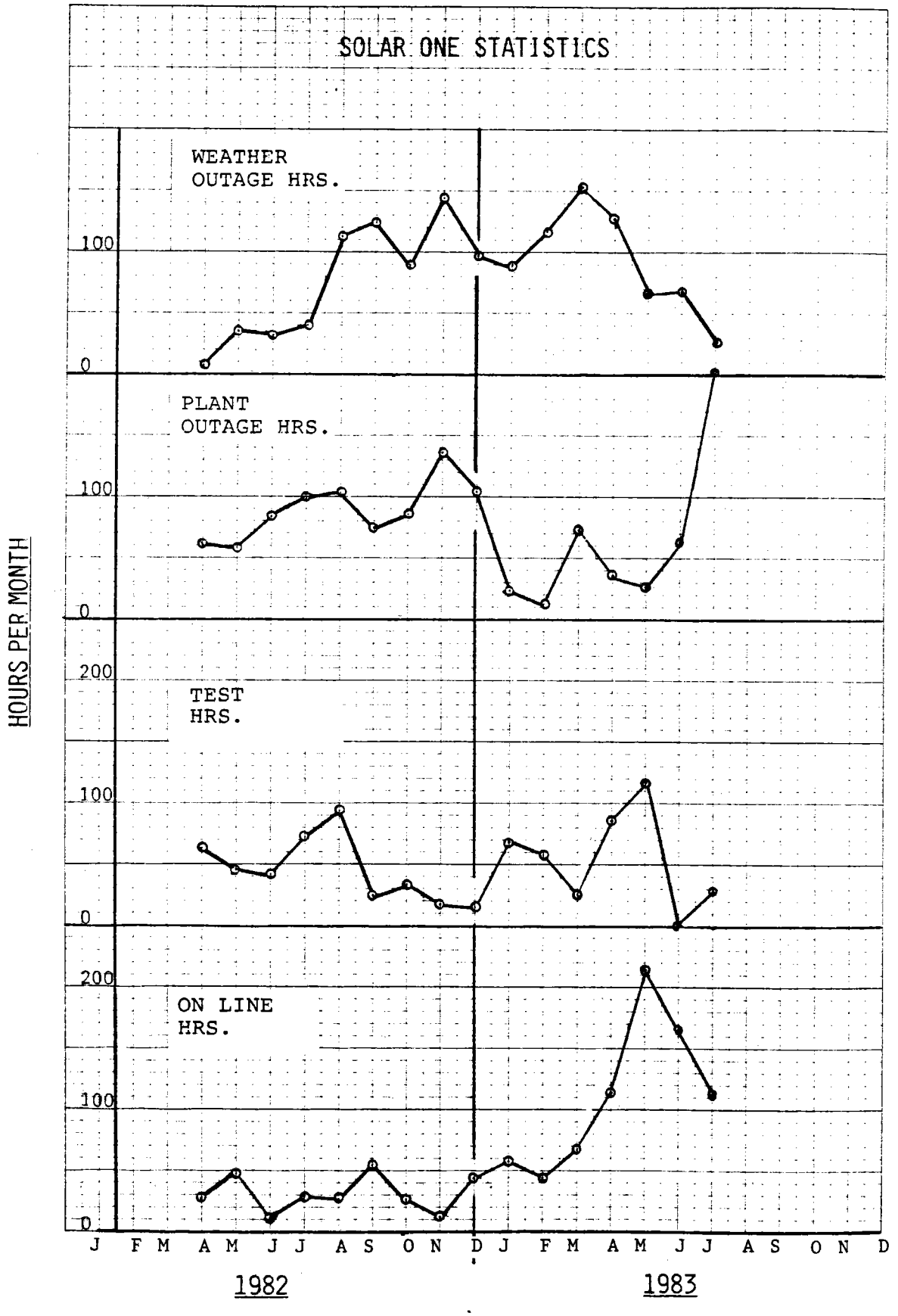


SOLAR ONE NET ELECTRICAL PRODUCTION



SOLAR ONE NET ELECTRICAL PRODUCTION

ATTACHMENT 4



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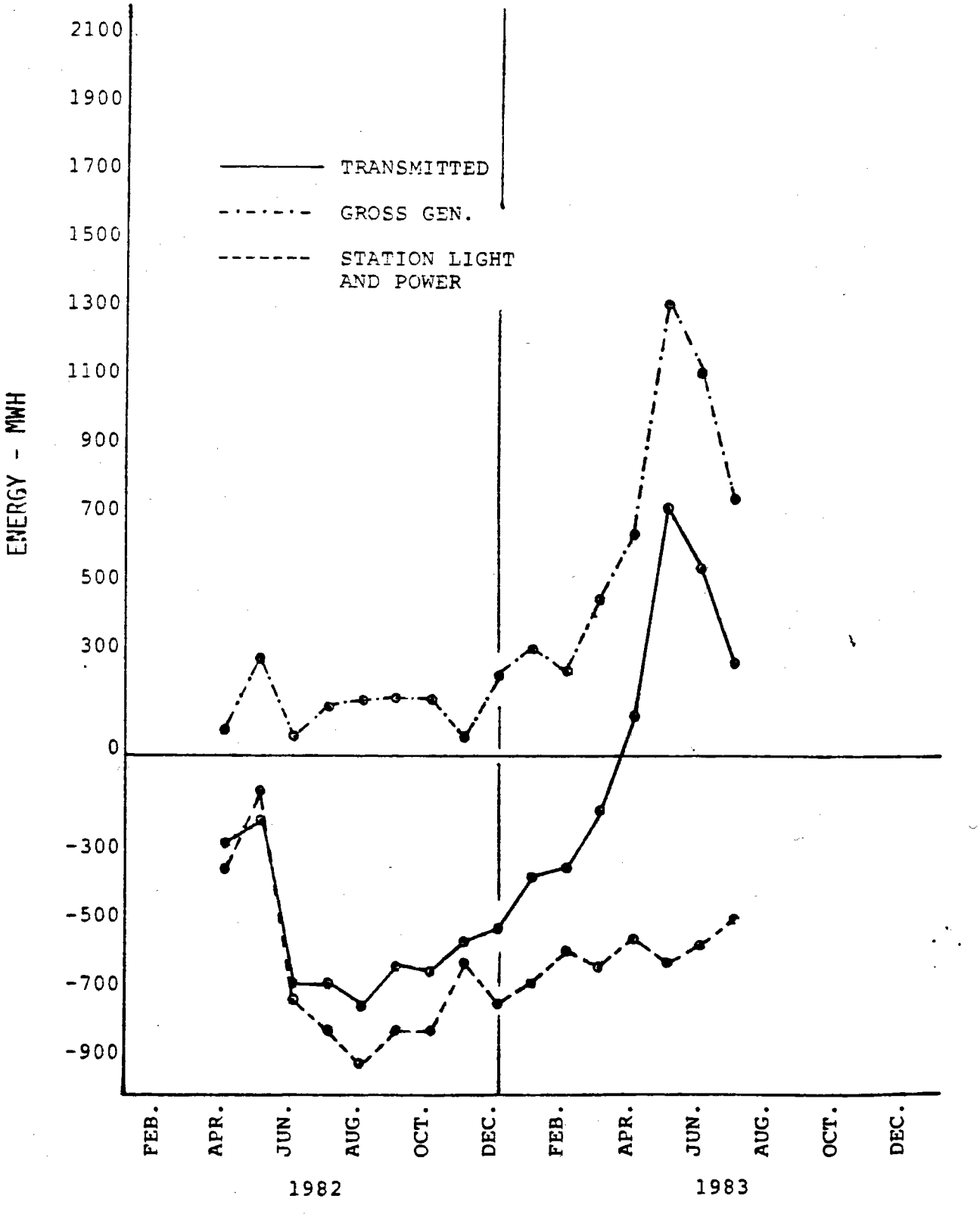
SOLAR ONE
MONTHLY METER REPORT SUMMARY



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(STMPO-817)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #17
AUGUST 1983

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This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and a monthly operation and maintenance cost summary.

Solar One operation was severely impacted during August due to a long weather outage and plant outage to effect receiver tube leak repairs. Three receiver boiler panel tube leaks were repaired and the plant returned to service on August 23. The net energy production for the month, while connected to the grid, was 234.7 MWH, however, on a 24-hour basis the plant consumed more energy than it generated in August. This is the first month since April '83 that this has occurred.

Operational Highlights

- All major plant systems were secured on August 3 for an extended outage to implement receiver tube inspection and leak repairs. The receiver tube leak repairs were completed on August 19 and the operational activity was resumed on the same day for condensate and receiver feedwater clean up. Solar One returned to normal operation on August 23, 1983 after the State Inspector had certified the weld repairs. Attachment 1 presents a status report on the receiver tube leaks.

- The meter constant on the backup auxiliary power source, 4KV well water line, was found to be in error during the receiver outage. At this time the plant was transfered from the primary auxiliary power source, 33KV bug line, to the backup source to minimize the plant's exposure to area lightning strikes. The extended operation on the backup power source evidenced near three times normal power consumption. Reevaluation of the electrical meter found the meter constant to be 1400 rather than 4000 as noted on the meter. Correction of station records in August to reflect the correct electrical meter constant in all previous months resulted in a 362 MWH reduction in auxiliary power consumption and consequently increased Solar One's net output by the same amount.

- The Operational Control System (OCS) check out and acceptance testing was partially completed in mid August. Following the acceptance testing, McDonnell Douglas control engineers and SCE operators were trained on building graphics using the Plant Operational Display System (PODS). Present plans are for operators to develop their own operational displays as they previously accomplished on the Beckman subsystem controls and for McDonnell Douglas control engineers to continue development of the host computer software.

Maintenance Highlights

The heliostat field was rain rinsed early August. Reflectivity measurements taken following the rainfall indicated an average of 95% mirror cleanliness (approximately 86% average reflectivity of

the collector field). Rain washing of the heliostats is effective but not "very reliable". Consequently, a specially equipped heliostat wash truck provided by Sandia (Attachment 2) and designed and built by Foster Miller and Associates specifically for the Solar One heliostats, was delivered on site the week of August 15th. The wash assembly has proven functional but will require correction of minor problems. SCE maintenance personnel have been trained in its operation. The average heliostat wash time, using the wash truck, including travel time between heliostats, is approximately two minutes per heliostat.

- Tumble weeds were removed from the 130 acre plant site to minimize personal exposure to rattlesnakes common to the facility and to provide ready access to heliostat junction box and controller. Selected collector field sections were left undisturbed to aid in the UCLA/LBES (University of California, Los Angeles/Laboratory of Biomedical and Environmental Sciences) studies regarding the re-establishment of desert vegetation under normal plant operation.

- An attemperation system was installed on the PVC portion of the plant effluent water line. The attemperator regulator was set at 100°F and will operate to reduce the temperature of the hot blowdown water to prevent PVC line failures due to thermal expansion.

- 1810 of 1818 heliostats (99.6%) were available for service on August 5. The previous record was 1805 on March 28, 1983.

- The receiver tower elevator was temporarily out-of-service during August due to failure of its power/control cable take-up spool. The damaged parts, including the power cable and cable guides, were replaced and the elevator was completely serviced during the manufacturer's normal quarterly visit.

- The receiver tower level 15 floor was modified to facilitate drainage of water from rain and start-up venting of the receiver. This eliminates water damage of the Remote Station One, Receiver Electronics Room, that was previously experienced. Additionally, the damaged coating on level 15 floor was removed and replaced with three layers of a new water resistant roof-type coating and the 3" receiver vent was relocated from the east to the west side of the tower to eliminate water from cascading onto the Remote Station One roof during start-up venting of the receiver.

- The Thermal Storage System (TSS) water and steam sample lines were routed to the chemical lab. This will ensure better TSS feedwater chemical control and consequently result in the use of higher purity water since instrumentation will be provided in the near future to continuously monitor parameters such as cation and straight conductivity and pH.

- Miscellaneous receiver maintenance work accomplished during this period included:

  a. Replacement of bonnet gaskets of the temperature control valves in receiver panels 6, 8, 14, 19, 20 and 21.

b. Packing adjustment of the temperature control valve in receiver panels 6, 8 and 14 and the receiver ring header inlet valve.

Plant Statistics

- Solar One did not operate during the most of August due to inclement weather (thunderstorm activity in the area) as well as the receiver tube leak repairs. In August, as shown in Attachment 3, Solar One had the longest weather outage and the second highest plant outage since start-up in April 1982.

  Some power production and testing took place, but not enough to ensure another positive output month. As Attachment 4 indicates, the gross generation for August dropped to 272.6 MWH which did not offset the auxiliary power usage (450 MWH) during the month. Worth noting is the fact that the monthly auxiliary power consumption is continually decreasing as a result of the ongoing efforts to increase plant efficiency.

- Attachments 5 and 6 show the daily and cumulative net energy production while the unit was on-line for the three previous months and year-to-date respectively.

Plant Statistics	August	Turbine Roll To Date
Energy Production (KWH net while connected to the grid)	234,700	5,422,900
Peak MW (net)	9.9*	10.4*
On-Line Hours	38.3	1101.9
Test Hours	41.0	957.5
Total Plant Outage Hours	165.0	1317.5
Scheduled	-0-	447.0
Unscheduled	165.0	870.5
Weather Outage Hours	166.0	1511.4

*Receiver generated steam only.

Operation and Maintenance Costs

- A summary of the O&M labor, material, contract, and other costs for the month of August 1983, is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

SOLAR ONE

MONTHLY O&M COST SUMMARY
($ X 1000)

MONTH OF AUGUST, 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	18.6	.1	-	.8	19.5
OPERATIONS	51.4	12.5	-	.4	64.3
MISC. SUPPORT	5.5	.5	3.9	1.6	11.5
MAINTENANCE					
Supervision/Indirects	9.5	2.7	.1	.2	12.5
Control System	5.8	1.2	7.9	-	14.9
Receiver System	9.5	.1	-	-	9.6
Thermal Storage System	.9	(2.8)	12.5	.2	10.8
Collector System	2.5	1.7	-	-	4.2
EPGS System	2.6	2.6	5.1	-	10.3
Misc.	5.4	2.4	1.7	.7	10.2
Total Maintenance	36.2	7.9	27.3	1.1	72.5
SUB TOTAL	111.7	21.0	31.2	3.9	167.8
Division O.H.					17.9
TOTAL DIRECT					185.7
Workman's Compensation					.9
Payroll Tax					7.3
Pension & Benefits					22.3
Administrative & General					35.4
GRAND TOTAL					251.6

AZK/PES:slw

ATTACHMENT 1

SOLAR ONE GENERATING STATION

RECEIVER PANEL TUBE LEAK STATUS

September 26, 1983

Background

On July 15, 1983, the first receiver tube leak was discovered after approximately 400 thermal cycles and 14 months of operation. This leak was located on tube 30 of panel 18. It was 5/8" in length along the interstitial weld on the receiver core side of the panel. Plans for repair were formulated; however, no action was taken at that time.

On July 26 and after approximately ten additional thermal cycles, a new leak developed on tube 41 of panel 18. The second leak was 3/8" long and mirror image of the leak on tube 30. At that time it was decided to stop operations until the failure mechanism was identified. All major plant systems were secured for an extended plant outage.

Extensive dye penetrant and hydrostatic testing of all receiver panels revealed additional cracks on August 2. The third tube failure was a circumferential crack 3/4" long, located on the top of the 90° bend over the panel support on tube 70 of panel 11. The fourth crack was found in the interstitial weld between tubes 30 and 31 of one of the spare panels, similar to the cracks found in panel 18. A panel drawing with the location of the first three cracks is shown in Attachment 1.a.

The complete work schedule for the removal/repair of the cracks, metallurgical testing, insulation replacement and start-up was prepared by McDonnell Douglas and Rocketdyne. Solar One was scheduled to return to service on August 24.

Tube Repair Details

Samples for metallurgical tests and stress analysis were removed and repairs were made in tube 30 panel 18 and tube 70 panel 11 as per drawings in attachments 1.b and 1.c respectively. After completion of the repairs, the interstitial welds were ground smooth, but were not replaced pending conclusions on tube failure mechanism.

Since the crack in tube 41 of panel 18 was the mirror image of that in tube 30, it was ground and weld filled only. A sample was removed from tube 30 of the spare panel for metallurgical examination. Repairs of the spare panel will be completed at a later date.

All repairs were completed on August 19 by a Rocketdyne certified welder and were approved by a State Inspector on August 22. Additional dye penetrant tests did not reveal any other cracks.

Solar One returned to normal operation on August 23, one day ahead of schedule.

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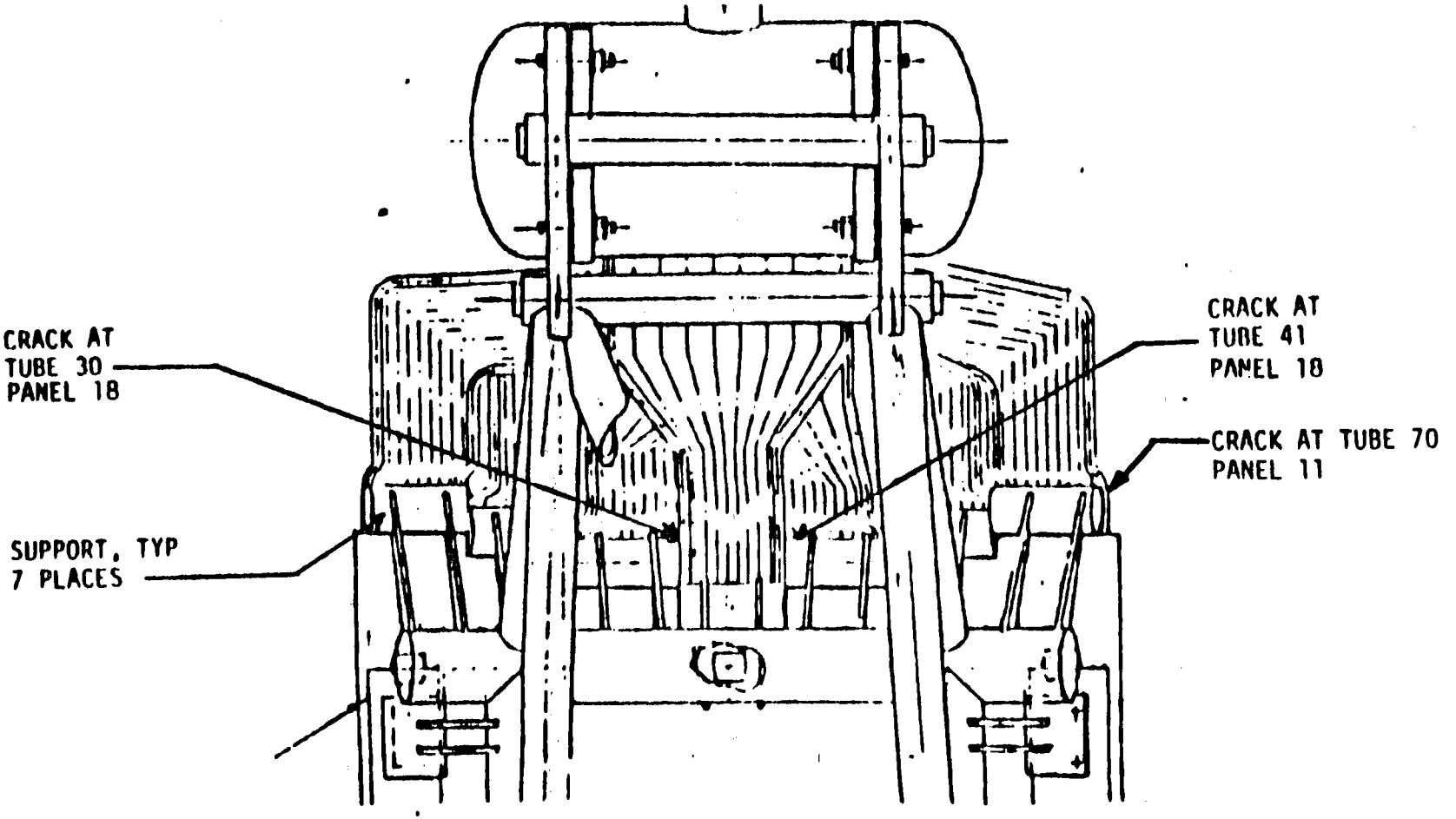
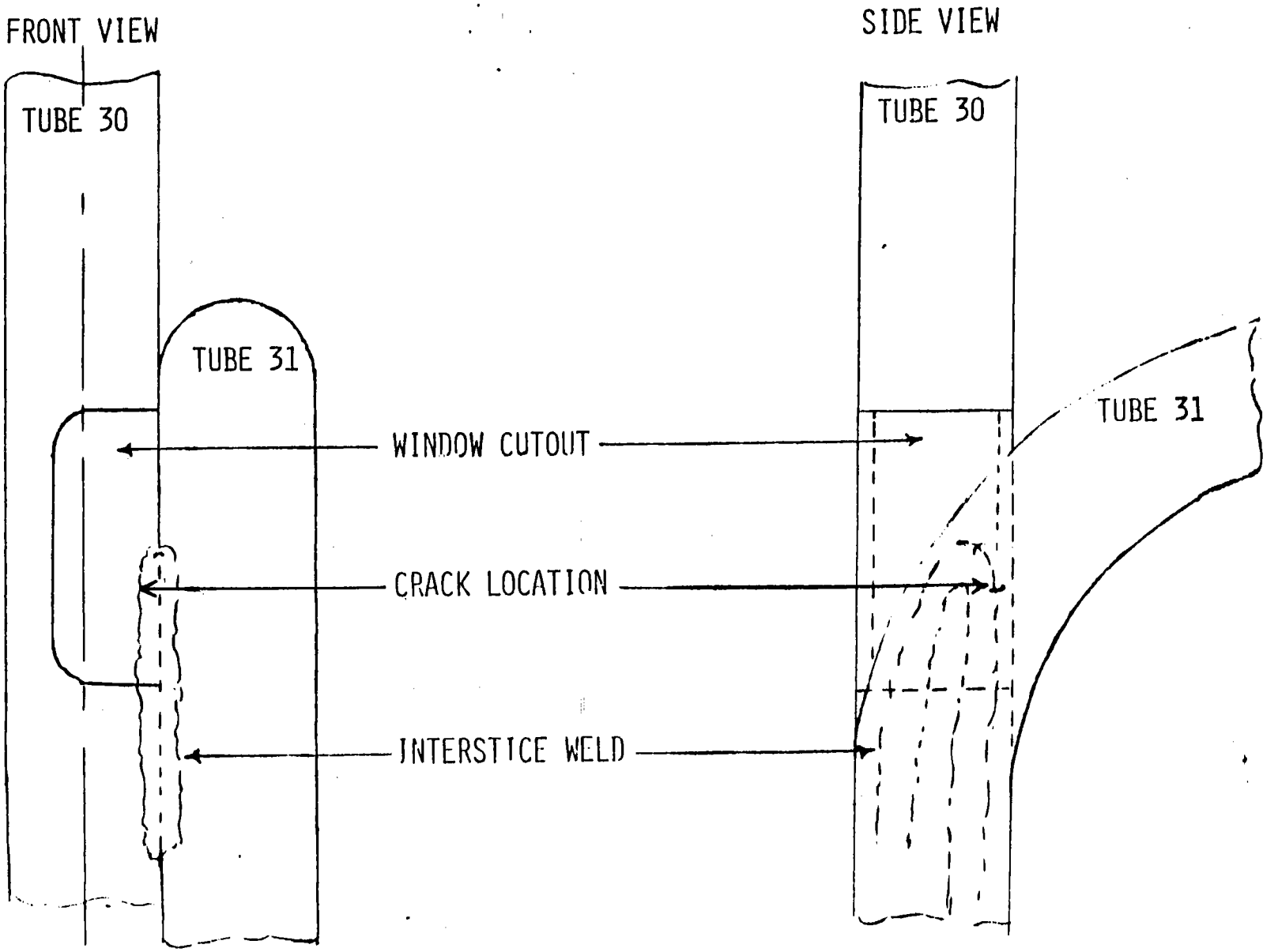
REAR VIEW - TOP OF PANEL



ATTACHMENT 1.a

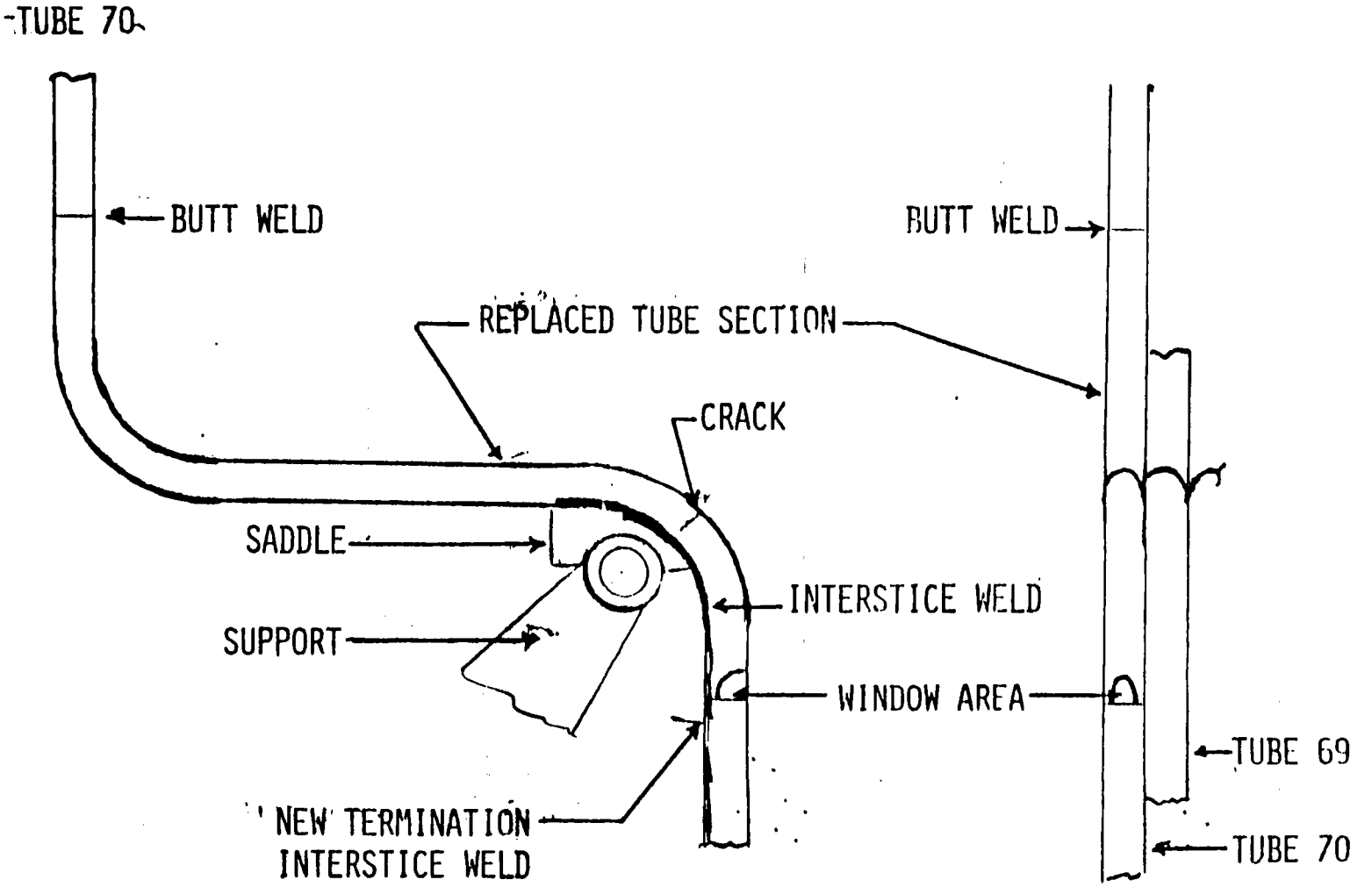
ATTACHMENT 1.b

REPAIR CONFIGURATION PANEL 18 TUBE 30

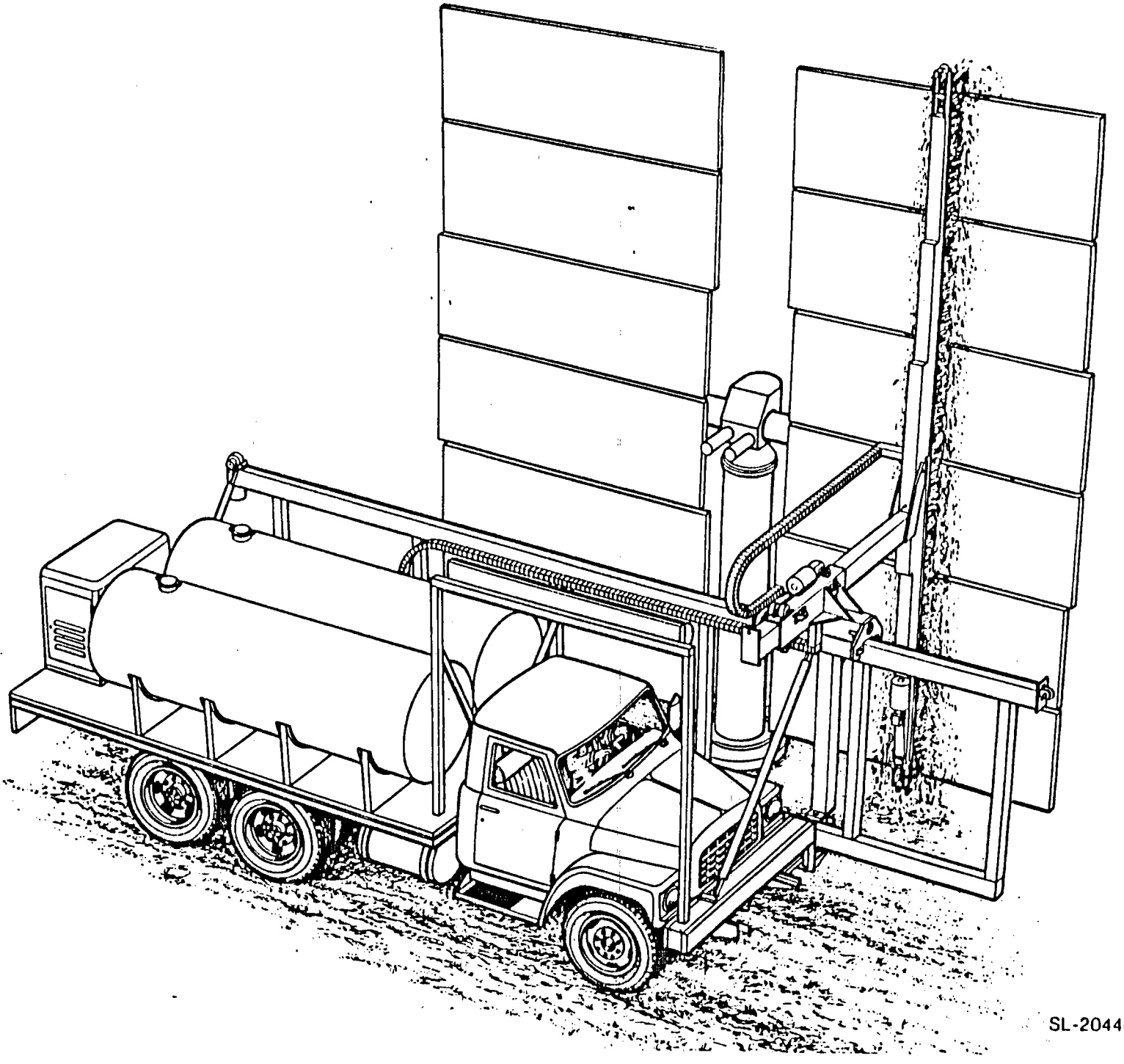


ATTACHMENT 1.c

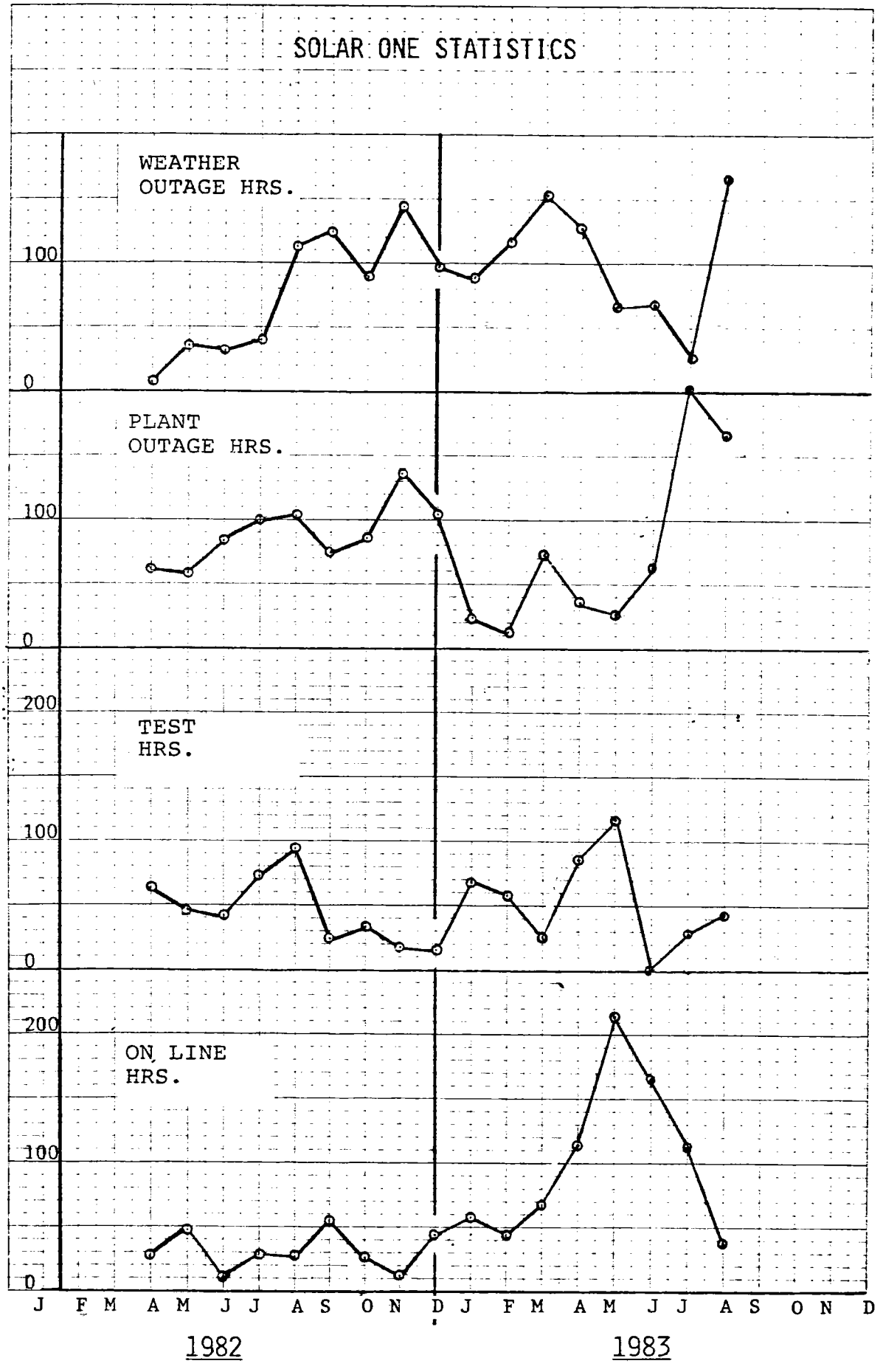
REPAIR CONFIGURATION PANEL 11 TUBE 70



ATTACHMENT 2

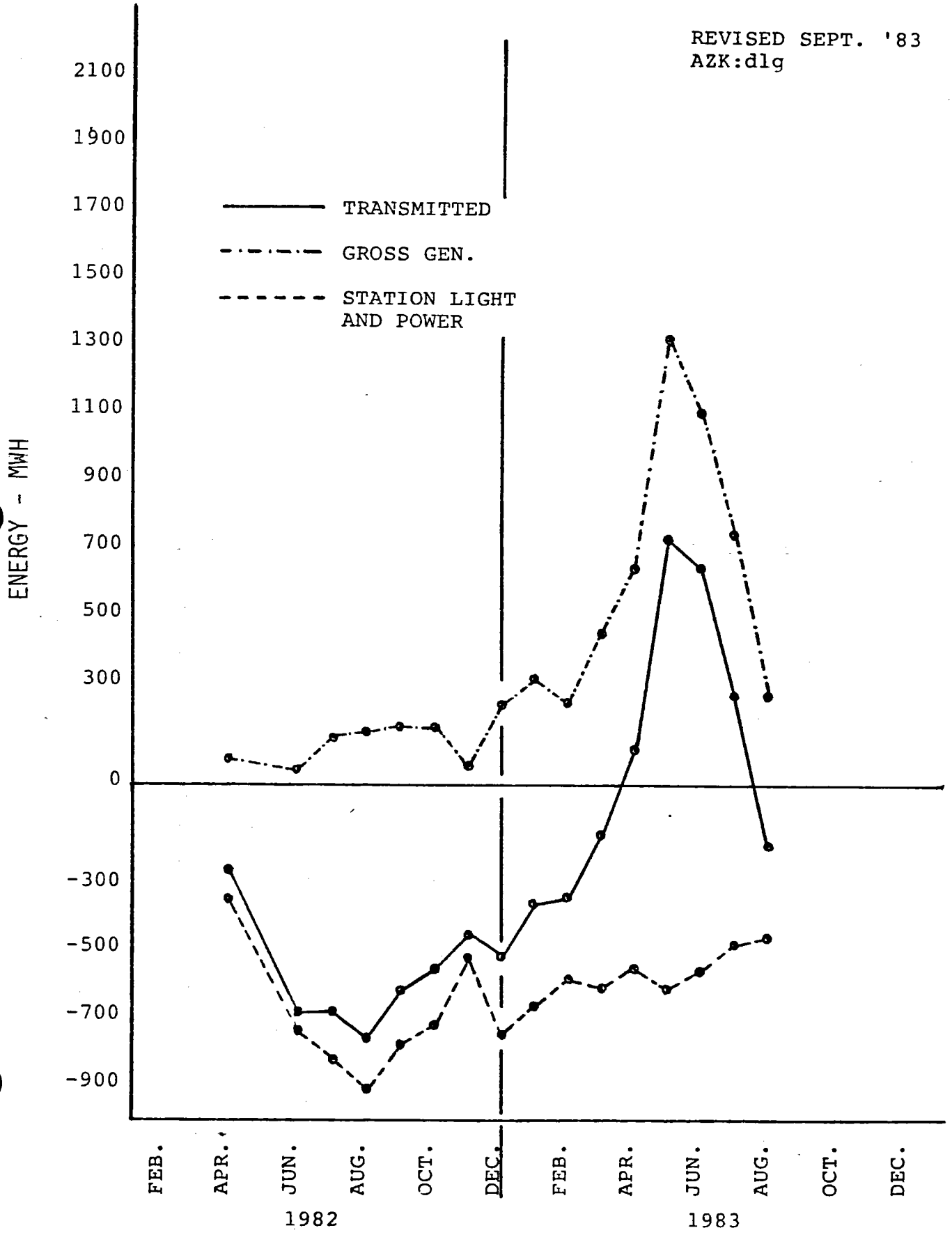


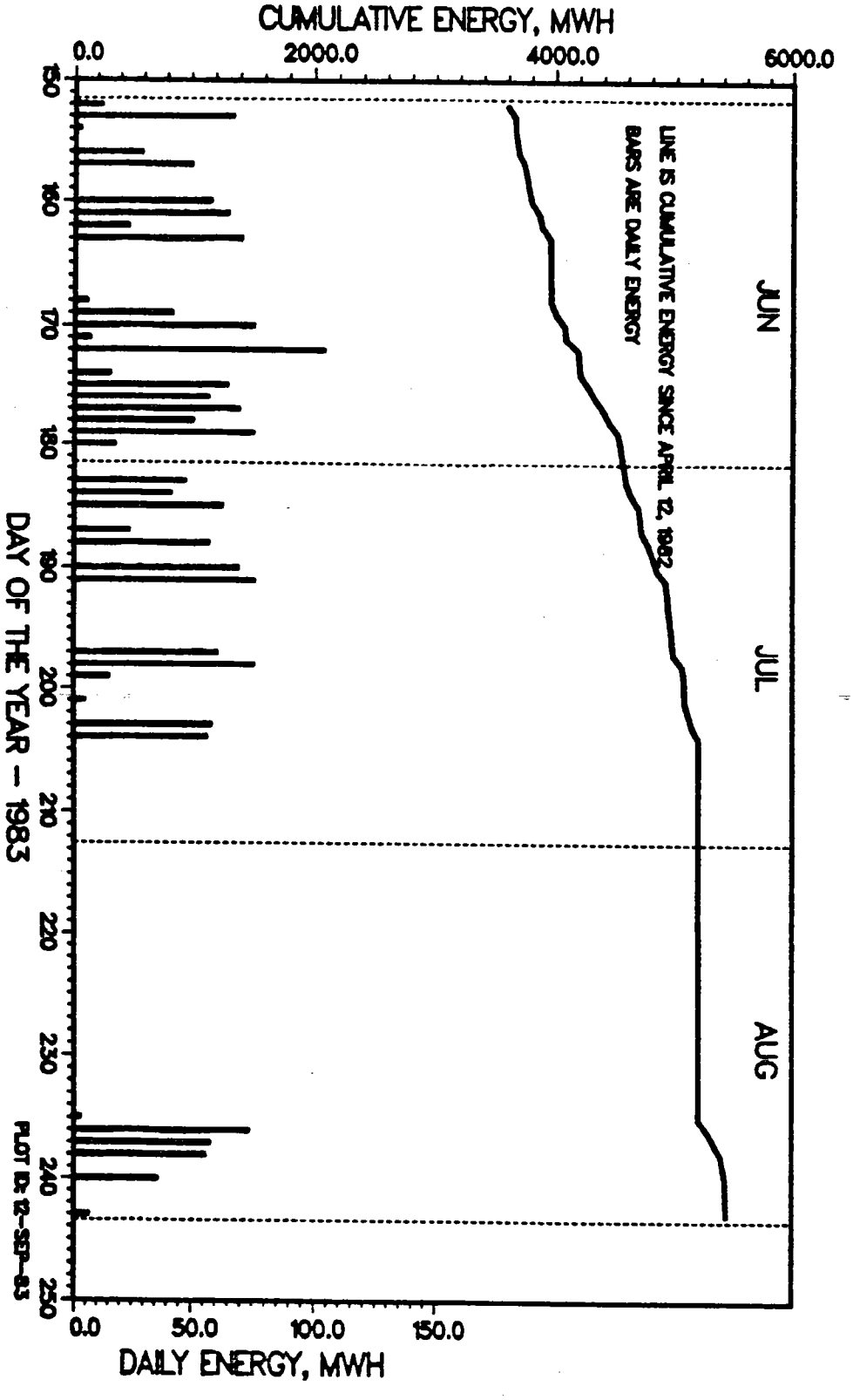
Heliostat Mirror Cleaning System



AZK/03/17/83

SOLAR ONE
MONTHLY METER REPORT SUMMARY

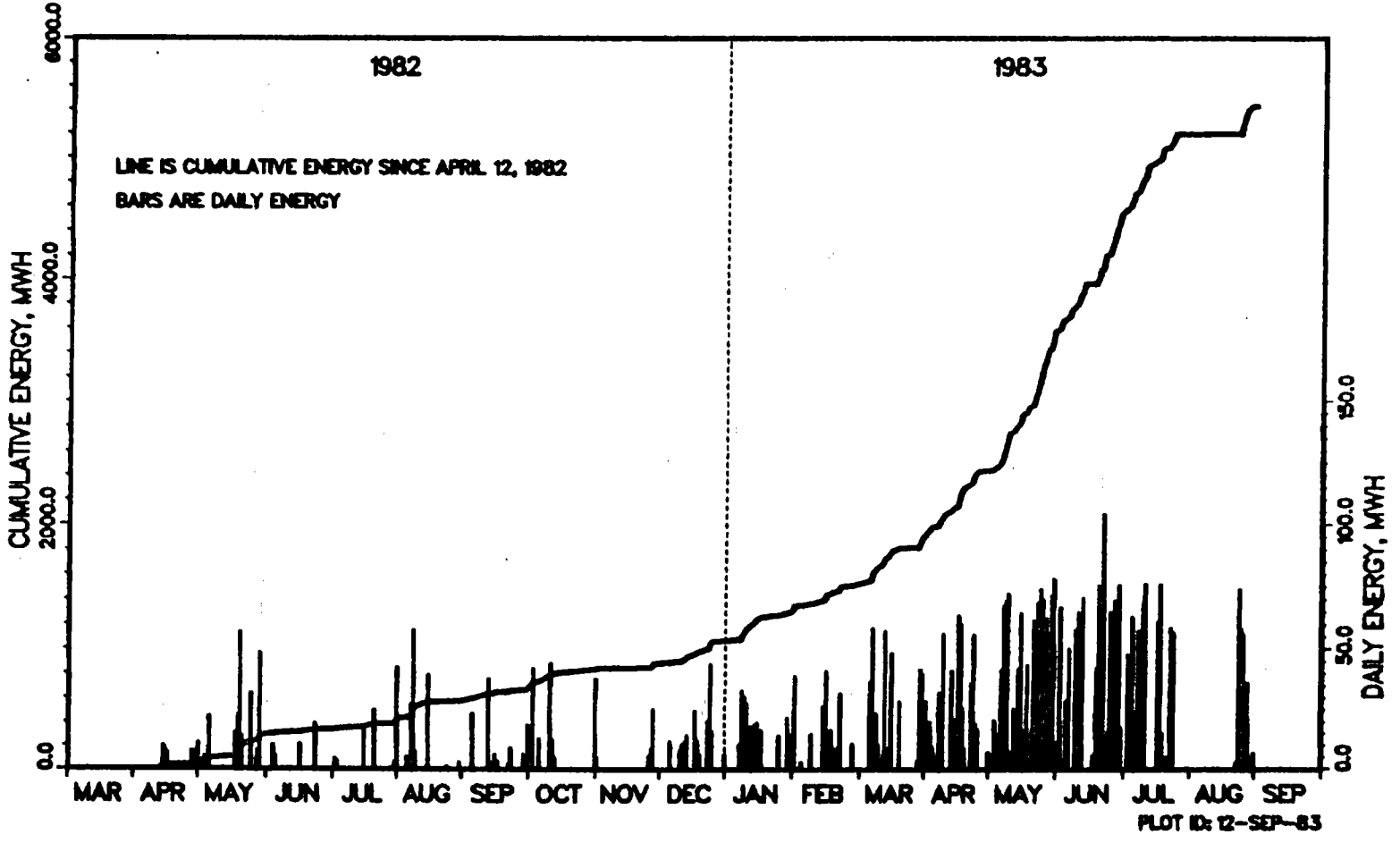




SOLAR ONE NET ELECTRICAL PRODUCTION

ATTACHMENT 6

SOLAR ONE NET ELECTRICAL PRODUCTION



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(STMPO-818)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT 18
SEPTEMBER 1983

M+R
TIC

THIS REPORT SUMMARIZES THE OPERATIONAL ACTIVITIES AND HIGHLIGHTS MAINTENANCE WORK THAT WAS PERFORMED DURING THE MONTH. IN ADDITION, IT PRESENTS PLANT STATISTICS AND A MONTHLY OPERATION AND MAINTENANCE COST SUMMARY.

Operations at Solar One were again this month severely impacted due to 131 hours of weather outage. Accordingly, power production was limited but sufficient to ensure another positive output month, 99.8 MWH net. The net energy production for the month, while connected to the grid, was 496.4 MWH.

The receiver tube leaks to date are attributed to low cycle fatigue.

Operational Highlights

- o On September 6, the receiver operation was hindered due to water chemistry analytical instrumentation malfunction. Investigation revealed that the standardizing pH electrode, combination type, had failed, resulting in erroneous readings. The faulty electrode was replaced and the water quality control was reestablished. Because the combination electrodes have a very short life span and their accuracy decreases with use, they are not very suitable for continuous pH monitoring. Consequently, the standardizing electrode was replaced by the more common and reliable reference/glass electrode set.

- o Leaks in the bearing cooling water at an estimated rate of 28 gpm resulted in abnormal consumption of the cooling water treatment chemicals. Uranine dye, phosphorescent green color, aided in the leak detection. The leaks were found to occur at the generator air cooler relief valves, which were subsequently repaired and reset to relieve at a 10 percent system overpressure.

- o A preliminary receiver no flux heat loss test was conducted under the direction of Sandia Lab engineers. According to the test procedure, the receiver feedwater was heated at the second point feedwater heater with thermal storage steam and the temperature drop across the receiver was determined. The heat losses through convection and radiation were then calculated. This proof test was successful and the data collected were meaningful. The final receiver heat loss experiment will be performed at a later date.

- o Testing of a new overnight plant shutdown scheme, Mode 8, was initiated in September. According to Mode 8, all major plant systems are secured and all condensate and feedwater equipment is blanketed with nitrogen, rather than steam, for outage protection. Data related to nitrogen consumption, parasitic load reduction, auxiliary steam usage reduction, and water quality during start-ups will be collected and evaluated to determine the feasibility of adopting this procedure as a normal overnight plant shut down.

- Automatic collector field start-ups were successfully conducted during early morning and mid-day. The heliostat field received and properly executed commands issued by the Operational Control System (OCS) to track the sun during both clear and partly cloudy conditions.

- Fifteen mirror modules, which contained water and displayed high amounts of corrosion, were fitted with one or more test vents and a humidity sensor. Five different venting configurations were used to determine the most effective one in drying out the modules. The selected venting arrangement will be used in the near future for venting all early production mirror modules.

- Representatives from the Honeywell Technology Development Center, under contract with EPRI, completed the first of the three phase survey of the plant digital control system and the resultant man-machine interface. The survey will be completed by the end of November.

- Southern California Edison was authorized to operate the plant in Mode 2, i.e., parallel receiver/turbine and thermal storage charging operation.

- The three receiver tube leak failures experienced to date are attributed to low-cycle fatigue. Details on the subject are reported on Attachment 1.

Maintenance Highlights

- A two-day fire protection equipment inspection was performed by FM Chemical Company. The fire detectors at certain locations were found to be unfit for the application, and it was decided that these detectors had to be replaced with less sensitive ones to avoid unnecessary alarming due to the dusty environment existing in the warehouse and switchgear rooms.

- Difficulty in maintaining the turbine on turning gear has recently been experienced. Since disassembling of the turning gear is required, the work will be accomplished during a two-week turbine inspection outage tentatively scheduled for January 1984.

- Miscellaneous maintenance work accomplished during September included:

  a. Replacement of bonnet gaskets in temperature control valves of receiver panels 15, 16, and 20.

  b. Replacement of receiver flowmeters in panels 4 and 19.

  c. Replacement of receiver prefilter gaskets in panels 6, 7, 14, 16, and 17.

  d. Replacement of the rupture disk in the oil side of charging train #2.

  e. Retorquing of the head flange bolts of charging train #2 condenser.

  f. Installation and routing of the thermal storage system sample lines to the chemical lab.

g. Installation of a 30 psi air pressure regulator and filter assembly at the local service air outlet, to facilitate the safe unloading of the bulk concentrated sulfuric acid and sodium hydroxide.

h. Replacement of three deteriorated receiver flux sensors in panels 9, 10, and 19.

i. Installation of a turbine type flowmeter at the steam inlet of the thermal storage charging system to improve flow measurement accuracy.

j. Replacement of the failed 5 volt power supply to the operational control system.

Plant Statistics

o Weather outage this month (Attachments 5 and 6) had a significant impact on energy production and testing. The gross generation for September was 589.4 MWH and the auxiliary energy usage was 489.4, corresponding to an hourly usage of 0.68 MW. The auxiliary energy usage is highly dependent on testing and it is expected to reach a constant, and lower, value with the beginning of the power production phase, August 1984.

o The testing activities, although limited due to inclement weather, emphasized two-train thermal storage charging and extraction, Modes 5 and 6 respectively. Process controls tuning and performance data collection were the objectives during these tests. Successful operational control system (OCS)/collector field automatic start-ups were also performed in conjunction with Mode 5 and 6 testing.

o Attachments 7 and 8 show the daily and cumulative net energy production while Solar One was on-line for the three previous months and for the year to date respectively.

Plant Statistics	September	Turbine Roll To Date
Energy Production (KWH net while connected to the grid)	496,400	5,919,300
Peak MW (Net)	9.7*	10.4*
On-Line Hours	88.9	1190.8
Test Hours	83.3	1040.8
Total Plant Outage Hours	46.2	1363.7
Scheduled	22.0	469
Unscheduled	24.2	894.7
Weather Outage Hours	131.0	1642.4

*Receiver Generated Steam Only

Operation and Maintenance Costs

o A summary of the O&M labor, material, contract, and other costs for the month of August 1983 is shown on the attached table. 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.
Miscellaneous 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 costs associated with direct labor plus company administrative and general expenses.

SOLAR ONE
MONTHLY O&M COST SUMMARY
($ X 1000)
MONTH OF SEPTEMBER 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	20.6	.1	-	.6	21.3
OPERATIONS	52.1	2.5	-	-	54.6
MISC. SUPPORT	5.5	-	3.0	2.0	10.5
MAINTENANCE					
Supervision/Indirects	8.6	2.1	-	.3	11.0
Control System	4.8	3.0	2.5	-	10.3
Receiver System	4.2	1.9	.3	-	6.4
Thermal Storage System	3.6	4.0	.3	-	7.9
Collector System	3.2	.8	-	-	4.0
EPGS System	3.1	.8	.1	-	4.0
Misc.	5.1	.2	11.0	.4	16.7
Total Maintenance	32.6	12.8	14.2	0.7	60.3
SUB TOTAL	110.8	15.4	17.2	3.3	146.7
Division O.H.					17.6
TOTAL DIRECT					164.3
Workman's Compensation					.9
Payroll Tax					6.9
Pension & Benefits					21.3
Administrative & General					29.3
GRAND TOTAL					222.7

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SOLAR ONE GENERATING STATION Attachment 1

Tube Leak Evaluation

On September 15, a meeting was held on site to discuss tube leak analysis results and to develop further action plans. The meeting attendees included McDonnell Douglas, Rocketdyne, and Sandia Lab engineers and metallurgists, on-site project participants, and engineers from Foster Wheeler Development Corporation and the Babcock and Wilcox Company.

The three tube failures experienced to that date were attributed to low-cycle fatigue. Details of the metallurgical test results, as presented at the meeting, are shown on Attachments 2, 3, & 4. Operational data, collected via existing instrumentation on the receiver for the five month period, November 1982 through March 1983, were evaluated and the data verified that operation of the receiver was within the design specifications.

Numerous metallurgical and stress analysis tests have been completed without positive identification of the failure cause. However, data presented at the meeting will be reevaluated by project participants as well as by the consultants from the Foster Wheeler and Babcock and Wilcox companies.

The plan for further action regarding tube failure investigation includes the collection and evaluation of additional data to be obtained by means of thermocouples and extensometers, which were installed on selected receiver tube panels. The installation of the thermocouples and the extensometers was completed during the first two weeks of September.

Emphasis has been placed on the tube 70, panel 11 failure since there are possibilities that the crack is due to a generic defect. Consequently, ultrasonic tests were conducted on Monday, September 26, on selected tubes of the receiver panels 9, 10, 11, and 12; however, no positive crack indications were found.

Effort to monitor panel movement is continuing and analysis is in progress at Sandia, McDonnell Douglas, and Rocketdyne. Results are being evaluated.

Modifications of receiver operating procedures, including reduction of steam outlet operating temperature from 960 to 850°F, and changing the receiver shutdown sequence to allow for slower cooling, are under consideration. These modifications will reduce the maximum metal temperature gradient at the top of the receiver panels and will reduce the thermal quenching effects in the receiver tubes following shutdown.

Review of the daily water analysis reports did not evidence any significant deviations from the recommended operating limits. However, in a second effort, the station is monitoring the receiver feedwater constituents to include chlorides, sulfates, and sodium. This monitoring program will continue for a period of approximately three months to establish baseline data, which will be evaluated to assess any potential relationship between the water chemistry and the receiver tube failures.

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ATTACHMENT 2

SOLAR 1 TUBE CRACKING

PANEL #18, TUBE 30

A LONGITUDINAL THROUGH CRACK OCCURRED AT EDGE OF WELD BEAD AT THE TOP OF THE INTERSTITIAL WELD BETWEEN TUBES 30 AND 31

- CRACKS PROGRESSED FROM OD TO ID BY LOW-CYCLE FATIGUE (STRIATION SPACING CONSISTED WITH 400 CYCLE FAILURE)
- INITIAL CRACKING OCCURRED AT THE TOP CURVED PORTION OF THE WELD
- MULTIPLE INITIATION POINTS WERE FOUND ALONG ENTIRE LENGTH OF WELD
- NO WELD DEFECTS WERE ASSOCIATED WITH FAILURE
- A SMALL LONGITUDINAL CRACK WAS FOUND ON INSIDE SURFACE ABOUT ONE-TENTH INCH FROM MAIN CRACK

ATTACHMENT 3

SOLAR 1 TUBE CRACKING
PANEL 11, TUBE 70

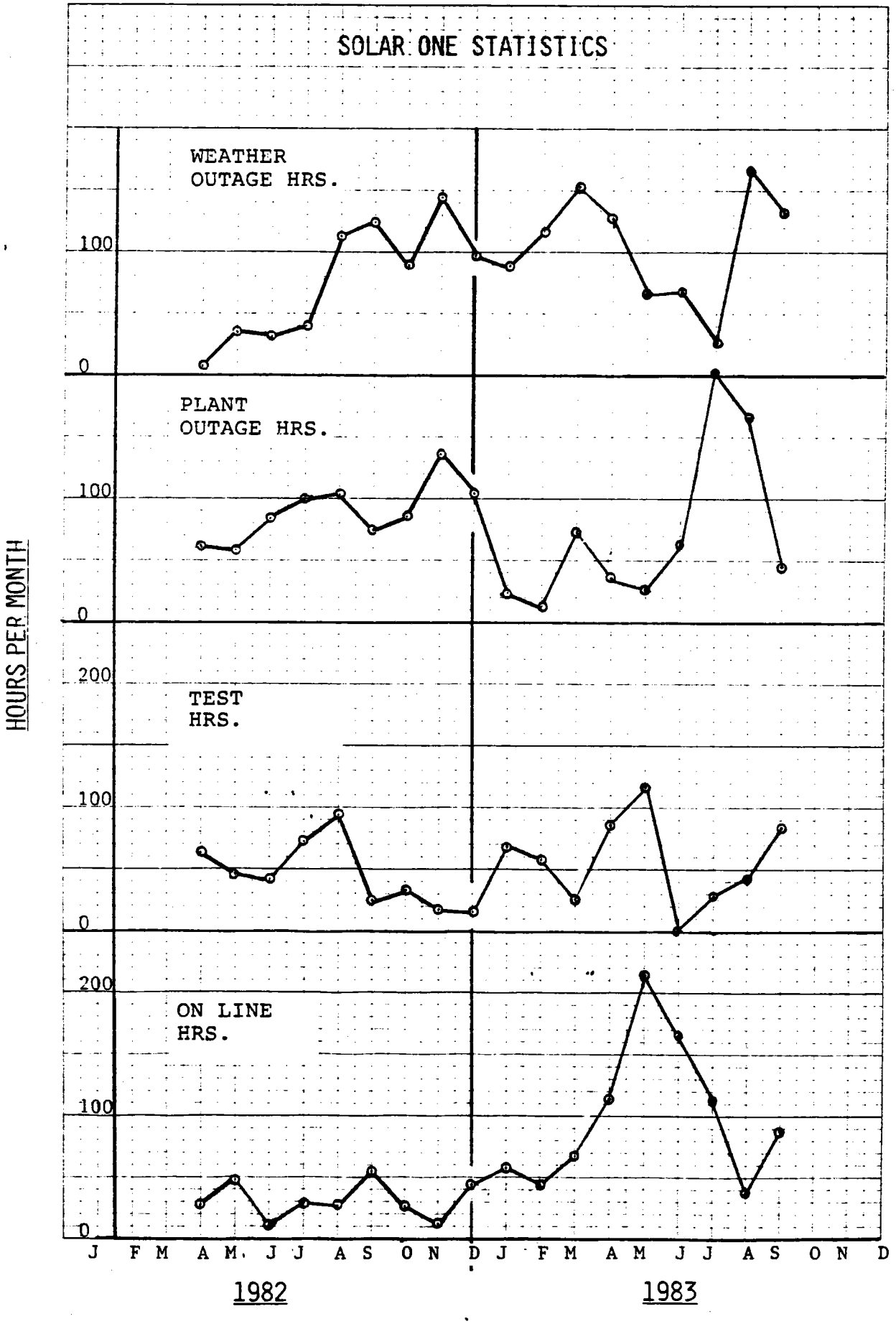
A CIRCUMFERENTIAL THROUGH CRACK OCCURRED AT THE OUTSIDE OF THE LOWER BEND

- SEVERAL PART-THROUGH CRACKS WERE ALSO PRESENT; RUNNING IN BOTH LONGITUDINAL AND TRANSVERSE DIRECTIONS
- CRACKING INITIATED AT THE TUBE INNER SURFACE
- MULTIDIRECTIONAL CRACKING INDICATIVE OF BIAXIAL STRAIN (I.E., HIGH EFFECTIVE STRAIN)
- DIRECTION OF CRACK PROGRESSION WAS ESTABLISHED BY DISTINCT ARREST LINES (BEACH MARKS) AND SHEAR LIP ON OD
- CRACKS SHOW EVIDENCE OF UPSETTING, INDICATIVE OF PLASTIC DEFORMATION
- INDISTINCT STRIATIONS, PARTIALLY OBSCURED BY OXIDATION, ARE EVIDENCE OF LOW-CYCLE FATIGUE FAILURE

ATTACHMENT 4

FURTHER DETAILS ON PANEL 11; TUBE 70

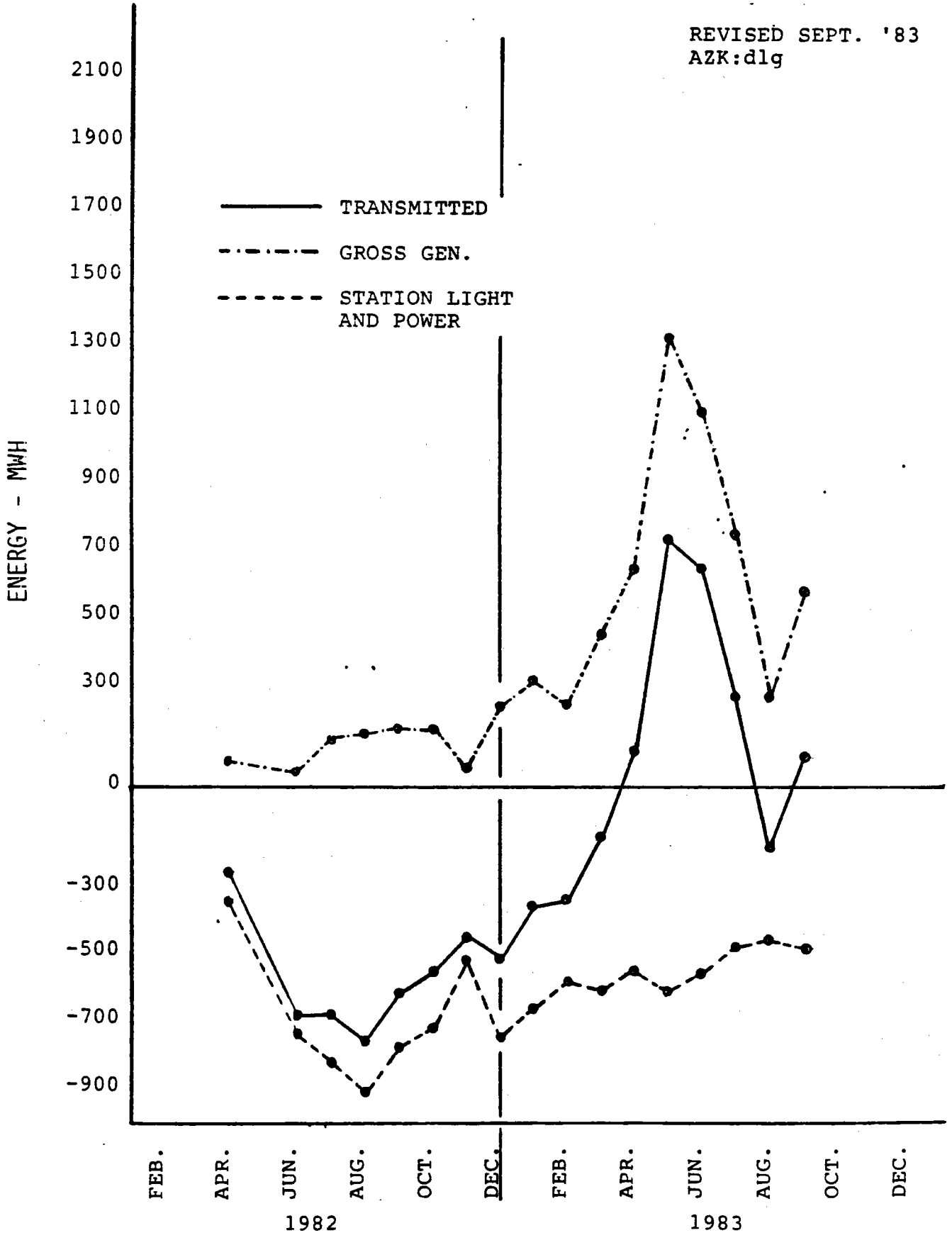
- ONE LONGITUDINAL CRACK 80% OF WALL THICKNESS
- OXIDE THICKNESS .0002-.0005 ON INNER SURFACE - SOMEWHAT THICKER ON OUTSIDE OF BEND
- OXIDE NEGLIGIBLE ON OUTSIDE OF TUBE
- SMALLER THAN AVERAGE GRAINS AND PRECIPITATION (ASSUMED TO BE OXIDE) WERE OBSERVED TO A DEPTH OF .0018-.0025 FROM THE INSIDE SURFACE
- RANDOM PRECIPITATION WAS FOUND IN AS-RECEIVED TUBE TO DEPTH OF .001"
- REDUCED DUCTILITY FOUND IN THIN ID LAYER WHEN RING CUT FROM TUBE WAS PARTIALLY COMPRESSED
- SEM EXAMINATION REVEALED BRITTLE LAYER TO DEPTH OF .005"
- RING FROM AN AS-RECEIVED TUBE WAS COMPLETELY FLATTENED WITHOUT CRACKING
- HARDNESS OF TUBE 70 WAS R_C 92-93, COMPARED TO R_C 85-86 ON AS-RECEIVED TUBE

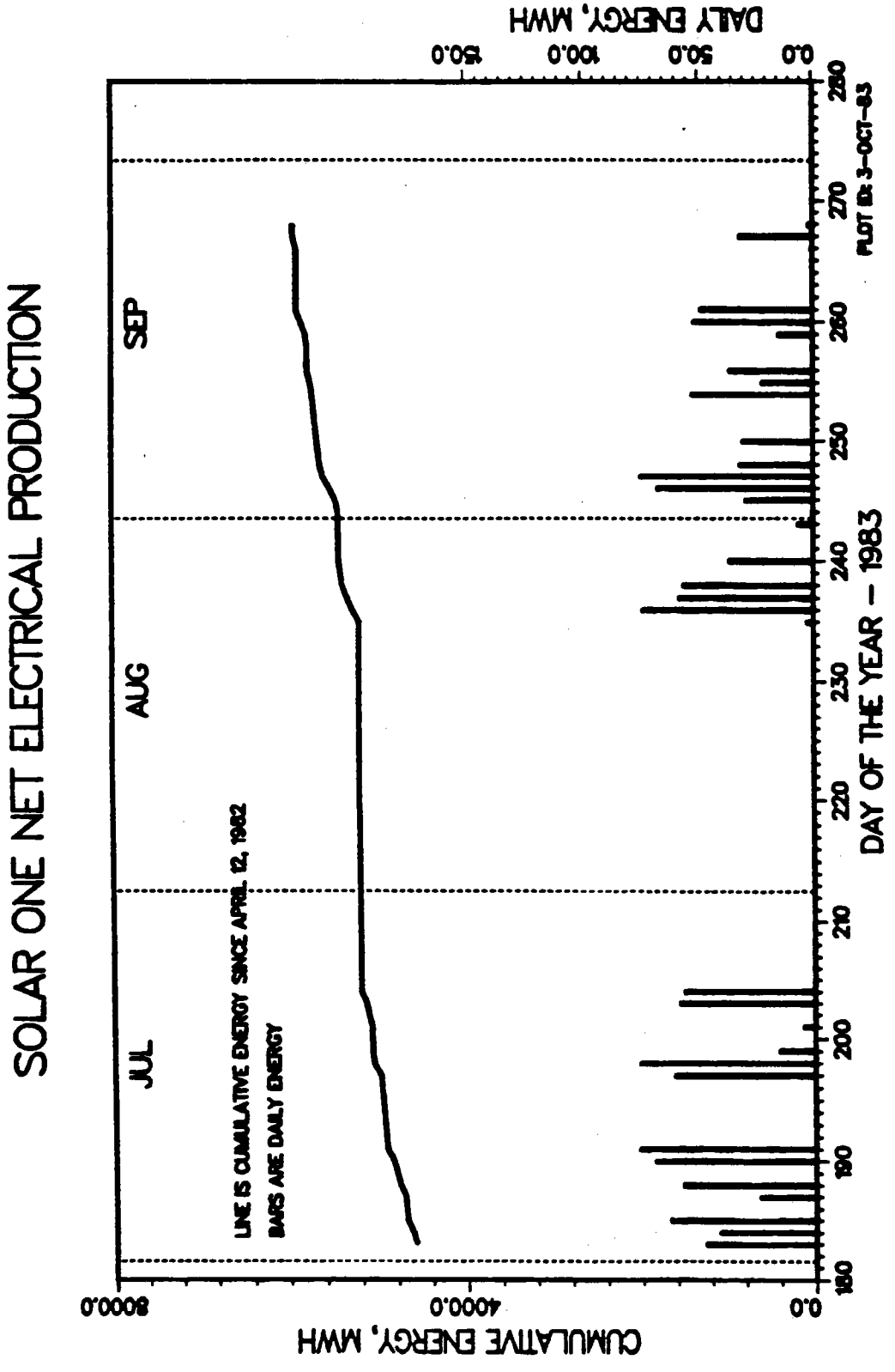


AZK/03/17/83

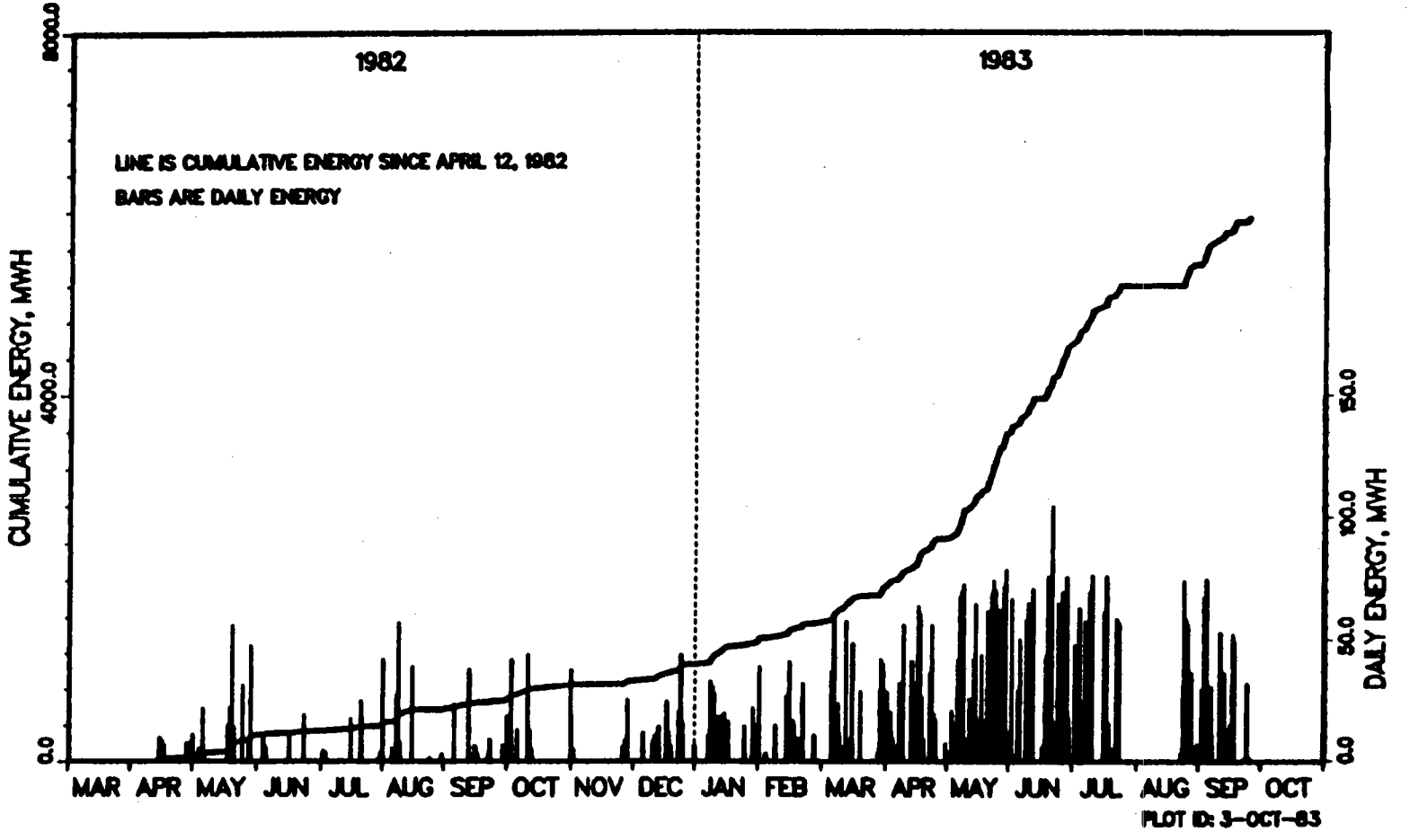
ATTACHMENT 6

SOLAR ONE
MONTHLY METER REPORT SUMMARY




SOLAR ONE NET ELECTRICAL PRODUCTION
JUL
AUG
SEP
LINE IS CUMULATIVE ENERGY SINCE APRIL 12, 1982
BARS ARE DAILY ENERGY
CUMULATIVE ENERGY, MWH
0.0
4000.0
8000.0
DAILY ENERGY, MWH
0.0
50.0
100.0
150.0
DAY OF THE YEAR — 1983
180
190
200
210
220
230
240
250
260
270
280
PLOT ID: 3-OCT-83

SOLAR ONE NET ELECTRICAL PRODUCTION



ATTACHMENT 8

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:
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Post Office Box 366
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(619) 254-2672

Mr. William D. Matheny
Chief, Control Branch
Document Control and Evaluation Division
DOE Technical Information Center
Post Office Box 62
Oak Ridge, TN 37830

DEC 19 1983

Submission of Monthly O&M Reports, Cooperative Agreement DE-FC03-77SF10501, for April - September, 1983

As a follow-up to our November correspondence, and in accordance with the document numbering approach summarized in my letter of December 9 to Mary Soderstrum of Burns & McDonnell - of which a copy was sent to you -I am enclosing the next six-months' installment of Solar One monthly Operation and Maintenance reports. As a change from the last submission, I am sending these directly to you, rather than via DOE/SAN, with a separate set to SAN/OPC for patent clearance (see Attch. 1). These reports pick up with No. 13, and, under our agreed-to (?) numbering scheme, are assigned primary and secondary document numbers as follows:

Month	Primary No.	Secondary No.
April	DOE/SF/10501-213	STMPO-813
May	DOE/SF/10501-214	STMPO-814
June	DOE/SF/10501-215	STMPO-815
July	DOE/SF/10501-216	STMPO-816
August	DOE/SF/10501-217	STMPO-817
September	DOE/SF/10501-218	STMPO-818

(The previous twelve reports are logged in your system as DOE/SF/10501-T1 through -T12, but not in order by month, and were collectively Designated as STMPO-600.)

Your feedback on this process, and recommendations as to any improvements we might make to further simplify proper logging and identification, will be greatly appreciated; in another month, I will have a batch of monthly Visitors' Center reports to forward to TIC, and I'd appreciate your inputs before then, if possible.

Thanks again for your support, and let me wish you and your staff a pleasant holiday season.

Encls.: 6 Reports (2 cc ea.) w/Forms RA426

Attch.: Letter to SAN/OPC w/SAN Form 70

cc: R. Gaither, SAN/OPC
D. Holz, SAN/ISEA
R. Hughey, SAN/FGS
C. Lopez, SCE R&D

Sincerely yours,

Doug Elliott

S. D. Elliott, Jr., Director,
DOE Project Office, Barstow

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

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DOE/SF/10501-213 (STMPO-813)	DE-FC03-77SF10501	UC-62

4. Title
SOLAR ONE OPERATION & MAINTENANCE REPORT #13; APRIL, 1983

5. Type of Document ("x" one)
- [X] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference _____
  Date of conference _____
  Exact location of conference _____ Sponsoring organization _____
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S. D. Elliott, Jr., Director, DOE Project Office, Barstow

Organization
Post Office Box 366, Daggett, CA 92327 (619) 254-2672

Signature S. D. Elliott Jr.

Date DEC 16 1983

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DOE/SF/10501-214 (STMPO-814)	DE-FC03-77SF10501	UC-62

4. Title
SOLAR ONE OPERATION & MAINTENANCE REPORT #14, MAY, 1983

5. Type of Document ("x" one)
- [X] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference _____
  Date of conference _____
  Exact location of conference _____ Sponsoring organization _____
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Organization
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DOE/SF/10501-215 (STMPO-815)	DE-FC03-77SF10501	UC-62

4. Title
SOLAR ONE OPERATION & MAINTENANCE REPORT #15; JUNE, 1983

5. Type of Document ("x" one)
- [X] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference _____
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Signature S D Elliott Jr

Date DEC 16 1983

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U.S. DEPARTMENT OF ENERGY

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1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10501-216 (STMPO-816)	DE-FC03-77SF10501	UC-62

4. Title
SOLAR ONE OPERATION AND MAINTENANCE REPORT #16; JULY, 1983

5. Type of Document ("x" one)
- [X] a. Scientific and technical report
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SOLAR ONE OPERATION AND MAINTENANCE REPORT #17; AUGUST, 1983

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SOLAR ONE OPERATION AND MAINTENANCE REPORT #18; SEPTEMBER, 1983

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Date DEC 16 1983

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(7-79)

U.S. DEPARTMENT OF ENERGY

memorandum

DATE: DEC 19 1983

REPLY TO ATTN OF: Doug Elliott, DOE Project Office, Barstow

SUBJECT: Submission of Monthly Operations and Maintenance Reports, April, 1983 through September, 1983, under Cooperative Agreement DE-FC03-77SF10501, for Patent Clearance

TO: Roger Gaither, OPC

Enclosed are one copy each of the six monthly Solar One Operation & Maintenance Reports for April through September, 1983, with one set of Form 70, "Contractor Request for Patent Clearance", signed by the Southern California Edison Company R&D Site Manager. Two additional copies of each of these reports are being forwarded directly to the DOE Technical Information Center for archiving at TIC and NTIS. Please review these reports to verify that no patentable material is included, and advise TIC as appropriate. The feedback copy of the Form 70 should be sent to SCE via me, at the Project Office address.

When review is completed, your copies of the reports may be discarded (or returned to FGS); copies have already been provided to M+R.

Encls: (6) Reports
SAN Form 70

Doug Elliott

S. D. Elliott, Jr., Director,
DOE Project Office, Barstow

cc: Bob Hughey, DOE/SAN (FGS)
Don Holz, DOE/SAN (ISEA)
W. D. Matheny, DOE/TIC
C. W. Lopez, SCE R&D

DEC 16 1983

Chuck: Doug

These two items represent the process by which Project reports are cleared for distribution and forwarded to DOE/TIC and DOC/NTIS. Your signature and date thereof are needed on the Form 70, just below Item 6. Paul Skvarna had no qualms about signing off on these, but feel free to consult with him or anyone else at SCE if in doubt. Return the whole mess to me, and I'll provide you copies of the forms and correspondence. 12/18/83.

Signed Chuck Doug.

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-FC03-77SF10501
Subcontract No.	N/A
Report No.	(see to left)
	Monthly Operation & Maintenance Reports, 13 - 18
Date of Report	April, 1983 thru Sept., 1983 (6 Reports)
Name & Phone No. of DOE Technical Representative	S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

1. DOE/SF/10501-213 (STMPO-813)
2. DOE/SF/10501-214 (STMPO-814)
3. DOE/SF/10501-215 (STMPO-815)
4. DOE/SF/10501-216 (STMPO-816)
5. DOE/SF/10501-217 (STMPO-817)
6. DOE/SF/10501-218 (STMPO-818)

FROM: DOE Project Office,
Barstow
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Daggett, CA 92327

1. Document Title:
SOLAR ONE OPERATION AND MAINTENANCE REPORT (Six Issues, April, 1983 thru Sept., 1983)

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): _____

3. In order to meet a publication schedule or submission deadline, patent clearance by _____ would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

☒ 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages _____ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. _____.
ii. A disclosure of the invention was submitted to DOE on _____ (date)
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iv. A waiver of DOE's patent rights to the contractor:
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Reviewing/Submitting Official: Name (Print/Type) C. W. Lopez
Title SCE R&D Site Manager
Signature Charles W. Lopez Date 12/16/83

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

☐ No patent objection to above-identified release.

☐ Please defer release until advised by this office.

Signed _____ Date Mailed _____

DOE/SF/10501-213
(STMPO-813)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #13
APRIL 1983

This report summarizes the operational activities and highlights maintenance work that was required during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

April was the anniversary month for Solar One. The turbine/generator was synchronized to SCE System for the first time on April 12, 1982.

April, also, was the first month since operations began that Solar One generated a net positive output (transmitted 107.8 MWhrs). Energy production while connected to the SCE System was 528 MWhrs. net.

Operational Highlights

- On two occasions during April, 1805 of 1818 heliostats were available for service. The significantly improved collector system reliability was the result of software revisions, replacement of defective motor/gear drives, installation of heliostat controller protective fuses, and routine servicing of limit switches.

- To reduce auxiliary power consumption and because of the demonstrated high reliability of the collector system, the collector field is now being operated only to support energy production, testing and rain washing rather than on a continuous basis.

- During Mode 5, TSS Charging Operation, it was noted that Solar One could operate for prolonged intervals with insolation values below 400 watts/m^2. This indicates that the plant is operative in Mode 5 at below the minimum design criterion of 450 watts/m^2.

- Receiver trips on false indications of low superheat temperature have sporadically been experienced. Investigation revealed that the trips occurred during the activation of the receiver moisture separators. A new operating procedure was instituted to enable moisture separators to be activated as soon as the receiver panels controlled by any two Multivariable Control Units (MVCU's) go into temperature control. The moisture separators disable after the last pair of receiver panels goes off temperature control. Previously, the moisture separators would activate at the operators discretion through the operation of an enable/disable switch. The automated procedure has solved the problem.

- Receiver flowmeters from panels 7, 18, 20 and 21 were replaced with meters having greater sensitivity at low flows to ensure accurate flow measurements during early morning start-ups. Other panel flowmeters may be changed in the future, if a significant improvement in operation during start-ups results.

DOE/SF/10501-214
(STMPO-814)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #14
MAY 1983

This report summarizes the operational activities and highlights maintenance work that was required during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

May was the second consecutive month since plant start-up that Solar One had a net positive output (transmitted 734.1 MWH). The net energy production while connected to the grid was 1138.8 MWH.

Two new records were achieved on May 30th when Solar One's net positive output while connected to the grid was 78.5 MWH with total on-line time of 11 hours and 22 minutes.

A new milestone was set on May 18th with the design point verification of 28 MWH capacity of the Thermal Storage System.

Operational Highlights

- A 28 MWH Thermal Storage System (TSS) capacity test was conducted on May 18, for design point verification. The design power level of 7 MW for four hours was met and power production on admission steam continued at derated temperature and pressure for a total gross generation of 50 MWH (43.8 MWH net). The turbine/generator was on-line for 8 hours and 5 minutes.

- A new turbine low load shutdown procedure that was developed during the first week of May was verified operational and released to SCE for service. The turbine/generator protective device is enabled when the load reaches 1.0 MW during start-up and removes the unit from service if the load drops to 0.5 MW. This unit shut-down logic is designed to preclude the turbine/generator motoring which had previously been experienced during severe changes in available insolation.

- A larger valve trim was installed in the charging train #1 pressure control valve (PV-3110). This modification improved charging operations, since the time required to charge the Thermal Storage Unit (TSU) with one charging train has been reduced to two-thirds of the original time.

- Significant progress is being made towards process control automation. The following subroutines have been verified operational and released to SCE Operations for service:

    1. Initialization of receiver for start-up.

    2. Transition from receiver flash tank to steam dump.

    3. TSS extraction train #2 operation for auxiliary steam generation.

DOE/SF/10501-215
(STMPO-815)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #15
JUNE 1983

This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and an operation and maintenance cost summary.

In June, Solar One had a net positive output of 561.8 MWH. The net energy production while connected to the grid was 956.9 MWH.

Three power production tests demonstrated once more the design validity and the capabilities of Solar One:

- Peak Power/Energy Test (12.1 MW net, 104 MWH net, 15 consecutive on-line hours).
- Extended Duration Test (33.6 consecutive hours of operation).
- Preoperational Power Production Test (729.9 MWH net for 23 days of operation).

Operational Highlights

- The General Electric admission steam stop valve internal bypass was replaced with a full arc admission internal bypass valve to allow better turbine speed control during start-ups on admission steam. Previously, throttling was achieved by operating the admission steam stop valve main plug resulting in poor turbine speed control. The modified valve was tested during start-up at low admission steam pressure and it was proven functional. However, adjustment of the turbine speed control is still sensitive.

- A new milestone was set during the Peak Power and Energy Test performed at Solar One on Tuesday, June 21, 1983 (summer solstice). The turbine/generator attained a net peak of 12.1 MW (13.1 MW gross) and generated 104.3 MWH. The unit was on-line for 15 consecutive hours operating in Mode 3, receiver/turbine direct and thermal storage system generated steam. The receiver steam conditions were 900°F, 1400 psi and 105,000 lb/hr and admission steam (from one extraction train only) 541°F, 412 psi and 31,000 lb/hr. 1792 recently washed heliostats were in service with insolation of 910 watt/m^2. The limited factor on the maximum power generation was the steam capacity of turbine control valves and air temperature of the generator.

- An Extended Duration and Performance Test was conducted on June 27th. Solar One was on-line for 33.6 consecutive hours - the longest on-line time since start-up - and generated 127 MWH net (171 MWH gross). The Thermal Storage Unit (TSU) was completely charged prior to testing. This test as well as the Peak Power/Energy Test verified once more the design validity of the Solar One Plant.

DOE/SF/10501-216
(STMPO-816)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #16
JULY 1983

This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and a monthly operation and maintenance cost summary.

Two tube cracks in receiver panel #18 along with several other equipment failures and scheduled outages -- synchronizing potential transformer failure, HAC Shadow Memory installation and receiver panel #15 temperature control valve leak resulted in an extended plant outage. However, July was another positive output energy production month of 271.4 MWH. The net energy production while connected to the grid was 654.6 MWH, which is the third highest monthly production since turbine roll.

Operational Highlights

- Following additional modifications the turbine admission stop valve underwent testing again at rated admission steam pressure (300 psi); previous testing at reduced pressure took place during June. Due to the turbine speed sensitivity using manual valve controller adjustment, turbine start-up on admission steam for the present is operated at reduced pressure conditions. Data collected during the test will be forwarded to General Electric Company for their evaluation.

- The cooling tower fan automation procedure was developed and tested. With this procedure the circulating water temperature will be maintained so that 1) maximum turbine efficiency is obtained, 2) maximum Thermal Storage System (TSS) charging operation (Mode 5) efficiency and auxiliary load reduction is achieved, since experience to date shows that operation of the condenser at higher back pressure does not materially affect plant efficiency during TSS charging operation.

- The TSS desuperheater (DS-902) spray water is currently being supplied by the condensate pump. The existing system does not provide protection of the feedwater and receiver systems in the event of hot well water contamination due to condenser leakage. Consequently, the system is being modified so that demineralized water (drawn at the polishing demineralizer outlet) rather than condensate is used as the desuperheater water supply.

- A new valve trim will replace the original trim in PV-1005, which is the cross tie between thermal storage steam and auxiliary steam systems. The new valve trim will allow adequate steam flow from TSS to auxiliary steam system when the TSS steam pressure is below 385 psi (shut-down or start-up periods).

DOE/SF/10501-217
(STMPO-817)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT #17
AUGUST 1983

This report summarizes the operational activities and highlights maintenance work that was performed during the month. In addition, it presents plant statistics and a monthly operation and maintenance cost summary.

Solar One operation was severely impacted during August due to a long weather outage and plant outage to effect receiver tube leak repairs. Three receiver boiler panel tube leaks were repaired and the plant returned to service on August 23. The net energy production for the month, while connected to the grid, was 234.7 MWH, however, on a 24-hour basis the plant consumed more energy than it generated in August. This is the first month since April '83 that this has occurred.

Operational Highlights

- All major plant systems were secured on August 3 for an extended outage to implement receiver tube inspection and leak repairs. The receiver tube leak repairs were completed on August 19 and the operational activity was resumed on the same day for condensate and receiver feedwater clean up. Solar One returned to normal operation on August 23, 1983 after the State Inspector had certified the weld repairs. Attachment 1 presents a status report on the receiver tube leaks.

- The meter constant on the backup auxiliary power source, 4KV well water line, was found to be in error during the receiver outage. At this time the plant was transfered from the primary auxiliary power source, 33KV bug line, to the backup source to minimize the plant's exposure to area lightning strikes. The extended operation on the backup power source evidenced near three times normal power consumption. Reevaluation of the electrical meter found the meter constant to be 1400 rather than 4000 as noted on the meter. Correctio of station records in August to reflect the correct electrical meter constant in all previous months resulted in a 362 MWH reduction in auxiliary power consumption and consequently increased Solar One's net output by the same amount.

- The Operational Control System (OCS) check out and acceptance testing was partially completed in mid August. Following the acceptance testing, McDonnell Douglas control engineers and SCE operators were trained on building graphics using the Plant Operational Display System (PODS). Present plans are for operators to develop their own operational displays as they previously accomplished on the Beckman subsystem controls and for McDonnell Douglas control engineers to continue development of the host computer software.

Maintenance Highlights

The heliostat field was rain rinsed early August. Reflectivity measurements taken following the rainfall indicated an average of 95% mirror cleanliness (approximately 86% average reflectivity of

DOE/SF/10501-218
(STMPO-818)

SOLAR ONE
OPERATION AND MAINTENANCE REPORT 18
SEPTEMBER 1983

THIS REPORT SUMMARIZES THE OPERATIONAL ACTIVITIES AND HIGHLIGHTS MAINTENANCE WORK THAT WAS PERFORMED DURING THE MONTH. IN ADDITION, IT PRESENTS PLANT STATISTICS AND A MONTHLY OPERATION AND MAINTENANCE COST SUMMARY.

Operations at Solar One were again this month severely impacted due to 131 hours of weather outage. Accordingly, power production was limited but sufficient to ensure another positive output month, 99.8 MWH net. The net energy production for the month, while connected to the grid, was 496.4 MWH.

The receiver tube leaks to date are attributed to low cycle fatigue.

Operational Highlights

- On September 6, the receiver operation was hindered due to water chemistry analytical instrumentation malfunction. Investigation revealed that the standardizing pH electrode, combination type, had failed, resulting in erroneous readings. The faulty electrode was replaced and the water quality control was reestablished. Because the combination electrodes have a very short life span and their accuracy decreases with use, they are not very suitable for continuous pH monitoring. Consequently, the standardizing electrode was replaced by the more common and reliable reference/glass electrode set.

- Leaks in the bearing cooling water at an estimated rate of 28 gpm resulted in abnormal consumption of the cooling water treatment chemicals. Uranine dye, phosphorescent green color, aided in the leak detection. The leaks were found to occur at the generator air cooler relief valves, which were subsequently repaired and reset to relieve at a 10 percent system overpressure.

- A preliminary receiver no flux heat loss test was conducted under the direction of Sandia Lab engineers. According to the test procedure, the receiver feedwater was heated at the second point feedwater heater with thermal storage steam and the temperature drop across the receiver was determined. The heat losses through convection and radiation were then calculated. This proof test was successful and the data collected were meaningful. The final receiver heat loss experiment will be performed at a later date.

- Testing of a new overnight plant shutdown scheme, Mode 8, was initiated in September. According to Mode 8, all major plant systems are secured and all condensate and feedwater equipment is blanketed with nitrogen, rather than steam, for outage protection. Data related to nitrogen consumption, parasitic load reduction, auxiliary steam usage reduction, and water quality during start-ups will be collected and evaluated to determine the feasibility of adopting this procedure as a normal overnight plant shut down.

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-FC03-77SF10501
Subcontract No.	N/A.
Report No. (see to left)	Monthly Operation & Maintenance Reports, 13 - 18
Date of Report	April, 1983 thru Sept., 1983 (6 Reports)
Name & Phone No. of DOE Technical Representative	S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

1. DOE/SF/10501-213 (STMPO-813)
2. DOE/SF/10501-214 (STMPO-814)
3. DOE/SF/10501-215 (STMPO-815)
4. DOE/SF/10501-216 (STMPO-816)
5. DOE/SF/10501-217 (STMPO-817)
6. DOE/SF/10501-218 (STMPO-818)

FROM: DOE Project Office,
Barstow
Post Office Box 366
Daggett, CA 92327

1. Document Title:
SOLAR ONE OPERATION AND MAINTENANCE REPORT (Six Issues, April, 1983 thru Sept., 1983)

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): _____

3. In order to meet a publication schedule or submission deadline, patent clearance by _____ would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

☒ 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages _____ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. _____
ii. A disclosure of the invention was submitted to DOE on _____ (date)
iii. A disclosure of the invention will be submitted shortly _____ (approximate date)
iv. A waiver of DOE's patent rights to the contractor:
☐ has been granted, ☐ has been applied for, or ☐ will be applied for _____ (date)

☐ 5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks:

Reviewing/Submitting Official: Name (Print/Type) C. W. Lopez
Title SCE R&D Site Manager
Signature Charles W. Lopez Date 12/18/83

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

☒ No patent objection to above-identified release.

☐ Please defer release until advised by this office.

Signed Harold M. Dixon Date Mailed 1/13/84

COPY FOR CONTRACTOR'S (SENDER'S) FILES AFTER OPC RELEASE