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Doug Elliott
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SOLAR ONE OPERATION AND MAINTENANCE REPORT #19 OCTOBER 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.

Power generation in the month of October was consistent with the previous nine month average. The energy transmitted to the SCE electrical grid was 98.2 MWH with a record of lowest auxiliary energy consumption since April 1982, of 441.2 MWH. The net energy production for the month, while Solar One was connected to the grid, was 453.7 MWH.

A new receiver tube leak was discovered and repaired during October. Ultrasonic inspection revealed two additional cracks similar to those previously experienced. Repairs of the tube cracks will take place during a two-week outage scheduled for December.

Operational Highlights

- o The Beam Characterization System (BCS) was released to SCE for operation. The system evaluates beam pointing accuracy of individual heliostats, and through the automation program, modifies the alignment of up to thirty heliostats per day. Problems still remain with this system's operation with the Heliostat Array Controllers (HAC's) and the investigation of the problem continues.
- o Heliostat Array Controller (HAC) failovers, prime to backup, have been reduced some by changes in the HAC software by Martin Marrietta. The problem was aggravated by the operation of the HAC/BCS, Beam Characterization System, or HAC/OCS, Operational Control System, computer to computer interfaces. A fundamental timing problem in the HAC appears to be the problem but the cause has not been found. The investigation into the problem continues.
- o Review of past receiver operating data found that the receiver metal temperatures change rapidly, as much as 400 degrees F during cloud transients, unit trips, and normal plant shutdowns. A new receiver shutdown procedure has been developed to moderate thermal transients during normal receiver shutdowns. Methods to minimize receiver thermal transients during plant trips or cloud transients are under investigation.
- o The sample lines from the extraction boiler #2 and the admission steam systems were routed to the chemical lab and placed in service. The remaining thermal storage system sample lines and the main steam sample line will be placed in service in the near future. This will improve sampling methods and will provide the means for continuous water and steam quality control.
- o A failure of the sodium hypochlorite timer/pump controller caused higher than normal concentrations of chlorine (16 ppm) in the circulating water. The

abnormal condition was promptly corrected by deconcentration.

- o Mode 8 (inactive) operation tests for overnight unit shutdown, which were initiated in late September, were discontinued temporarily due to high dissolved oxygen concentrations experienced in the condensate and feedwater during unit start-ups. Mode 8 operation tests will be resumed as soon as implementation of system modifications for adequate oxygen removal during start-ups is complete. The modifications include the replacement of the trim in the thermal storage and auxiliary steam systems cross tie valve (PV1005) to allow for more steam flow to the deaerator during start-ups to ensure adequate venting.
- o The collector field was rain washed on October 1st. Aside from washing the collector field manually using a conventional insulator wash truck, this is the best alternative for maintaining the collector field cleanliness. The heliostat wash truck had been inoperable since its introduction to Solar One due to mechanical problems associated with the vehicle as well as the wash mechanism controls.
- o The plant was forced to remain shut down on October 21 because of silica contamination in the unit's make-up water due to premature exhaustion of the rental make-up demineralizer. The maximum acceptable silica concentration in the make-up water is 20 parts per billion.
- o A receiver ultrasonic inspection on selected panels followed by a hydrostatic leak test, on October 26, revealed a leak on tube 41, panel 12 similar to the leak previously experienced on tube 41, panel 18. The leak was ground and weld repaired two days following its discovery. Ultrasonic inspection on October 27 found an internal 20 mil deep crack on tube 1, panel 18. Visual inspection at the same time revealed an additional crack on tube 41, panel 13. It was decided to postpone the repair of the two new cracks until the two-week plant outage scheduled for December of this year. However, a program was established to monitor the crack growth by ultrasonic inspections at two week intervals. The weld repair on tube 41, panel 12 was approved by a state inspector on October 31.
- o The thermal storage system automatic shutdown sequence for the charging trains was completed and released to SCE for use. This sequence also allows for quick steam transition to steam dump or the turbine as soon as the last charging train is taken out of service.

Maintenance Highlights

- o The inline demineralizer sluice water pump suction and discharge piping was modified to increase the pump's flow capacity. Flow restricting diaphragm valves were replaced with gate valves and the excessive number of pipe fittings was eliminated. Prior to the above modifications each pump delivered approximately 28 gpm compared to its rated capacity of 55 gpm. Pump capacity testing after the modifications indicated that the flow was well above 55 gpm. This will definitely improve the inline demineralizer's performance since adequate flow will be available for rinsing and backwash of the resin during the resin's regeneration process.
- o The oil strainers at the extraction train #2 boiler and superheater inlets were inspected for pluggage. Both strainers were found free of debris, which

indicates the absence of oil oxidation.

- o SCE Division Maintenance personnel developed and qualified a weld procedure for the receiver Incoloy 800 tube repairs. Station welders are currently being trained using the above weld procedure and will be certified to perform such repairs. The in-house capability of receiver tube leak repairs will ensure promptness in repairing future tube failures.
- o Miscellaneous maintenance work accomplished during October included:
 1. Replacement of leaky flowmeter in receiver panel 4.
 2. Replacement of charging trains, one and two, steam flowmeters (tag numbers 3205 and 3705).
 3. The cross tie valve between the thermal storage system steam and auxiliary steam systems, PV-1005, was removed and sent to the manufacturer for trim modifications. The new trim will allow for more steam flow to the deaerator during start-ups to ensure positive receiver feedwater deaeration.
 4. The internals of the check valve at the PV-1005 bypass line were removed to allow for steam flow to the auxiliary steam system in the absence of PV-1005.
 5. The thermal storage system flash tank rupture disk was replaced with a disk of higher ductility material to avoid premature disk failures that were experienced in the past.
 6. The extraction train one steam flowmeter, Tag #3715, was removed from service due to faulty operation. The flowmeter, although properly installed, was found to have its shaft bent opposite to the direction of the flow. A blind flange was installed in its place until flowmeter design changes are complete.
 7. A leak at the top vent valve of receiver panel 19 was repaired.
 8. Several leaking inspection plugs on receiver panels 18 and 23 were repaired.
 9. The fire detector sensors in the warehouse were replaced with less sensitive ones to better fit the dusty environment.
 10. The charging train one oil side condenser head flange bolts were retorqued to eliminate minor oil leakage.
 11. The inline demineralizer acid transfer pump motor failed due to acid attack at its shaft. The motor was removed and the acid is temporarily gravity transferred to the acid day tank pending motor replacement.
 12. The extraction train one steam outlet valve, AOV 3717, was lapped.

<u>Plant Statistics</u>	<u>Oct. '82</u>	<u>Oct. '83</u>	<u>Turbine Roll To Date</u>
Energy Production (KWH net while connected to the grid)	154,831	453,700	6,373,000
Peak MW (Net)	10.4*	9.8*	10.4*
On-Line Hours	26.3	87.4	1278.2
Test Hours	34	101.6	1142.4
Total Plant Outage Hours	82	74.7	1438.4
Scheduled	0	12.0	481.0
Unscheduled	82	62.7	957.4
Weather Outage Hours	91	91.5	1733.9

*Receiver Generated Steam Only

Plant Statistics

- o For comparison purposes, on the plant statistics chart, data for October 1982 are presented in parallel with that of October 1983. Although October 1983 was an average month compared to previous months of this year, the testing and power production activity level was over three times higher than that of October 1982. This is, for the most part, due to time spent last year in preparation of the Thermal Storage System equipment for start-up. In addition, the experience gained in operating the plant during the past year is certainly a positive factor in this year's operation.
- o Both weather and plant outages, Attachment 1, limited energy production to 539.5 MWH gross. The auxiliary energy consumption, 441.3 MWH, is the lowest since April 1982, Attachment 2. The daily and cumulative net energy production while Solar One was on-line for September and October and for the year-to-date are shown on Attachments 3 and 4 respectively.
- o 101.6 hours of testing were accomplished during October and it was the second highest testing period in a month since start-up. The previous record of 118.8 hours occurred in May 1983. The testing pertained to the development and verification of operating procedures of Mode 3, turbine run under both receiver and admission steam; mode 4, series thermal storage system charging and extraction; and mode 5, thermal storage system charging with emphasis on two-train operation. The Operational Control System, OCS, development and software checkout continued. OCS/Collector field start-ups were also routinely tested during the month.

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. |

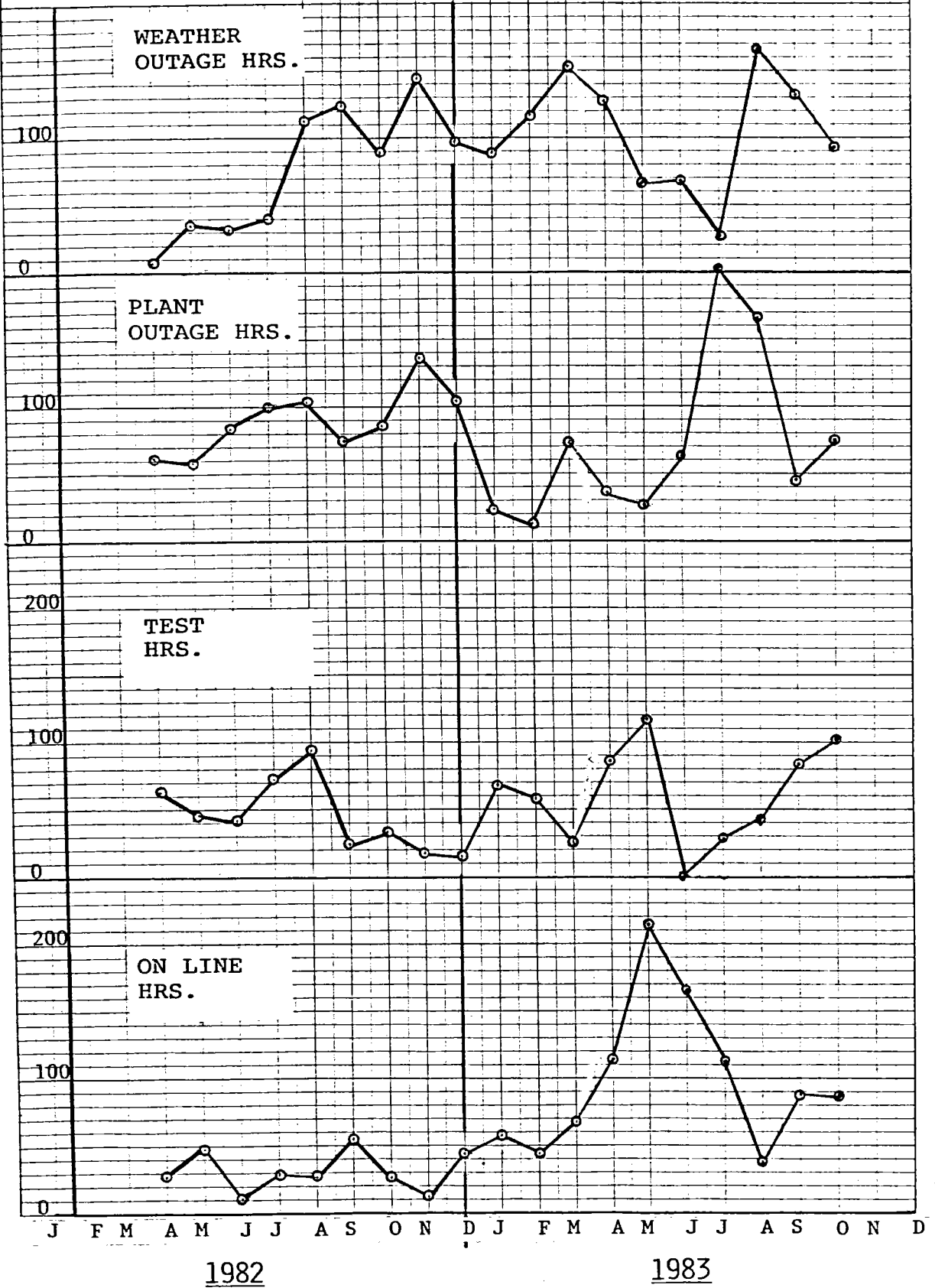
SOLAR ONE
MONTHLY O&M COST SUMMARY
(\$ X 1000)
MONTH OF OCTOBER 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	22.8	-	-	3.0	25.8
OPERATIONS	73.8	11.7	-	.1	85.6
MISC. SUPPORT	9.0	-	1.3	1.8	12.1
MAINTENANCE					
Supervision/Indirects	16.6	1.4	-	.3	18.3
Control System	6.3	1.8	2.3	-	10.4
Receiver System	5.6	-	-	.1	5.7
Thermal Storage System	2.3	.3	.8	.3	3.7
Collector System	3.9	.5	.2	-	4.6
EPGS System	5.1	1.8	-	-	6.9
Misc.	6.9	2.1	9.7	1.1	19.8
Total Maintenance	46.7	7.9	13.0	1.8	69.4
SUB TOTAL	152.3	19.6	14.3	6.7	192.9
Division O.H.					26.2
TOTAL DIRECT					<u>219.1</u>
Workman's Compensation					1.3
Payroll Tax					10.2
Pension & Benefits					31.2
Administrative & General					41.9
GRAND TOTAL					<u>303.7</u>

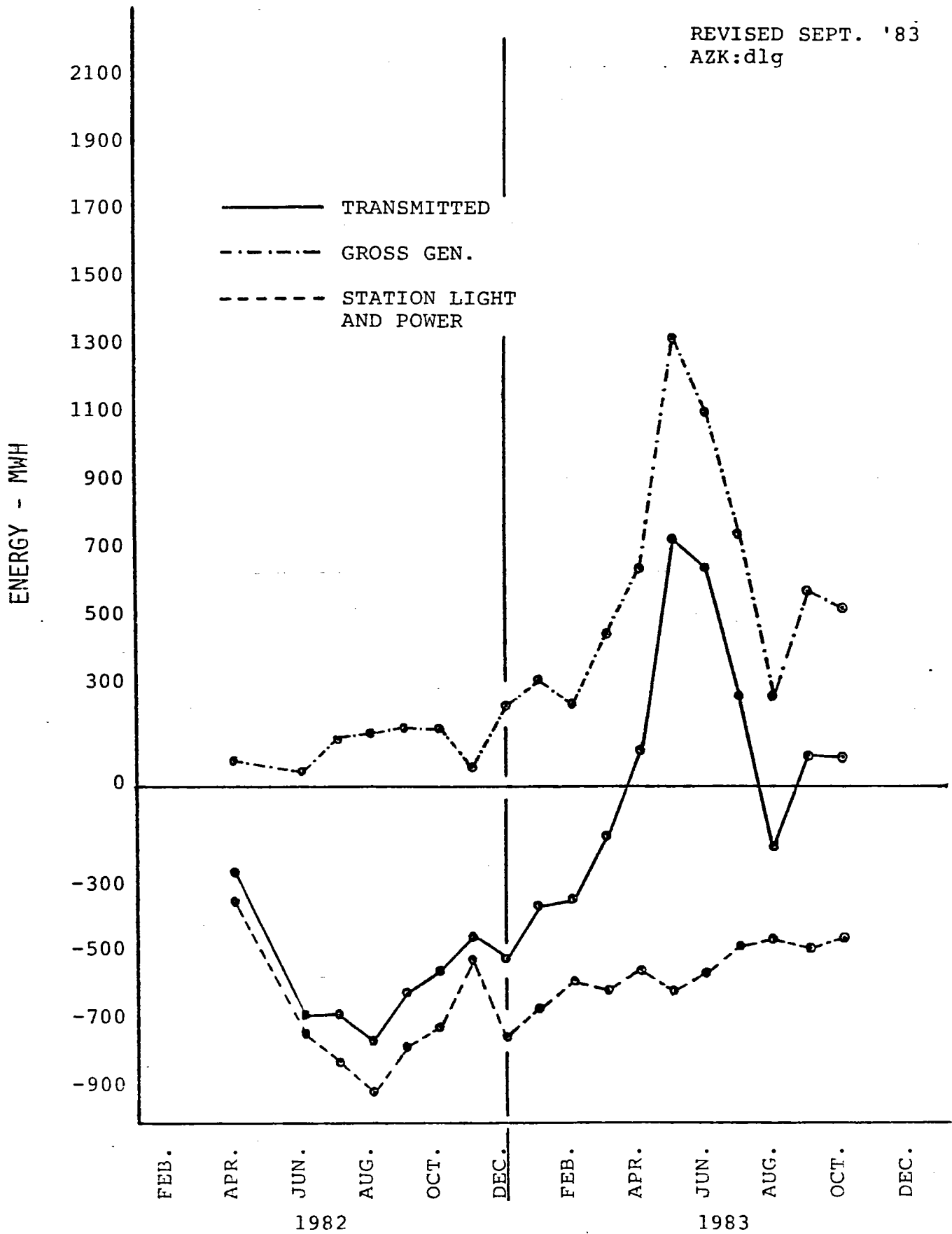
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SOLAR ONE STATISTICS

HOURS PER MONTH

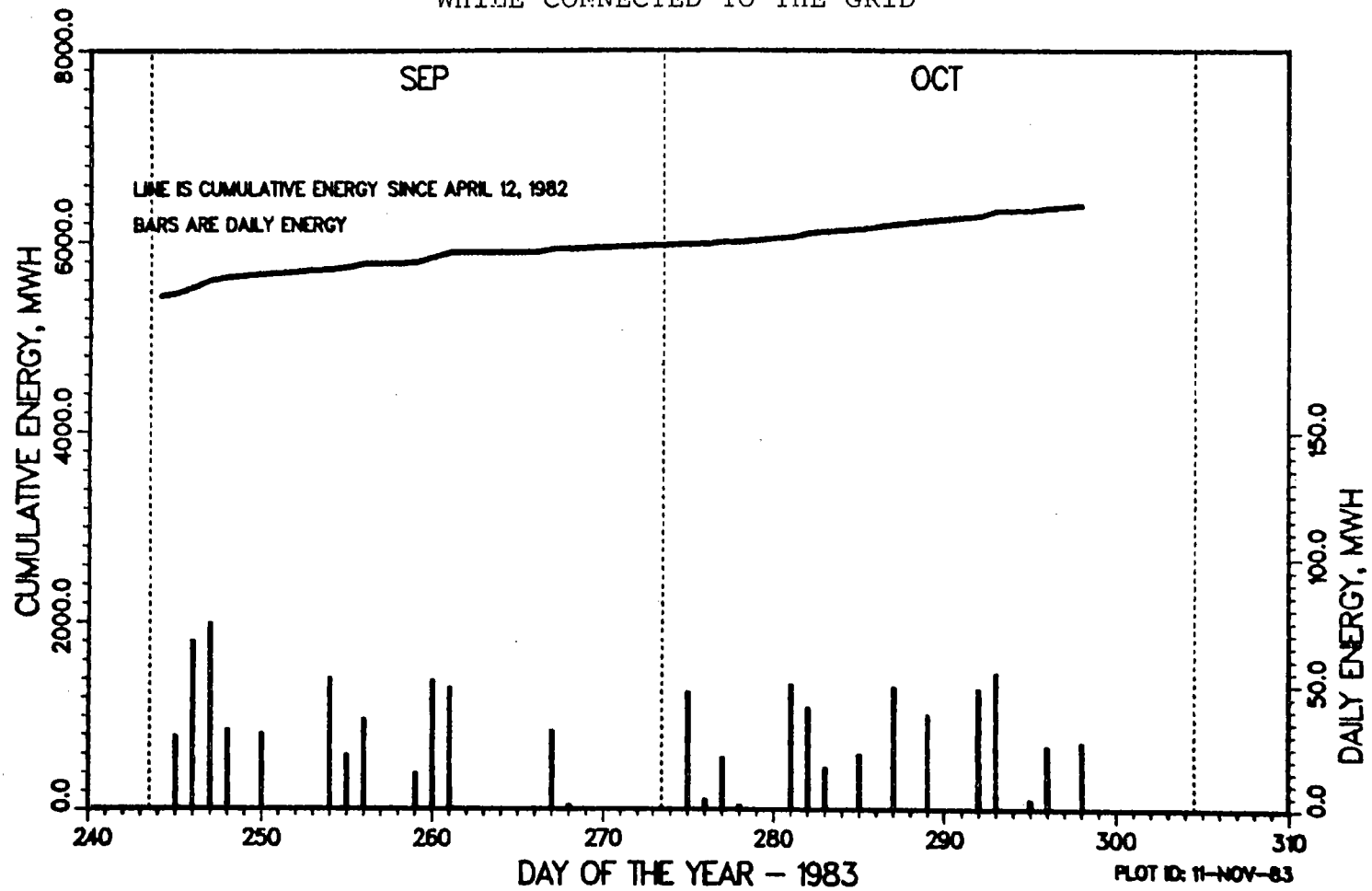


SOLAR ONE
MONTHLY METER REPORT SUMMARY

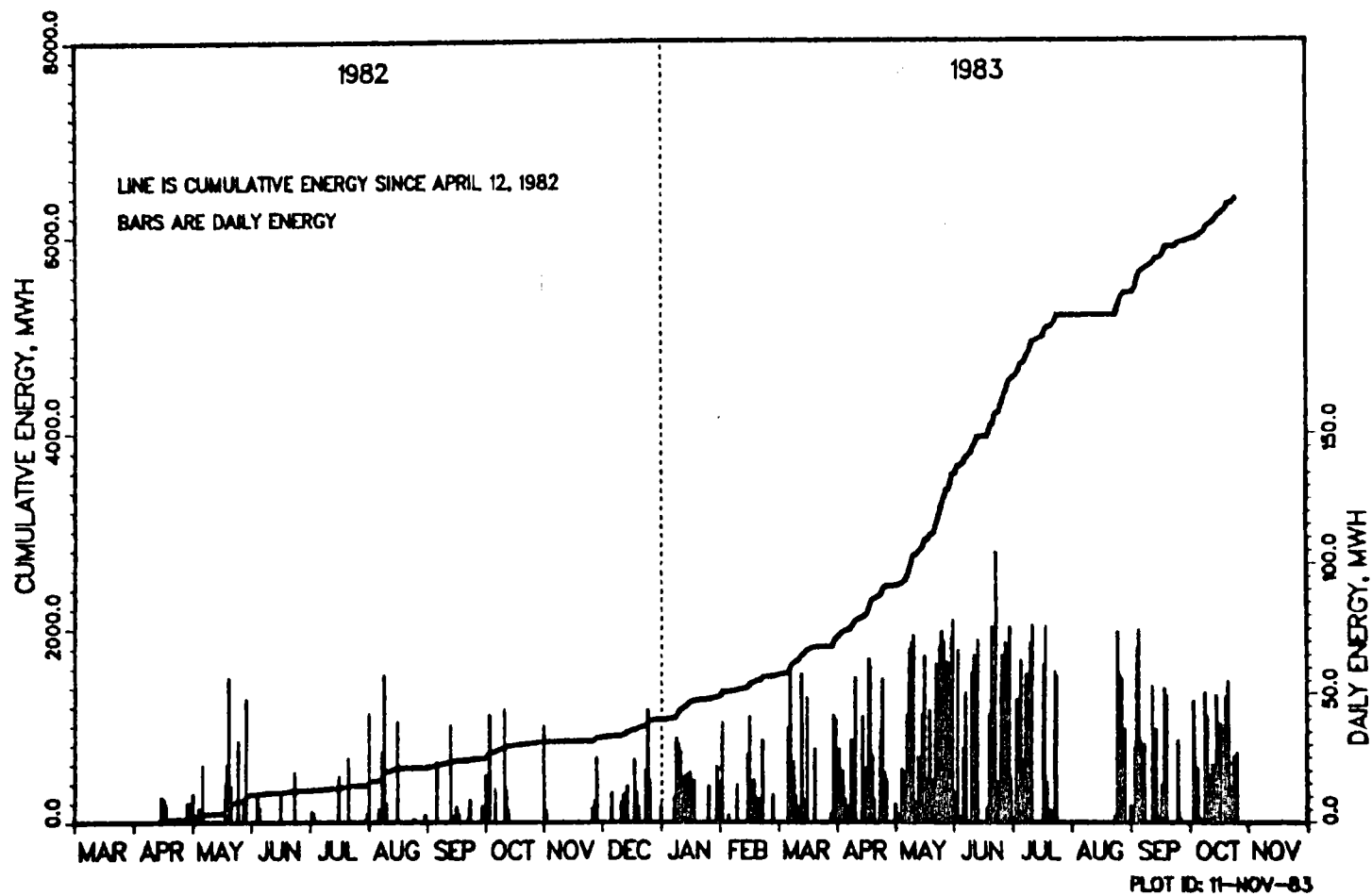


SOLAR ONE NET ELECTRICAL PRODUCTION

WHILE CONNECTED TO THE GRID



SOLAR ONE NET ELECTRICAL PRODUCTION WHILE CONNECTED TO THE GRID



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SOLAR ONE OPERATION AND MAINTENANCE REPORT #20 NOVEMBER 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.

Inclement weather precluded significant power production. The gross energy production was 203.5 MWH while the auxiliary energy consumption was 498.5 MWH. The net energy production while Solar One was on line was 166.7 MWH. Test activities generally concentrated on thermal storage system automation to include the parallel operation of two charging and two extraction trains.

A two-week plant outage is scheduled for December 5, primarily for receiver tube inspection and repairs.

Operational Highlights

- o Effort is continuing to minimize condensate and feedwater dissolved oxygen during unit start-ups. A revised start-up procedure, whereby the hotwell condensate is heated and deaerated prior to start-up utilizing the condenser hotwell sparging system, has been successful in minimizing the dissolved oxygen problem.

In addition to the revised start-up procedure, the thermal storage auxiliary steam system supply valve is being modified to increase its flow capacity. The increased capacity will ensure higher deaerator pressure and temperature, thus better feedwater deaeration during start-ups and during low load operation.

- o Plant testing continues to minimize plant parasitic power consumption. During inactive periods, the plant's parasitic power consumption is normally 500 KW. The power consumption during the tests was reduced to as low as 300 KW by breaking condenser vacuum allowing shut down of additional auxiliary equipment. This method of inactive operation, however, was accompanied by high condensate and feedwater dissolved oxygen during the following morning's start-up. The revised start-up procedure and the modified thermal storage auxiliary steam supply valve should resolve this start-up problem.
- o The plant trip logic was revised to ensure complete receiver temperature control valve closure on a plant trip or on collector field defocus. The positive valve closure will prevent excessive panel stress due to water quenching of these panels consequent to water flow through the temperature control valve when energy is removed from the receiver. This revision coupled with panel modification should serve to minimize future receiver tube failures.
- o The turbine/generator first phase automation sequence was developed and tested

during November. According to the automation, the steam pressure control can be transitioned from the receiver to the turbine and back to the receiver through the operation of two enable switches. The automation includes loading and unloading of the turbine/generator based on available insolation.

- o Mode 6, Thermal Storage System extraction steam to turbine, was released to SCE for unrestricted operation on November 16. However, it is not anticipated that this mode of power production will have any extensive use due to unit efficiency losses resulting from the transitions between receiver, charging, and extraction.
- o Generally, in the past months operation was limited to power production and on occasion to charging to provide a reliable low cost auxiliary steam supply. Because plant testing is presently concentrated on thermal storage automation, weekend operation will now provide for increased charging operation to ensure thermal storage steam availability for week day tests.
- o Dye penetrant tests on selected receiver panels performed on November 1st revealed cracks at the panel interstitial welds between tubes 30/31 and tubes 40/41. In addition, receiver ultrasonic inspection on November 16 revealed cracks at the top tube bends of certain panel tubes. Both of these types of failures were previously experienced. The repairs of the tube bend cracks will be accomplished during the two-week plant outage beginning December 5 of this year. The repairs of the interstitial weld cracks will be performed during the next plant outage which is scheduled for January 1984. Attachment 1 shows the chronological order of the receiver tube failures to date.

Maintenance Highlights

- o All receiver panel temperature control valves, including three receiver vent valves, were tested for leakage. Three of eighteen control valves and two vent valves were determined to be leaking. In addition, the majority of the control valves did not respond to low signal outputs. All valves will be restroked during the December outage and the leaking vent valves will be repaired.
- o A four foot longitudinal crack with a six inch leak was experienced on the fire main line adjacent to the diesel pump house. The leak was temporarily repaired pending arrival of replacement material.
- o The plant effluent water line developed a leak at its original PVC section. The leak was promptly repaired.
- o Miscellaneous maintenance work performed during November included:
 1. Repair of a bonnet leak of the receiver panel 24 drain valve.
 2. Replacement of the receiver panel 4 flowmeter gasket.
 3. Repairs of two inspection plugs on each of the receiver panels 5 and 7.
 4. Repairs of flange leaks at the charging train steam inlet control valve.
 5. Installation of new trim at the temperature control valve of receiver panel 8. The new trim improved measurement accuracy at low flow

conditions.

6. Replacement of the drain valve at the steam supply line to the Thermal Storage System desuperheater (DS 301).
7. Replacement of the auxiliary electric boiler drain valve.
8. Replacement of a leaky gasket at the Thermal Storage System (TSS) charging train #1 steam inlet valve (AOV 3206).
9. A small fire, with no effect on equipment, resulted from oil leakage at the TSS extraction valves 3905, 3906, and 3910. The valve flange bolts were tightened to stop leakage.

<u>Plant Statistics</u>	<u>Nov. '82</u>	<u>Nov. '83</u>	<u>Turbine Roll To Date</u>
Energy Production (MWH net while connected to the grid)	44.6	166.7	6539.7
Peak MW (Net)	-	7.8*	10.4*
On-Line Hours	11.7	38.8	1317
Test Hours	18.8	47.4	1189.8
Total Plant Outage Hours	136	23.1	1461.5
Scheduled	114	9	490
Unscheduled	22	14.1	971.5
Weather Outage Hours	144	121.6	1855.5

 *Receiver Generated Steam Only

- o Inclement weather limited testing and power production during both November of 1982 and November of 1983 as the above chart and Attachment 2 indicate. In addition, operations during November 1982 were impacted by a two week plant outage for miscellaneous receiver maintenance work and thermal storage heat exchanger leak repairs.
- o In testing, emphasis was placed in the completion of the performance tests in mode 5, Thermal Storage System charging, with one and two trains. Transitions to and from mode 3, receiver to turbine plus thermal storage extraction, were also successfully accomplished. Routine Operational Control System (OCS)/Collector Field automatic start-ups indicated that it only takes 16 to 18 minutes to bring steam to the steam downcomer once tracking begins.
- o Attachment 3 shows the monthly energy production summary since April 1982. For November 1983, Solar One had an energy liability of 295 MWH. The daily and cumulative energy production while Solar One was on-line for the year-to-date and the three previous months are shown on Attachments 4 and 5.

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 NOVEMBER 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	8.6	-	.5	1.1	10.2
OPERATIONS	47.6	10.6	-	-	58.2
MISC. SUPPORT	4.6	-	4.3	1.6	10.5
MAINTENANCE					
Supervision/Indirects	11.5	3.5	.1	.1	15.2
Control System	8.7	.2	3.3	-	12.2
Receiver System	1.6	.1	-	-	1.7
Thermal Storage System	1.2	1.9	-	-	3.1
Collector System	.2	-	-	-	.2
EPGS System	2.4	2.9	-	-	5.3
Misc.	4.3	.8	.9	1.5	7.5
Total Maintenance	29.9	9.4	4.3	1.6	45.2
SUB TOTAL	90.7	20.0	9.1	4.3	124.1
Division O.H.					15.6
TOTAL DIRECT					<u>139.7</u>
Workman's Compensation					.8
Payroll Tax					6.0
Pension & Benefits					18.4
Administrative & General					26.3
GRAND TOTAL					<u>191.2</u>

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SOLAR ONE GENERATING STATIONChronological Summary of
Receiver Tube Leaks

July 15, 1983	- Interstitial weld leak	tube 30, panel 18
July 26, 1983	- Interstitial weld leak	tube 41, panel 18
Aug 2, 1983	- Bend leak	tube 70, panel 11
Aug 18, 1983	- Repair/removal of sample	tube 30, panel 18
	- Repair, grind & fill	tube 41, panel 18
Aug 19, 1983	- Replaced cracked tube section	tube 70, panel 11
Sept 8, 1983	- Crack indication	tube 30, panel 19
Oct 26, 1983	- Crack indication	tube 1, panel 18
	- Interstitial weld leak	tube 41, panel 12
	- Interstitial weld crack	tube 41, panel 13
Nov 1, 1983	- Interstitial weld crack on:	tube 41, panel 4
		tube 41, panel 6
		tube 30, panel 7
		tube 41, panel 8
		tube 41, panel 10
		tube 30, panel 17
Nov 16, 1983	- Bend leak	tube 1, panel 15
	- Bend crack	tube 1, panel 16
	- Bend crack	tube 3, panel 16
	- Bend crack	tube 1, panel 17

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SOLAR ONE STATISTICS

HOURS PER MONTH

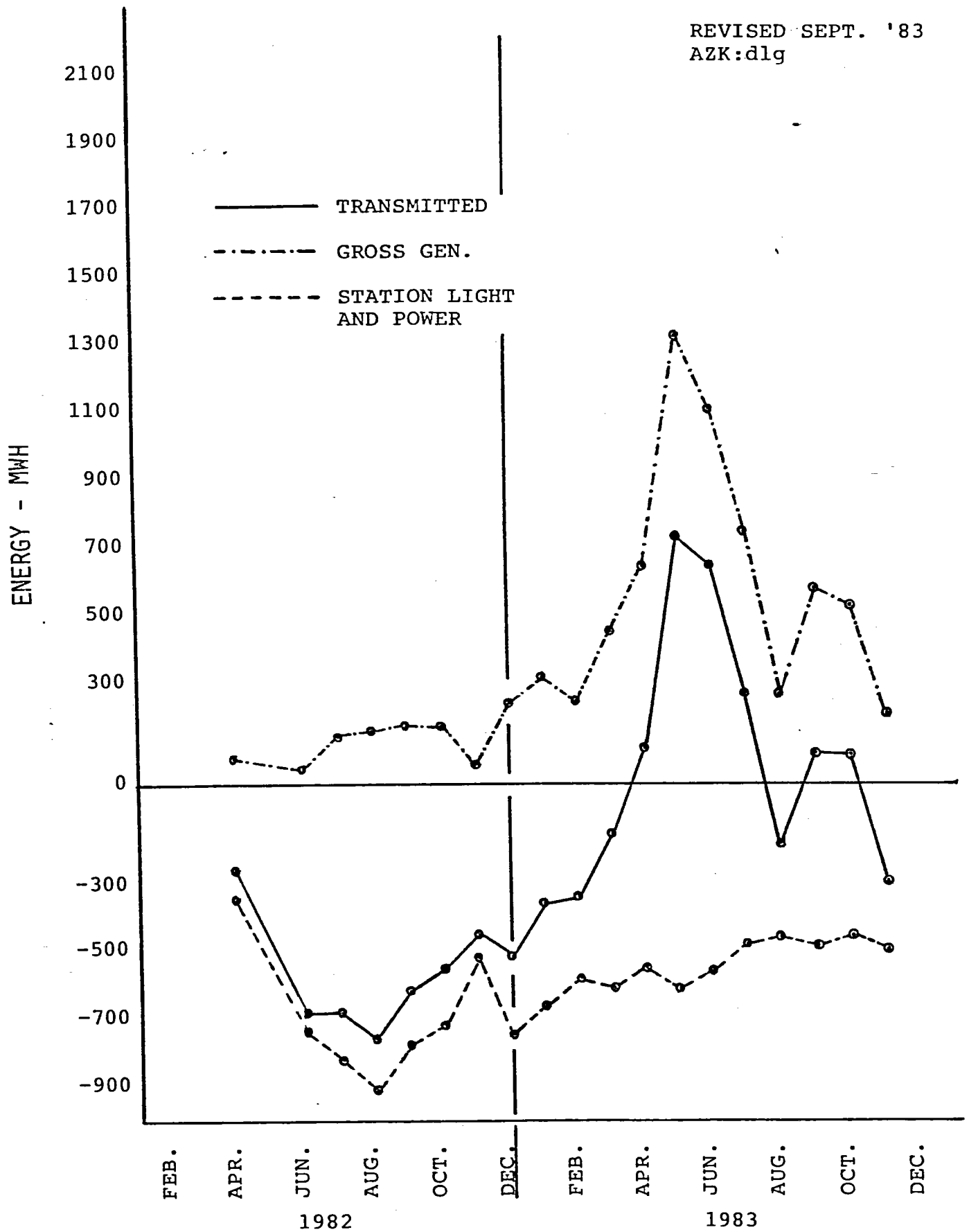
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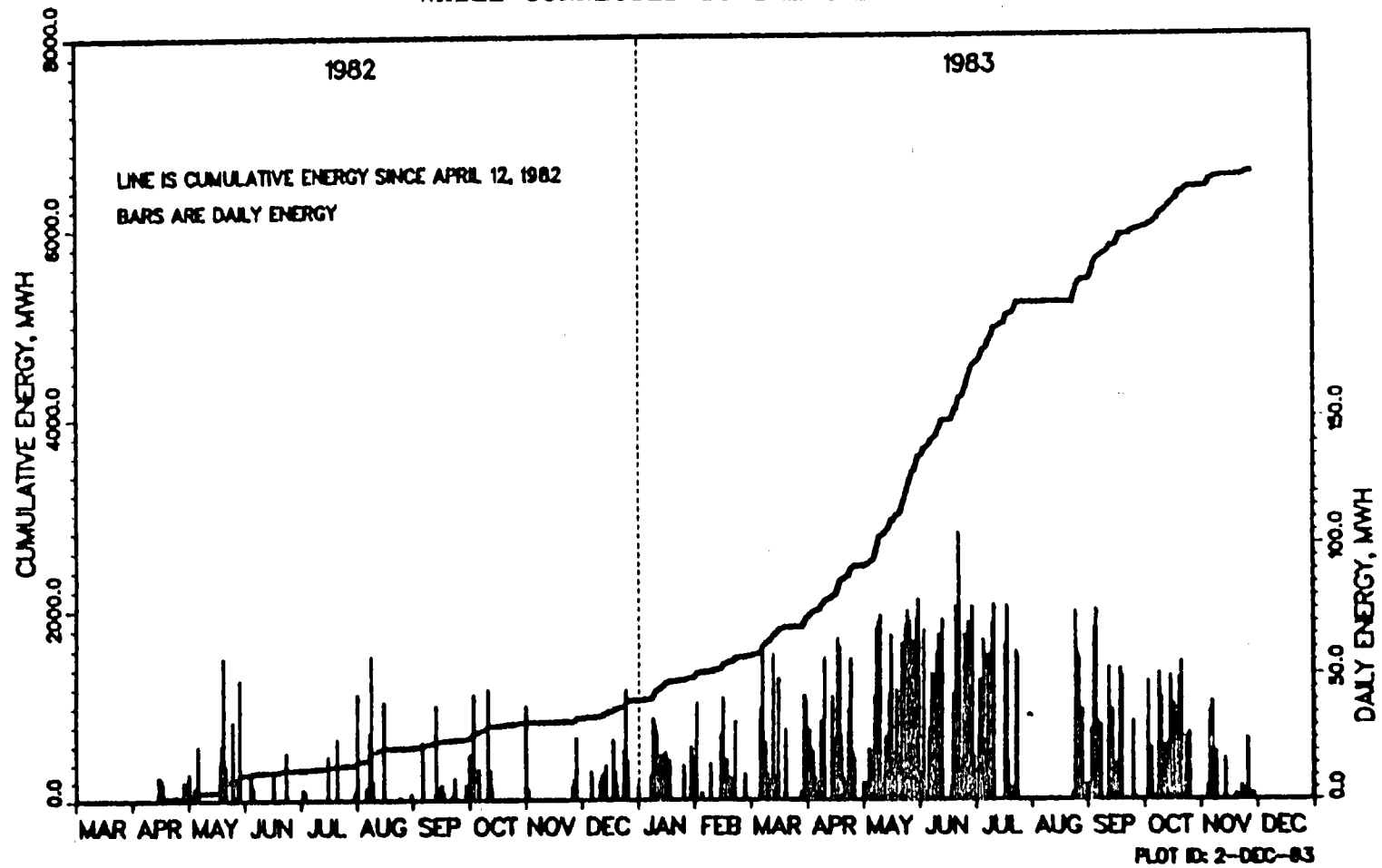
SOLAR ONE
MONTHLY METER REPORT SUMMARY

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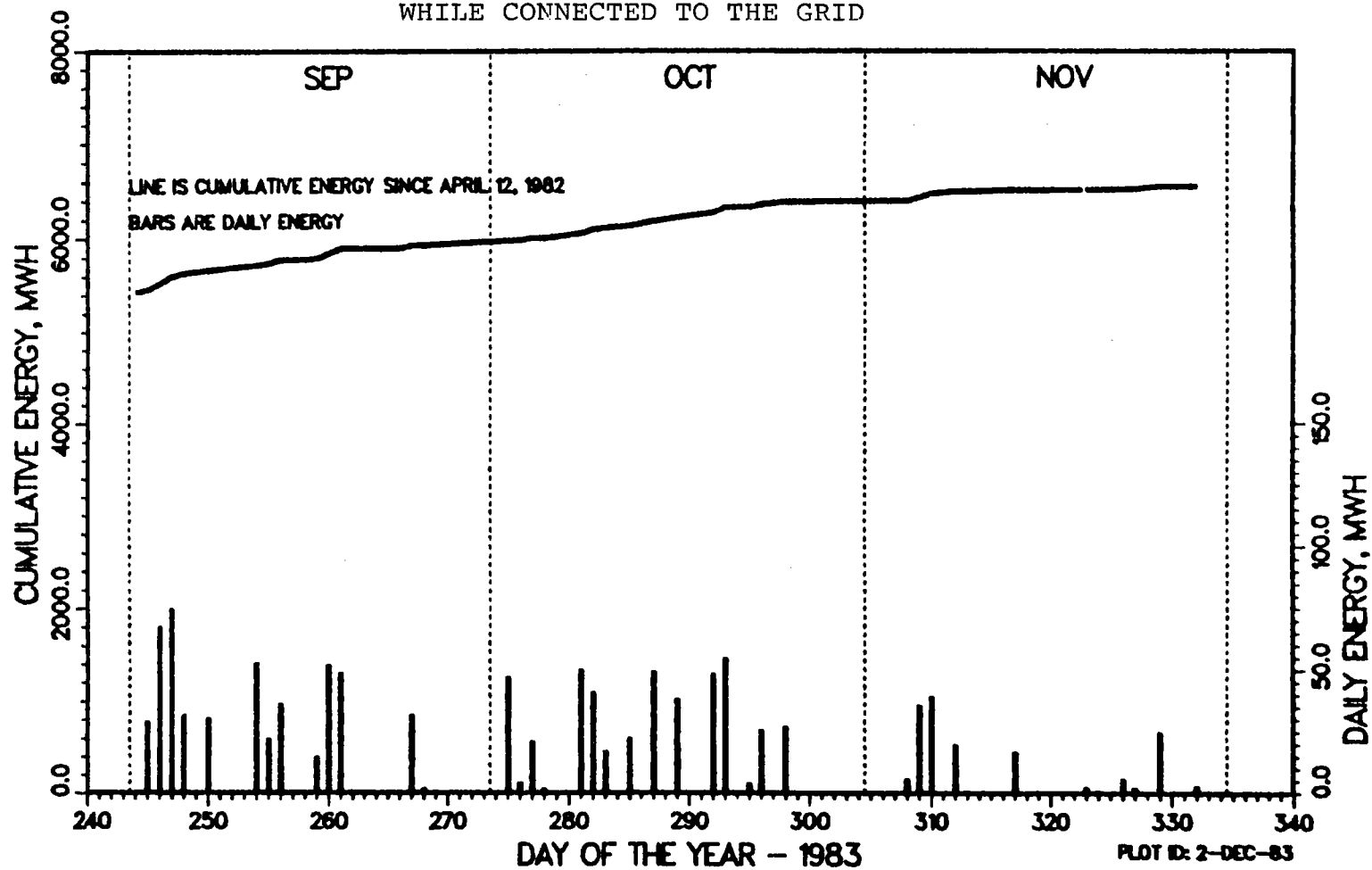
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SOLAR ONE OPERATION AND MAINTENANCE REPORT #21 DECEMBER 1983

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.

Abstract

Power production and plant testing were impacted by inclement weather and a scheduled two week plant outage. The gross energy output was 59.5 MWH while the auxiliary power consumption for the month was 416.8 MWH. The net energy generation while Solar One was on line reached 48.9 MWH.

A scheduled plant outage took place December 5 through December 16 for receiver tube leak repairs.

Operational Highlights

- o A two week scheduled outage went in effect on December 5 to remove samples from and repair the receiver panel edge tube cracks. All receiver tube repairs were completed on schedule and repairs were approved by the State Inspector. Solar One returned to operation on December 17. The interstitial weld cracks will be repaired during the next outage, January 1984. The chronological order of the receiver tube failures and repairs is tabulated in Attachment 1.
- o Receiver panel absorptivity measurements indicated some degradation of the "pyromark" paint, a high absorptivity coating. Plans are to recoat the receiver panels in early FY1985.
- o Receiver ultrasonic inspection of all panel edge tubes that had not previously been inspected was completed in the beginning of the outage and no additional tube cracks were found.
- o Moon tracking, a heliostat computer operation similar to suntracking, was successfully tested on December 19th and 20th. During the tracking operation, which lasted for four hours on the 20th, the receiver assumed a ghost-like silverish glow; however, as expected, no temperature changes on the receiver were experienced. Moon tracking will be used in the future for "no heat" flux measurement experiments and will facilitate flux mapping on the receiver during non normal working hours.
- o Several attempts to run the winter solstice test were unsuccessful due to inclement weather. The goal was to operate Solar One at 10 MW net power level at 10:00 a.m. or 2:00 p.m.
- o Ethylene glycol, antifreeze, was added to the Bearing Cooling Water System to

prevent water from freezing during the low temperatures that are frequently experienced in the area. The concentration of the antifreeze used will provide system protection down to 10 degrees Fahrenheit.

- o Calibration of instrumentation like the receiver thermocouples, the Special Heliostat Instrumentation and Meteorological Measurements System (SHIMMS), as well as the Data Acquisition Remote Multiplexing System (DARMS), took place during the outage.
- o A General Electric Company factory representative was on site during the outage period for turbine speed controller modifications. Following the repairs, testing of the turbine roll sequence on admission steam revealed that the high sensitivity problem with the speed controller has been corrected. Data were collected during the test and were sent to G.E. for evaluation.

Maintenance Highlights

- o The second point feedwater heater was suspected of having tube leaks due to previously experienced high levels in the shell side. The heater was inspected during the December outage and three tube leaks were discovered. The leaks were caused by weld cracks between the tubes and their seal weld to the tube sheet. In the process of repairing these tube leaks, two additional leaks developed. It was decided that the failures were due to a manufacturing defect and no further attempt was made to repair the new leaks. The heater problem will be further investigated during the next two week outage scheduled for January 1984 in the manufacturer representative's presence. At this point, the heater tube pluggage is 5.5%.
- o The main steam to auxiliary steam desuperheater DS-902 spray water supply line was modified to prevent receiver system contamination in the event of condenser inleakage. Condensate downstream of the inline demineralizer will now be used for steam attemperation. In the original design, the spray water supply was immediately downstream of the condensate pump discharge.
- o The circulating water winterizing line, i.e., the circulating water return which bypasses the cooling tower, was modified to discharge away from the suction of the north circulating water pump to prevent cavitation due to turbulence at the pump inlet.
- o The cooling tower was shut down for an annual inspection according to the manufacturer's recommendation. The louvers and fill were freed from accumulated scale and the basin was drained and cleaned.
- o The connecting bolts from twelve receiver panel support rollers were found broken. Inspection of the rollers indicated that this was a result of seizing of the rollers onto their axles. A considerable amount of corrosion was also found on both rollers and studs, which may have caused the seizing. The rollers and studs were repaired or replaced. A regular inspection of the first three levels of rollers began after the incident and Rocketdyne, the receiver designer, is investigating the problem.
- o The heliostat 1851 was taken out of service on December 23 due to an unusual failure of its drive mechanism. The heliostat will be disassembled in January under the direction of a Martin Marietta Engineer and a manufacturer's representative. At that time the cause of the failure will also be

investigated.

o Miscellaneous maintenance work accomplished during the month of December including work performed during the outage period is as follows:

- 1) Replacement of the level indicator and a manhole gasket in the electric auxiliary boiler.
- 2) Replacement of flowmeters in receiver panels 4, 5, and 6 with lower capacity ones to improve measurement accuracy at low flows.
- 3) Installation of new insulation panels at the top and bottom of the receiver; work performed by the Metalclad Company.
- 4) Replacement of the west turbine lube oil pump bearings.
- 5) Replacement of nine degraded receiver heat flux sensors.
- 6) Restroking of all receiver temperature control valves.
- 7) Installation of new trim in receiver vent valves tag numbers 2903 and 2007. During a previous inspection the vent valves were found to be leaking through.
- 8) Replacement of the check valve at the caustic transfer pump discharge.
- 9) Replacement of the heat tracing on the caustic transfer line.
- 10) Replacement of charging train one condensate return valve (PV3110).
- 11) Replacement of the 2nd point feedwater heater shell side vent valves.
- 12) Replacement of the flowmeter rotor in the charging train steam inlet. The old rotor was missing from the turbine style steam flowmeter.
- 13) Replacement of the bonnet gasket in the receiver steam main outlet valve UV2905.
- 14) Replacement of the elevation motor in heliostat 1122.
- 15) Reinstallation of the crosstie valve between auxiliary steam and thermal storage steam system (PV1005).

<u>Plant Statistics</u>	<u>Dec. '83</u>	<u>Turbine Roll To Date</u>
Energy Production (MWH net while connected to the grid)	48.9	6588.7
Hourly Peak MW (Net)	7.7*	10.4*
On-Line Hours	9.1	1326.1
Test Hours	8.0	1197.8
Total Plant Outage Hours	135.0	1596.5
Scheduled	130.0	620.0
Unscheduled	5.0	976.5
Weather Outage Hours	109.5	1965.0

*Receiver Generated Steam Only

- o The two-week scheduled plant outage, as well as 109.5 hours of weather outage, severely impacted energy generation and testing. Consequently, December was a negative output month, -357.3 MWH (Attachment 3). During December, Solar One also had the lowest on-line time (9.1 hours) and the second lowest testing time (8.0 hours) since start-up.
- o The daily and cumulative energy production while Solar One was on-line for the year-to-date and the three previous months are shown on Attachments 4 and 5 respectively.

Operation and Maintenance Costs

- o A summary of the O&M labor, material, contract, and other costs for the month of December 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 DECEMBER 1983

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	12.9	.2	.3	1.1	14.5
OPERATIONS	55.9	10.9	-	.1	66.9
MISC. SUPPORT	5.3	-	1.6	1.9	8.8
MAINTENANCE					
Supervision/Indirects	13.2	1.6	-	(.1)	14.7
Control System	6.8	2.0	.3	-	9.1
Receiver System	8.1	3.6	-	-	11.7
Thermal Storage System	1.3	1.0	3.3	-	5.6
Collector System	.4	.7	-	-	1.1
EPGS System	5.7	2.8	-	-	8.5
Misc.	5.0	(1.5)	1.6	6.0	11.1
Total Maintenance	40.5	10.2	5.2	5.9	61.8
SUB TOTAL	114.6	21.3	7.1	9.0	152.0
Division O.H.					19.8
TOTAL DIRECT					<u>171.8</u>
Workman's Compensation					1.0
Payroll Tax					7.6
Pension & Benefits					23.4
Administrative & General					32.4
GRAND TOTAL					<u>236.2</u>

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SOLAR ONE GENERATING STATIONChronological Summary of
Receiver Tube Failures

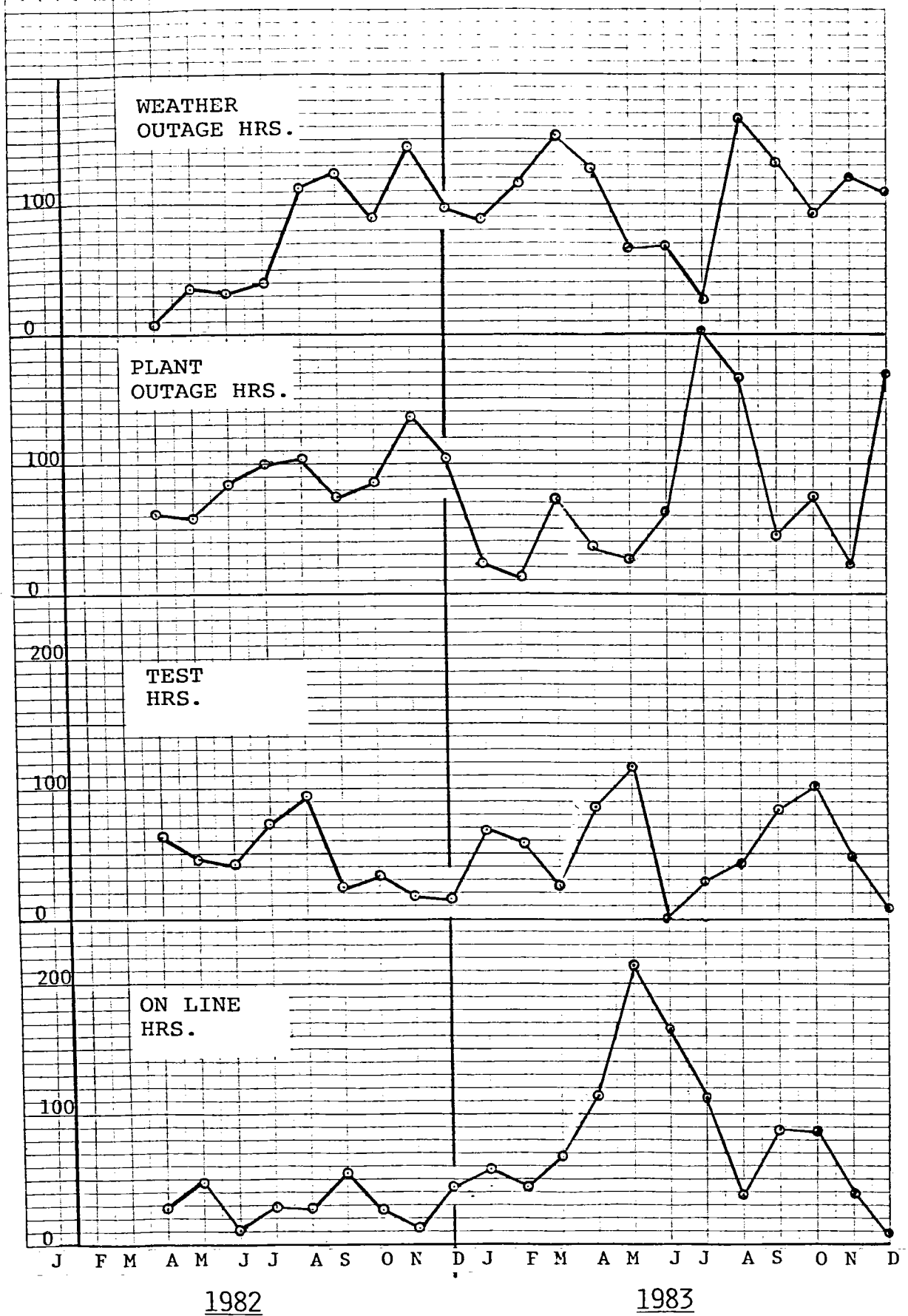
Jul 15, 1983 - Interstitial weld leak	tube 30, panel 18
Jul 26, 1983 - Interstitial weld leak	tube 41, panel 18
Aug 2, 1983 - Bend leak	tube 70, panel 11
Aug 18, 1983 - Repair/removal of sample	tube 30, panel 18
- Repair, grind & fill	tube 41, panel 18
Aug 19, 1983 - Replaced cracked tube section	tube 70, panel 11
Sep 8, 1983 - Crack indication	tube 30, panel 19
Oct 26, 1983 - Crack indication	tube 1, panel 18
- Interstitial weld leak	tube 41, panel 12
- Interstitial weld crack	tube 41, panel 13
Nov 1, 1983 - Interstitial weld crack on:	tube 41, panel 4
	tube 41, panel 6
	tube 30, panel 7
	tube 41, panel 8
	tube 41, panel 10
	tube 30, panel 17
Nov 16, 1983 - Bend leak	tube 1, panel 15
- Bend crack	tube 1, panel 16
- Bend crack	tube 3, panel 16
- Bend crack	tube 1, panel 17
Dec 1983 - Outage - Removal of sample	tube 1, panel 4
	tube 1, panel 6
Repair of cracks	tube 1, panel 15
	tube 1, panel 16
	tube 2, panel 16
	tube 3, panel 16

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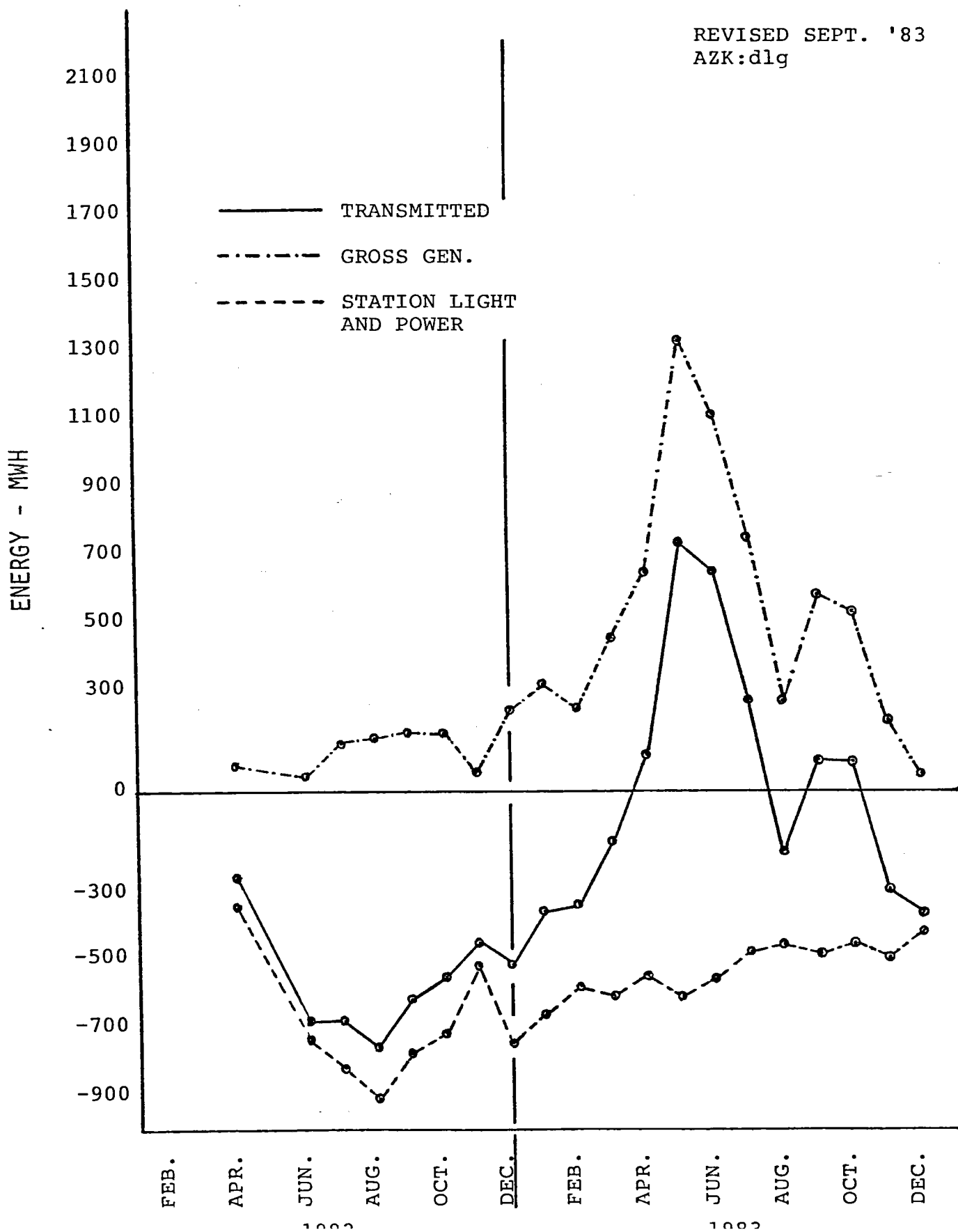
DIETZGEN CORPORATION
MADE IN U.S.A.

HOURS PER MONTH

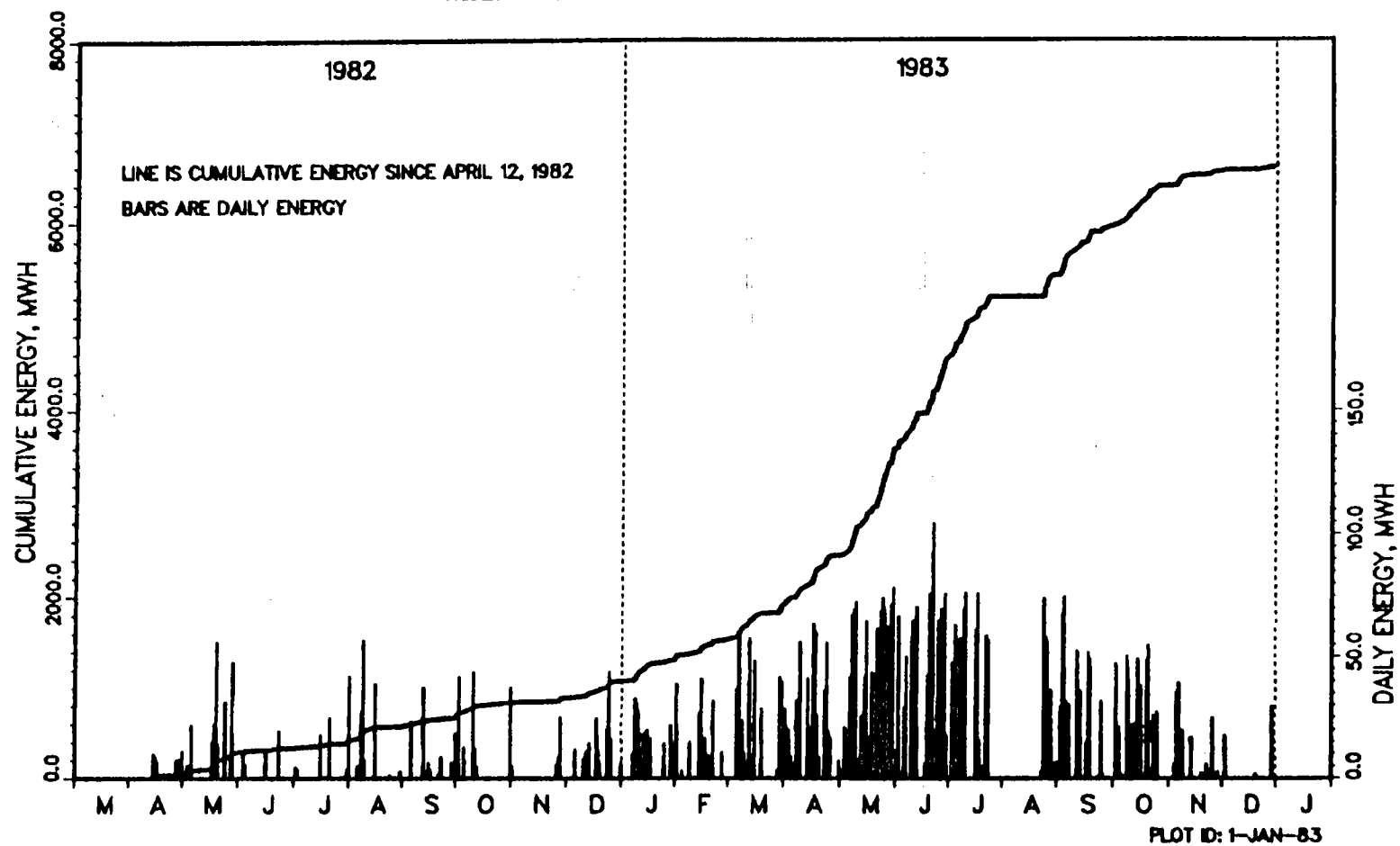
SOLAR ONE STATISTICS



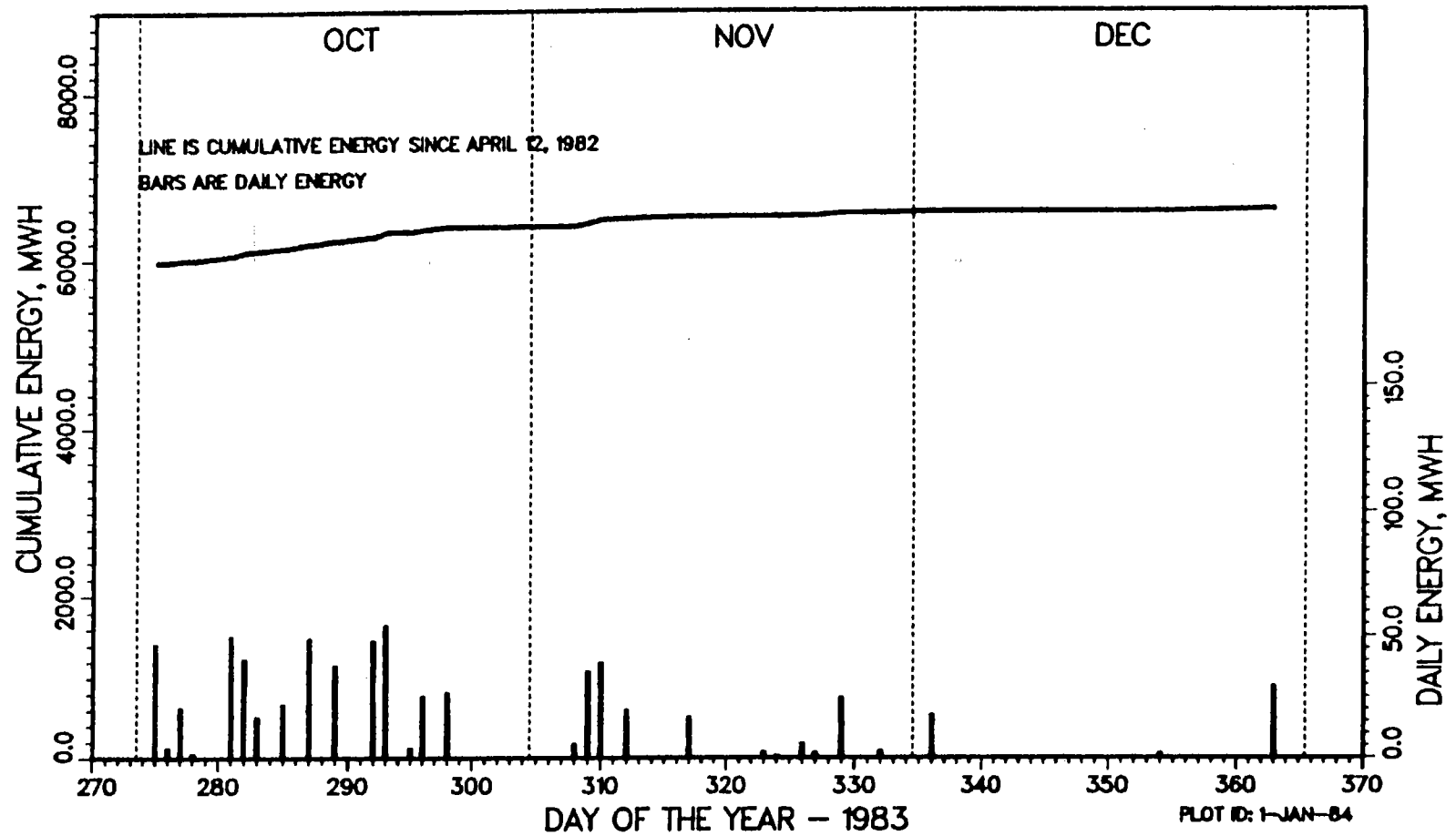
SOLAR ONE
MONTHLY METER REPORT SUMMARY



SOLAR ONE NET ELECTRICAL PRODUCTION WHILE CONNECTED TO THE GRID



SOLAR ONE NET ELECTRICAL PRODUCTION WHILE CONNECTED TO THE GRID



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(STMP0-822)

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M+R ✓
CPC ✓
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SOLAR ONE OPERATION AND MAINTENANCE REPORT #22 JANUARY 1984

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.

Abstract

Power production and plant testing were impacted by 90.5 hours of inclement weather. The gross energy production for the month was 405.1 MWH and the net energy production while on line was 335.1 MWH.

A planned two-week plant outage started January 30 and will continue through February 10, to allow for receiver tube crack inspection, repairs, and for receiver panel support modifications.

Operational Highlights

- o Testing this month concentrated on the turbine automatic sequence transitions:
 - Admission steam to main steam and admission steam and back.
 - Admission steam and main steam to just main steam and back.
 - Automatic transition testing, Mode 5 to 9 (charging to steam dump), and Mode 2 to 1 to 9 (turbine direct and charging to turbine direct to steam dump) were also accomplished.
- o The receiver panel expansion guides (rollers) are being regularly inspected by operations after unit shut-downs. Following the incident of the broken receiver panel expansion guide (roller) studs found on December 15, 1984, Rocketdyne, receiver designer, is evaluating alternatives to permanently correct the problem.
- o Random aborts of OCS (Operational Control System) have occurred periodically during start-ups and transitions. Causes are being investigated.
- o In an effort to lower receiver tube temperatures, receiver tube temperature testing utilizing aimpoint changes and receiver pressure step changes were implemented. Thermocouples were installed on tubes 2 and 4 on receiver panel 15, and flow distribution orifices were removed from tubes 2, 3, 4, and 5 on this same panel to allow evaluation of tube metal temperature response before and after the orifice removal.
- o In January the heliostat field was observed to be tracking higher on the receiver than expected, and some panel tubes have indicated higher temperatures than expected. SCE Operations measured the centroid of several heliostats which indicated high tracking. Similar problems were

reported in January by SSPS (Small Solar Plant System in Almeria, Spain).

A test was completed to verify the suspected cause of the tracking problem experienced with the heliostat field in January. The date in the heliostat array controller computer was set back one day. The centroid of 10 heliostats were checked and found to be, on the average, tracking correctly. The one day change moved these heliostats an average of five feet lower in elevation and two feet to the left in azimuth. Martin Marietta engineers have made a software change to correct the problem.

- o An infrared thermography system is undergoing field test at Solar One. It is hoped that this system will provide the capability for measuring receiver panel front surface temperatures. This particular application of IR thermography is very complex due to the following factors.
 - The large target distance (greater than 600 feet).
 - The non-uniform target temperatures.
 - The non-uniform target optical properties.
 - The high degree of accuracy required to make the data useful.
- o Thermal storage extraction trains one and two run-automation was checked. The logic for train two checked okay. Extraction train one boiler PV-3702 valve logic was corrected to open at 30% automatically.
- o Solar One is under a temperature restriction of 775 degrees F with regards to McDonnell Douglas and Sandia's recommendation. This was done due to the belief that lower temperatures will minimize thermal expansion on the receiver tubes.

Maintenance Highlights

- o Auxiliary steam (admission) four inch safety valve PVS 1033 was adjusted and pressure tested to lift at 76.68 psig according to specification. Safety valve was previously lifting at approximately 65 psig.
- o The heliostat #1851 drive mechanism was inspected on January 12, 1984. A broken pinion gear was found. This broken gear allowed the mirror support structure to fall (rotate) until the torque tube hit the gear box casting and azimuth motor mount. The azimuth motor mount was broken but the remainder of the azimuth drive was undamaged. Dents and rust on the torque-tube indicates that the elevation drive was driven against the casting. The cables, electronics, limit switches, and motor will be thoroughly tested to determine the cause of the failure. SCE Operations conducted a heliostat field survey and found 20 heliostats with torque-tubes indicating damage (dents) caused by overtravel similar to heliostat #1851.
- o Tom Wesik, SCE Apparatus Engineer, inspected the turbine's high pressure first and sixth stage blading, and the turbine's low pressure last three stage blading with a borescope. No measureable erosion was observed on the blading.
- o The thermal storage flash-tank drain-pump was removed and retired. Previous test indicated that the pump was not required for the return of the TSS

(Thermal Storage System) condensate to the main process stream.

o Miscellaneous maintenance work accomplished during the month of January:

- Valve stem on PV1003 (Main steam line going to the deaerator) was lubricated to prevent adhesion.
- Number four panel temperature control valve was removed, calibrated, and installed.
- A new flow element FE 3715 was installed on extraction train 1 steam outlet.
- A new flow element FE 3106 was installed on thermal storage inlet.
- Demineralizer sump pump P-937 experienced a jam nut failure, which caused the pump to bind. Motor and pump were repaired and pump was returned to service.
- Receiver moisture separator indicator LT 2901 was calibrated.
- Inspection plugs were repaired on receiver panel inlet header.
- Receiver inlet filter drain valve was repaired.
- Replaced level limit switch on receiver tower elevator.
- Adjusted trip coil lever on cooling water circulating pump P-906 breaker.

<u>Plant Statistics</u>	<u>Jan. '83</u>	<u>Jan. '84</u>	<u>Turbine Roll To Date</u>
Energy Production (MWH net while connected to the grid)	245.5	335.1	6923.8
Hourly Peak MW (Net)	9.9*	8.9*	10.4*
On-Line Hours	57.7	66.0	1392.1
Test Hours	69.5	74.5	1272.3
Total Plant Outage Hours	24.3	41.8	1638.3
Scheduled	8.0	16.0	636.0
Unscheduled	16.3	25.8	1002.3
Weather Outage Hours	88.8	90.5	2055.5

*Receiver Generated Steam Only

- o The chronological order of the receiver tube failures and repairs is tabulated in Attachment 1.
- o January was a negative output month, -69.3 MWH (Attachment 3).
- o The daily and cumulative energy production while Solar One was on-line for the year-to-date and the three previous months are shown on Attachments 4 and 5 respectively.

Operation and Maintenance Costs

o A summary of the O&M labor, material, contract, and other costs for the month of January 1984 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 JANUARY 1984

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	10.5	.2	-	.1	10.8
OPERATIONS	38.8	10.1	-	3.6	52.5
MISC. SUPPORT	3.1	.1	4.4	1.6	9.2
MAINTENANCE					
Supervision/Indirects	6.6	3.0	.1	-	9.7
Control System	6.2	2.3	5.4	-	13.9
Receiver System	1.7	2.6	10.9	.1	15.3
Thermal Storage System	2.5	2.7	.3	-	5.5
Collector System	2.9	-	.3	-	3.2
EPGS System	2.3	1.8	-	-	4.1
Misc.	4.9	(1.7)	2.2	.2	5.6
Total Maintenance	27.1	10.7	19.2	.3	57.3
SUB TOTAL	79.5	21.1	23.6	5.6	129.8
Division O.H.					13.5
TOTAL DIRECT					<u>143.3</u>
Workman's Compensation					.7
Payroll Tax					5.2
Pension & Benefits					15.9
Administrative & General					27.0
GRAND TOTAL					<u><u>192.1</u></u>

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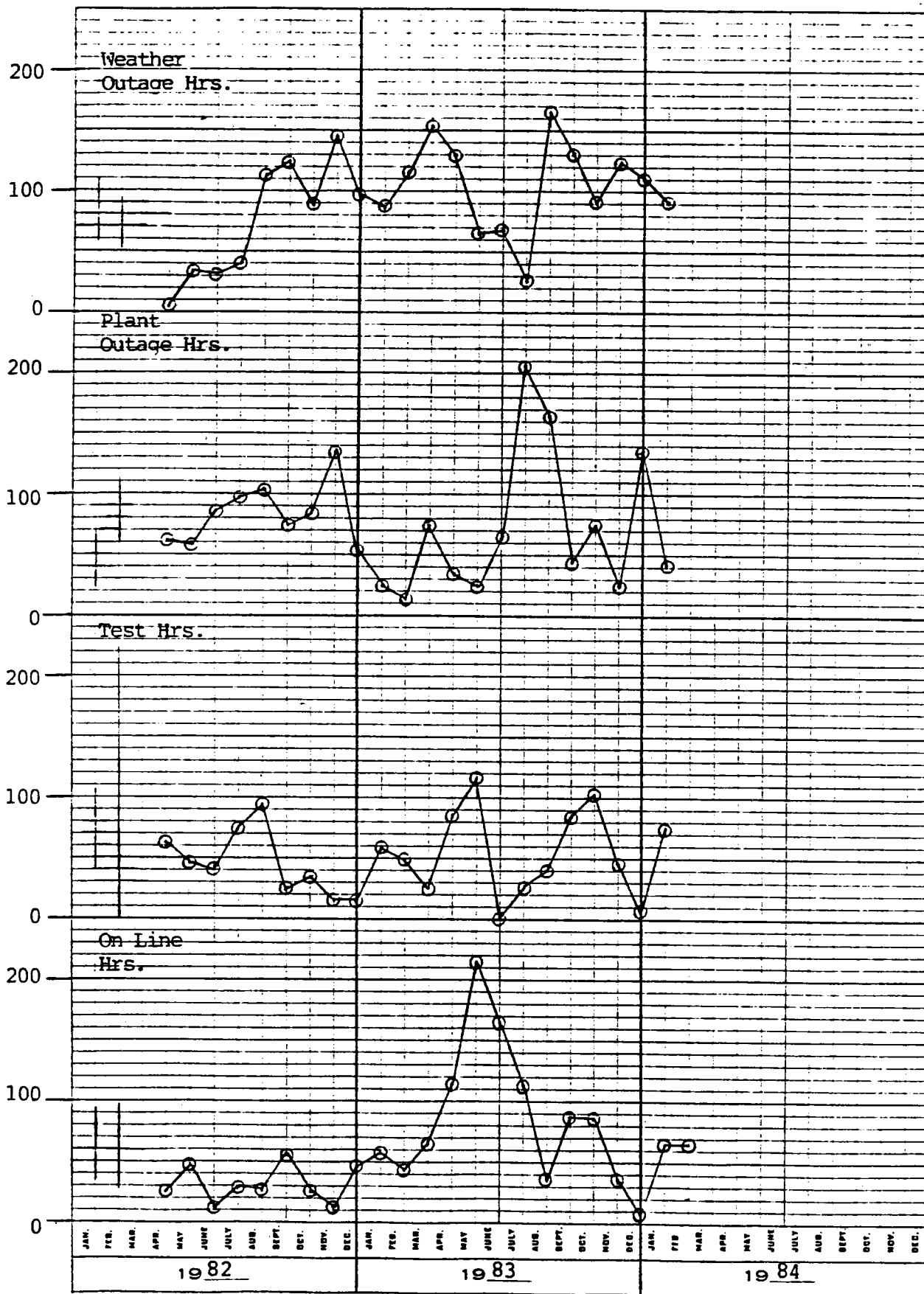
SOLAR ONE GENERATING STATIONChronological Summary of
Receiver Tube Defects

<u>DATE</u>	<u>DESCRIPTION OF TUBE DEFECT</u>	<u>LOCATION</u>
Jul 15, 1983	Interstitial weld leak	tube 30, panel 18
Jul 26, 1983	Interstitial weld leak	tube 41, panel 18
Aug 2, 1983	Bend leak	tube 70, panel 11
Aug 18, 1983	Repair/removal of sample Repair, grind & fill	tube 30, panel 18 tube 41, panel 18
Aug 19, 1983	Replaced cracked tube section	tube 70, panel 11
Sep 8, 1983	Crack indication	tube 30, panel 19
Oct 26, 1983	Crack indication Interstitial weld leak Interstitial weld crack	tube 1, panel 18 tube 41, panel 12 tube 41, panel 13
Nov 1, 1983	Interstitial weld crack on:	tube 41, panel 4 tube 41, panel 6 tube 30, panel 7 tube 41, panel 8 tube 41, panel 10 tube 30, panel 17
Nov 16, 1983	Bend leak Bend crack Bend crack Bend crack	tube 1, panel 15 tube 1, panel 16 tube 3, panel 16 tube 1, panel 17
Dec 1983	Outage - Removal of sample Repair of cracks	tube 1, panel 4 tube 1, panel 6 tube 1, panel 15 tube 1, panel 16 tube 2, panel 16 tube 3, panel 16
Jan 1984	Outage - Interstitial weld crack repaired	tube 41, panel 13

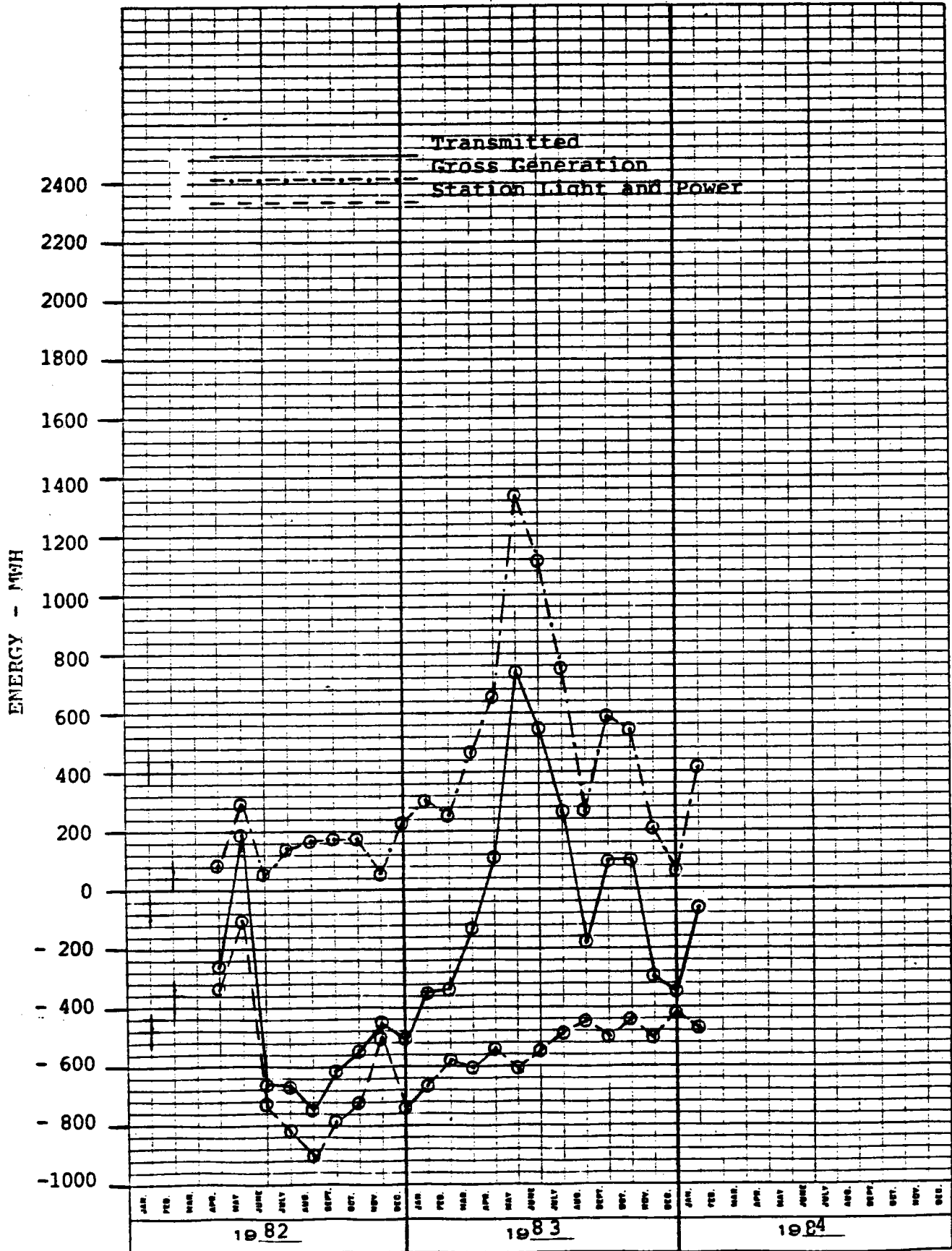
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SOLAR ONE STATISTICS

HOURS PER MONTH

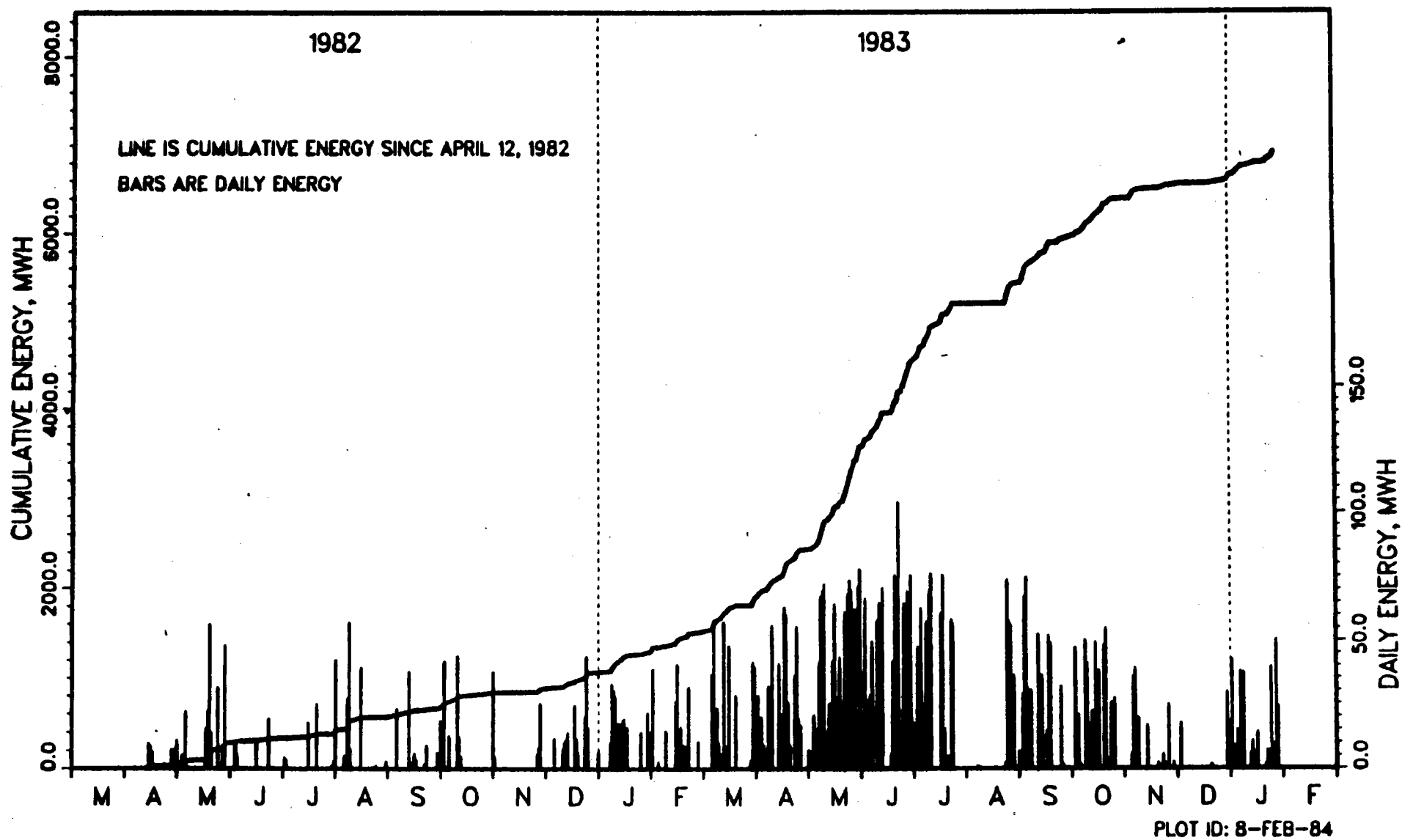
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3 YEARS BY MONTH

SOLAR ONE MONTHLY METER REPORT SUMMARY



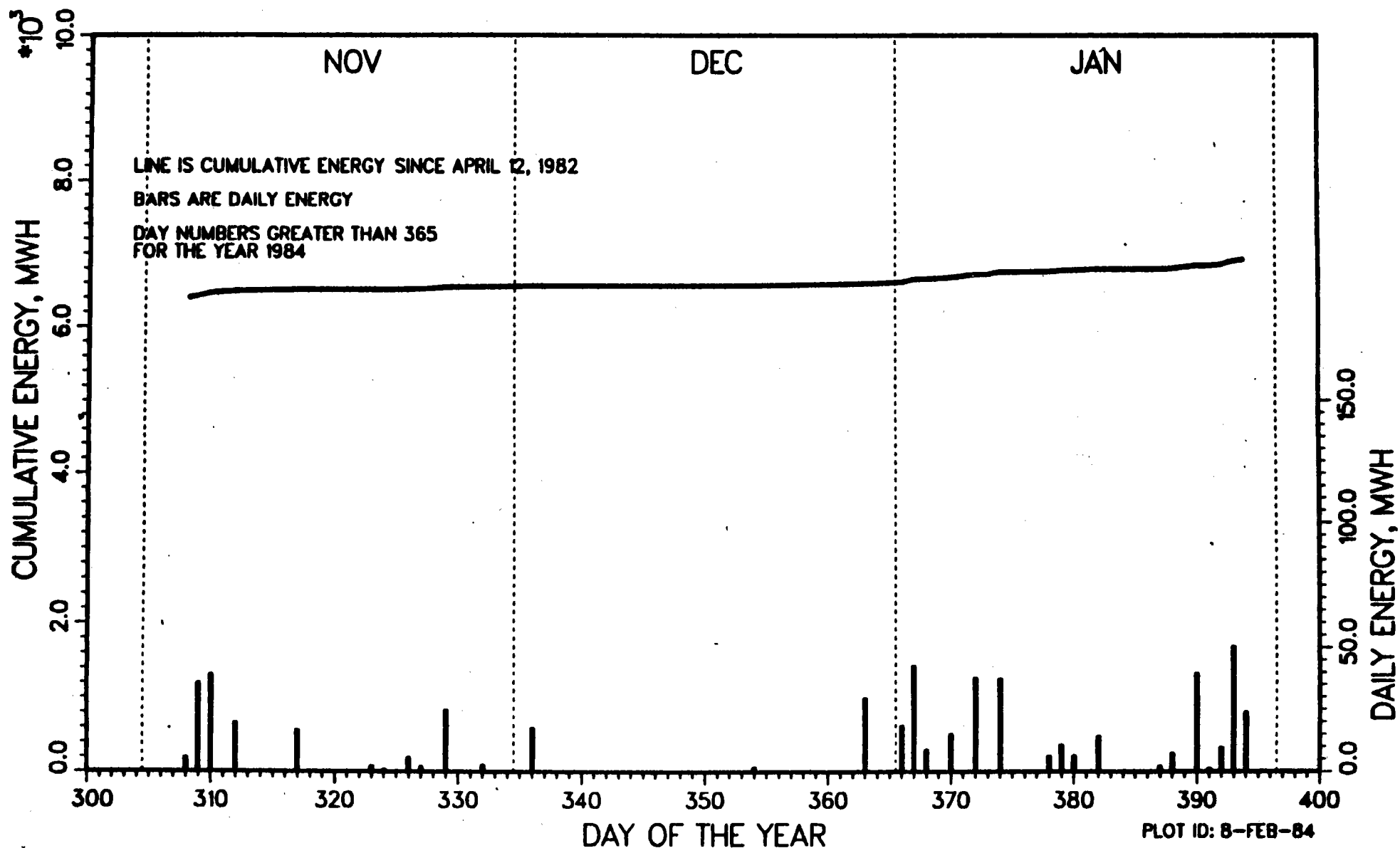
SOLAR ONE NET ELECTRICAL PRODUCTION

(WHEN SYNCHRONIZED TO THE GRID)



SOLAR ONE NET ELECTRICAL PRODUCTION

(WHEN SYNCHRONIZED TO THE GRID)



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(STMP0-823)

Final @ 5/22/84
MTR ✓
CPC ✓
TLC ✓

SOLAR ONE OPERATION AND MAINTENANCE REPORT #23 FEBRUARY 1984

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.

Abstract

Power production and plant testing were limited by 78.0 hours of inclement weather and a scheduled two-week plant outage. The gross energy production for the month was 418.6 MWH and the net energy production while on line was 359.0 MWH.

A two-week scheduled plant outage took place January 30 through February 10 to allow for receiver tube crack inspection, repairs, and receiver support modifications.

Operational Highlights

- o Outage activities were completed on schedule Friday, February 10th. The weekend after the outage was devoted to water cleanup, a receiver hydrostatic test and miscellaneous maintenance.
- o Moon tracking was conducted on February 14, 1984. The heliostat field was surveyed for pointing errors while reflecting the moon onto aimpoints above the receiver and above the BCS target. Observations were made from the top of the receiver and from the BCS deck. A total of 138 heliostats were identified as requiring pointing error corrections to decrease spillage on the top or bottom of the receiver.
- o The summer wire walks were loaded into the heliostat array controller. As a safety precaution, project participants were reminded that the summer wire walks will cause heliostat beams to cross the east and west collector field access roadways.
- o On February 29, the early morning start program on the OCS (Operational Control System) was aborted due to insufficient heliostat field application to the receiver. This was caused by a faulty heliostat cleanliness factor of 96% which will have to be changed to show our current cleanliness factor of 86%. In the future, MDAC will establish a procedure by which operations may change this cleanliness factor as the heliostats change in condition.
- o The exhausted resin in bed #1 of the in-line polishing demineralizer was replaced on February 17. After placing the new Duolite resin in bed #1 in service, the receiver steam sample indicated high cation conductivity, i.e., 3.0 micro-mhos compared to the expected 0.15 micro-mhos limit. High cation conductivity still existed on the receiver steam after several regenerations

were done on bed #1 per SCE Division Chemical recommendations. At this time the plan is to change out the Duolite resin in bed #1 and replace it with resin from Rohm & Haas.

- o The plant was released for unrestricted Mode 3, storage boosted operation, effective February 21.
- o The plant was released for unrestricted Mode 4, in-line flow, effective February 24.

Maintenance Highlights

- o Ultrasonic inspection of receiver edge tubes was completed and four new cracks were detected. The new cracks were found in tube 70 of panels 9, 10, 11, and 12. The cracks initiated from within the internal surface of the tube bend. None of the four new cracks broke through. It should be noted that tube 70, panel 11 was previously replaced on August 19, 1983. In addition, during the outage three receiver tube interstitial weld cracks were ground out and weld repaired. A chronological summary of receiver tube defects is tabulated in Attachment 1.
- o The 2nd point feedwater heater had seal (tube to tube-sheet) leaks repaired. The 2nd point heater was checked for leaks, and the heater shell side indicated no leakage at 1250 psig (receiver feed pump pressure).
- o Gene Riley, MDAC, has installed three switches to provide for flowmeter selection on the TSS charging system. Switches will allow the operator to select one of three flow elements for automatic control of the TSS charging operation.
- o The receiver panel expansion guides (rollers) at the 2nd and 3rd levels from the bottom were modified to help prevent adhesiveness between the roller and pin.
- o Control Components Inc. representative inspected the receiver steam dump valve. The valve internals were found in good condition; however, the valve plug and seat were replaced during the outage to insure operation until the next inspection in 1985.
- o The calibration of receiver thermocouples was completed. The effort began during the December 1983 outage. The impetus for thermocouple calibrations was established during the convective loss proof test in September 1983, when puzzling trends were noted in the data.

In addition to the calibrations, a differential temperature thermocouple was installed to directly measure the differential temperature change between the preheat panel inlet (TEX 2050) and the receiver outlet (TI 2903). An accurate measurement of overall receiver heat loss is critical to the convective loss test.

- o The upper receiver panel supports were modified to reduce lateral stresses. This consisted of removing 5 of 7 supports and adding reinforcement gussets to the remaining 2 supports. MDAC and Rocketdyne stated that the 2 supports that will remain are sufficient to support the panel for required wind and seismic loads as well as operating conditions.

o Miscellaneous maintenance work accomplished during the month of February including work performed during the outage period is as follows:

- Modern Alloy cut concrete in the TSS (Thermal Storage System) skid area to allow proper water drainage.
- Leaky inspection plugs on receiver panels 22 and 23, and a drain plug on the receiver flash tank were seal welded.
- Cleaned and calibrated differential pressure alarm switch on in-line demineralizer bed #2.
- Replaced receiver inlet filter located upstream of preheaters.
- Replaced bonnet gasket on temperature control valve of receiver panel #5.
- Replaced blown diaphragm on steam dump/atomizing steam control valve FV1007.
- Repaired a leak on the waste water system.
- Replaced bad diaphragm on back-wash and rinse valve B2 of the inline demineralizer regeneration system.
- Repaired flowmeter flange leak on receiver panel #17.
- Calibrated flowmeter FI 2230 on receiver panel #1.
- Replaced worn-out seal on the inline demineralizer caustic transfer pump P-943.
- Replaced two bad unions on the inline demineralizer acid feed pump P-932.
- Replaced steam dump system trip relay due to a burned coil; and tested circuits in the plant trip box.

<u>Plant Statistics</u>	<u>Feb. '83</u>	<u>Feb. '84</u>	<u>Turbine Roll To Date</u>
Energy Production (MWH net while connected to the grid)	202.7	359.0	7262.8
Hourly Peak MW (Net)	9.7*	9.1*	10.4*
On-Line Hours	43.6	64.1	1456.2
Test Hours	59.5	32.4	1304.7
Total Plant Outage Hours	12.5	91.0	1729.3
Scheduled	-0-	85.0	721.0
Unscheduled	12.5	6.0	1008.3
Weather Outage Hours	116.0	78.0	2133.5

*Receiver Generated Steam Only

- o The two-week scheduled plant outage, as well as 78.0 hours of weather outage, impacted energy generation and testing. February was a positive output month, 61.4 MWH (Attachment 3).
- o The daily and cumulative energy production while Solar One was on line for the year-to-date and the three previous months are shown on Attachments 4 and 5.

Operation and Maintenance Costs

o A summary of the O&M labor, material, contract, and other costs for the month of February 1984 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 FEBRUARY 1984

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	17.8	.1	-	1.9	19.8
OPERATIONS	47.4	3.7	-	.8	51.9
MISC. SUPPORT	3.5	.7	3.1	1.4	8.7
MAINTENANCE					
Supervision/Indirects	14.0	3.4	.3	.4	18.1
Control System	8.0	8.2	6.4	-	22.6
Receiver System	21.4	1.7	.5	.3	23.9
Thermal Storage System	2.2	.1	3.2	1.1	6.6
Collector System	2.1	1.1	.2	-	3.4
EPGS System	9.1	11.9	-	.7	21.7
Misc.	3.7	1.2	1.0	-	5.9
Total Maintenance	60.5	27.6	11.6	2.5	102.2
SUB TOTAL	129.2	32.1	14.7	6.6	182.6
Division O.H.					23.3
TOTAL DIRECT					<u>205.9</u>
Workman's Compensation					1.1
Payroll Tax					8.5
Pension & Benefits					26.0
Administrative & General					38.8
GRAND TOTAL					<u>280.3</u>

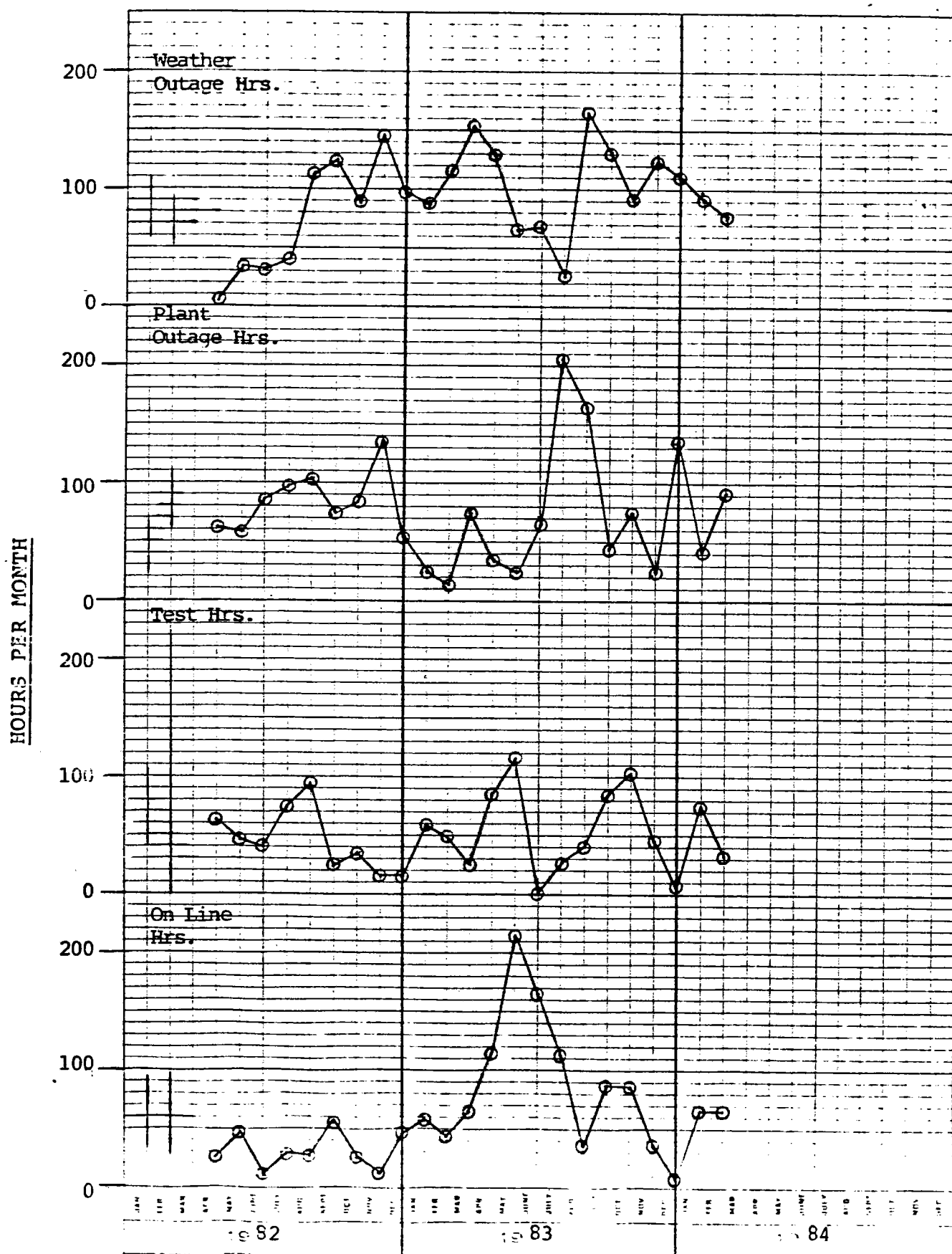
Solar One FY83 Operation and Maintenance Cost was \$3.238 million, which was \$62.0 thousand under the planned budget. See Attachment 6 for Solar One FY83 Operation and Maintenance Budget and Cost Breakdown.

SOLAR ONE GENERATING STATIONChronological Summary of
Receiver Tube Defects

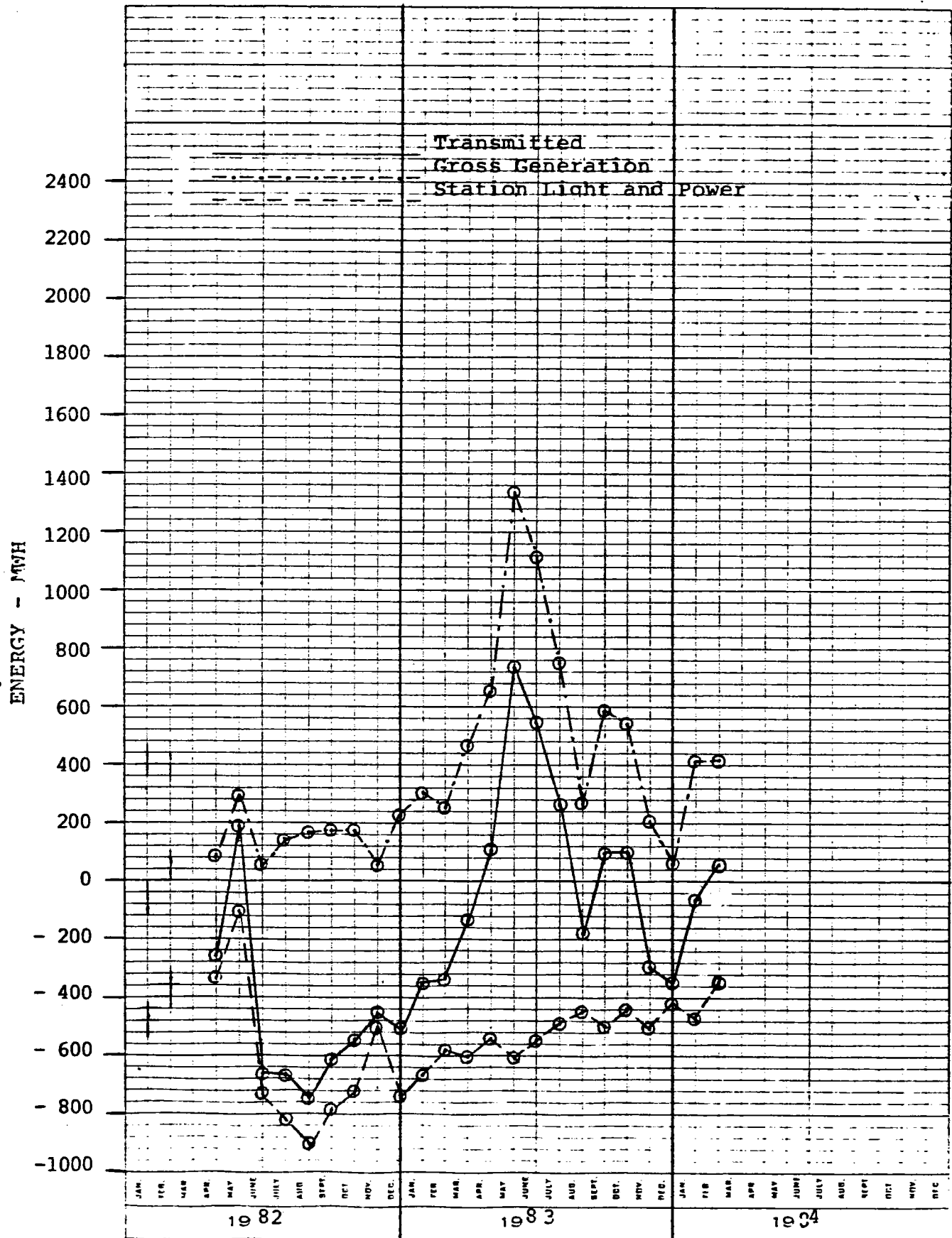
<u>DATE</u>	<u>DESCRIPTION OF TUBE DEFECT</u>	<u>LOCATION</u>
Jul 15, 1983	Interstitial weld leak	tube 30, panel 18
Jul 26, 1983	Interstitial weld leak	tube 41, panel 18
Aug 2, 1983	Bend leak	tube 70, panel 11
Aug 18, 1983	Repair/removal of sample Repair, grind & fill	tube 30, panel 18 tube 41, panel 18
Aug 19, 1983	Replaced cracked tube section	tube 70, panel 11
Sep 8, 1983	Crack indication	tube 30, panel 19
Oct 26, 1983	Crack indication Interstitial weld leak Interstitial weld crack	tube 1, panel 18 tube 41, panel 12 tube 41, panel 13
Nov 1, 1983	Interstitial weld crack on:	tube 41, panel 4 tube 41, panel 6 tube 30, panel 7 tube 41, panel 8 tube 41, panel 10 tube 30, panel 17
Nov 16, 1983	Bend leak Bend crack Bend crack Bend crack	tube 1, panel 15 tube 1, panel 16 tube 3, panel 16 tube 1, panel 17
Dec 1983	Outage - Removal of sample Repair of cracks	tube 1, panel 4 tube 1, panel 6 tube 1, panel 15 tube 1, panel 16 tube 2, panel 16 tube 3, panel 16
Jan 1984	Outage - Interstitial weld crack repair	tube 41, panel 13
Feb 1984	Outage - Interstitial weld crack repair Interstitial weld crack repair Bend crack Bend crack Bend crack Bend crack	tube 41, panel 8 tube 41, panel 9 tube 70, panel 9 tube 70, panel 10 tube 70, panel 11 tube 70, panel 12

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SOLAR ONE STATISTICS

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3 YEARS BY MONTHS

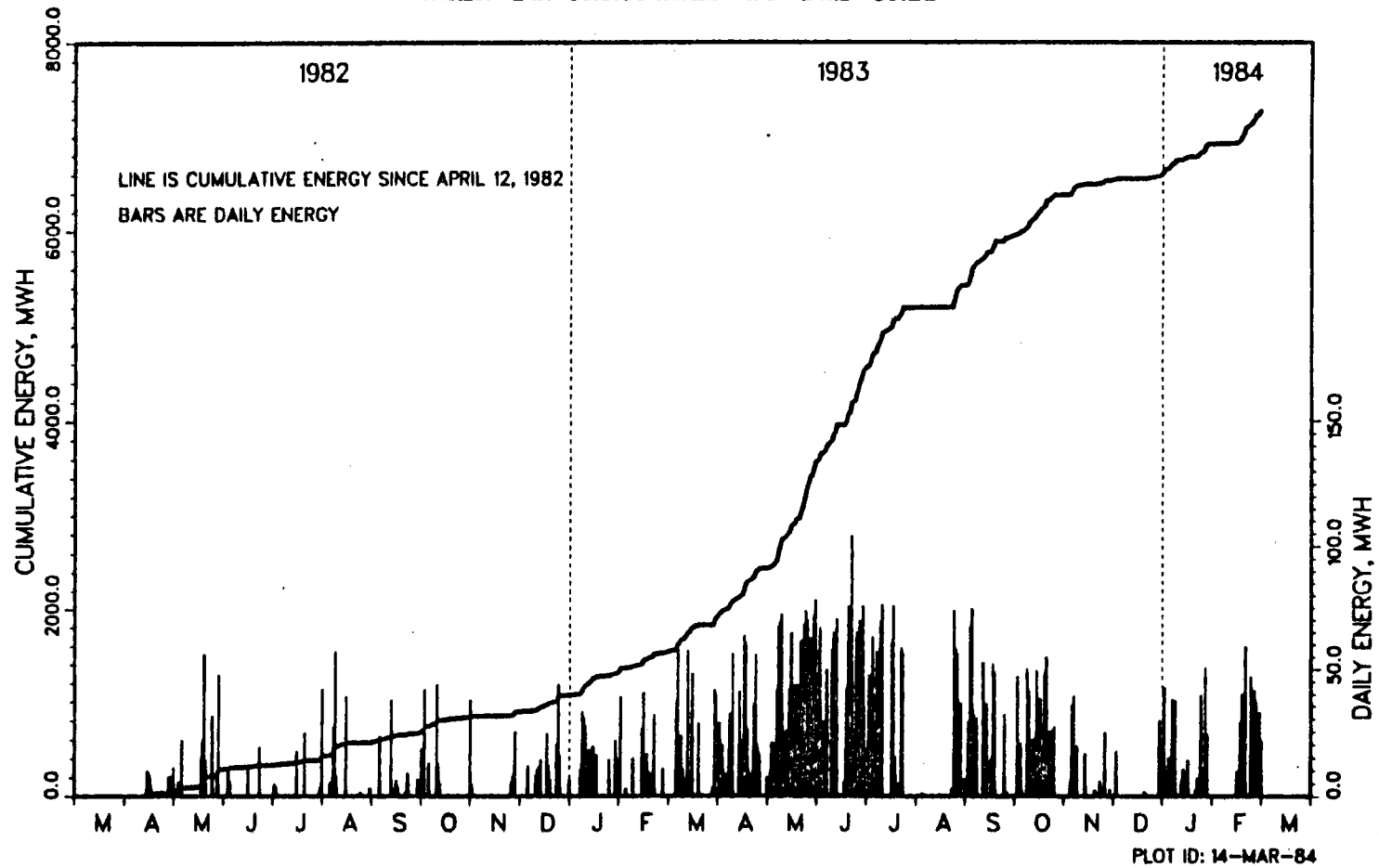
SOLAR ONE MONTHLY METER REPORT SUMMARY



DIETZGEN CORPORATION
MADE IN U.S.A.

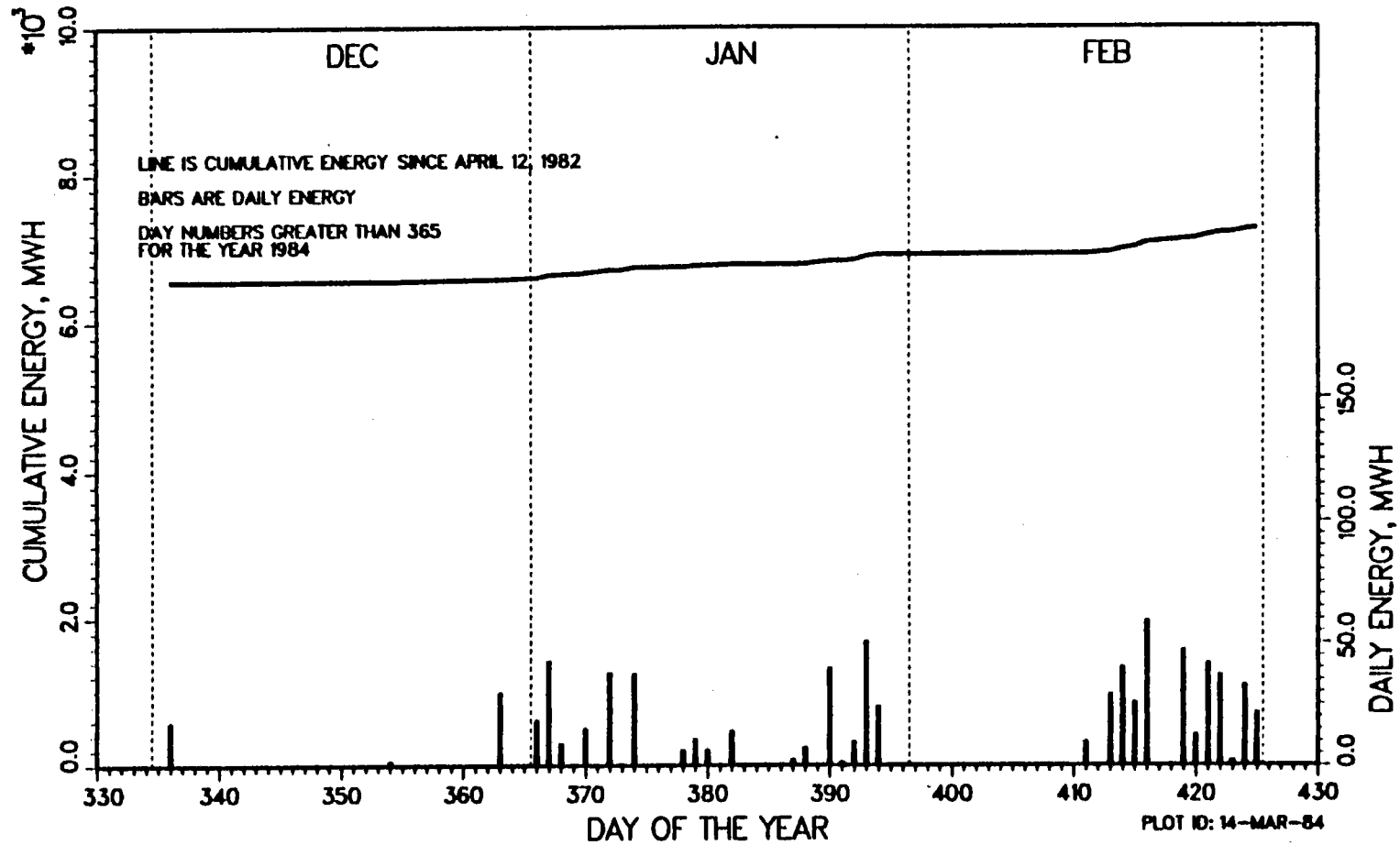
NO. 340-T30 DIETZGEN GRAPH PAPER
3 YEARS BY MONTHS

SOLAR ONE NET ELECTRICAL PRODUCTION WHEN SYNCHRONIZED TO THE GRID

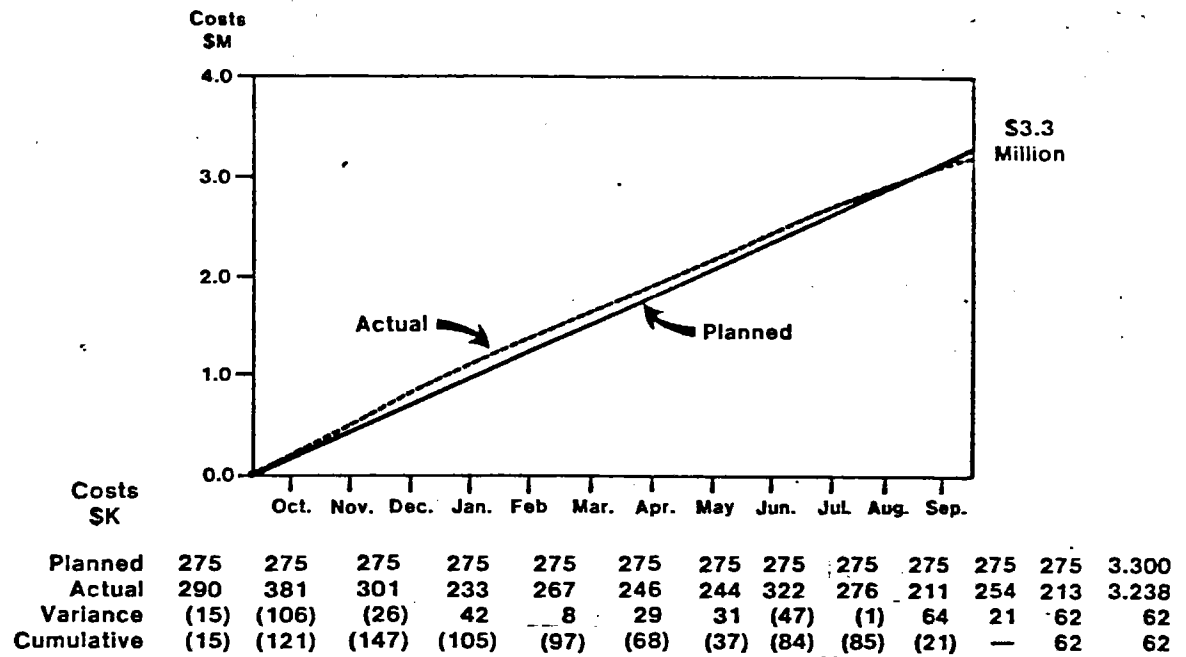


SOLAR ONE NET ELECTRICAL PRODUCTION

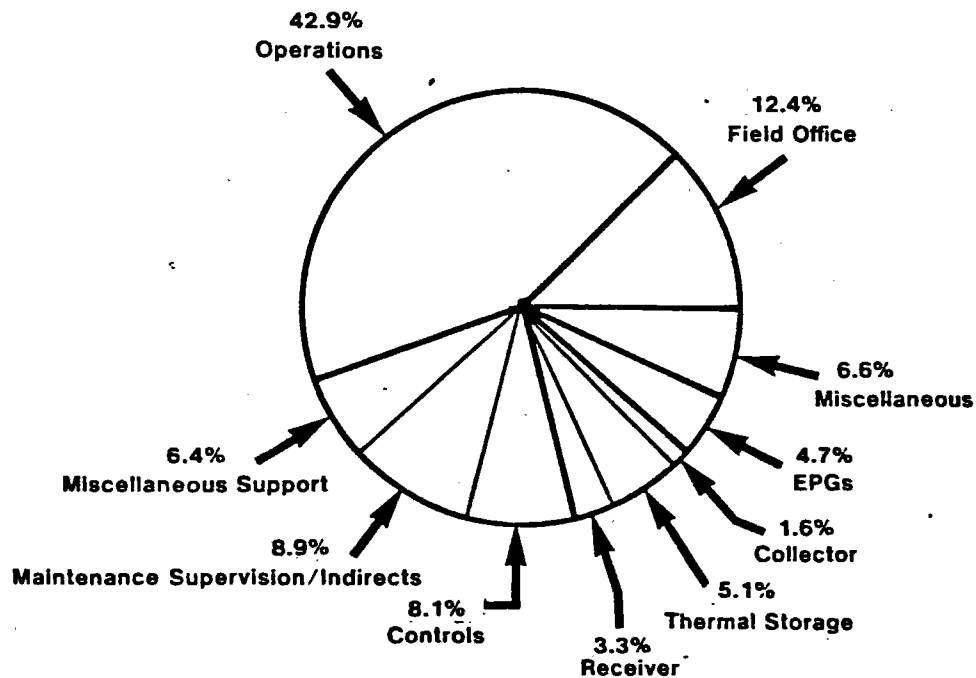
WHEN SYNCHRONIZED TO THE GRID



Solar One FY83 Operation and Maintenance Budget



Solar One 1983 Operation and Maintenance Cost Breakdown



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SOLAR ONE OPERATION AND MAINTENANCE REPORT #24 MARCH 1984

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.

Abstract

Inclement weather of 129.8 hours precluded significant power production and plant testing. The gross energy production for the month was 574.1 MWH and the net energy production was 169.8 MWH.

Operational Highlights

- o The OCS computer experienced problems during the automated plant start-up while transitioning from flow to temperature control. The low flow 20-25K lb/hr problem was temporarily corrected to the design flow of 33-40K lb/hr as noted below:
 - a. By revising the OCS computer software to reflect a heliostat cleanliness factor of 68% (Actual 86%).
 - b. By not allowing active south receiver boiler panels to decrease their power levels during the transition from receiver flow to temperature control. During early morning start-up heliostats are removed from tracking as the sun rises, to hold total receiver flow at a constant 40K lb/hr. However, this reduction of tracking heliostats on south boiler panels precludes their transitioning to temperature control, therefore preventing completion of the start-up sequence.
- o SCE Operations has provided an updated set of operating instructions for Mode 8, Inactive, for DOE, SNLL, and MDAC review. These procedures reflect the techniques developed over the past two years to minimize both the daily plant parasitic load and the time required to bring the plant on line each morning.
- o Mode 7, (Turbine Direct; Charging; Extracting), was released for unrestricted use by SCE Operations March 1, 1984.
- o Moon Tracking: New heliostat aimpoint files for moon tracking have been created to allow the heliostats to track one of four aimpoints one foot above, and center of the beam characterization target handrail. The field was photographed from these aimpoints while moon tracking on March 14, 1984, to identify heliostats with large tracking errors. These heliostats will be the first ones measured with the beam characterization system for bias corrections to improve their sun tracking accuracy.
- o On March 20, a failure in a circuit breaker status indicator logic module in

the plant's Discrete Logic system caused a plant loss of power.

When power failed, the receiver Discrete Logic (Red Line Unit), which is not on a battery powered UPS (Uninterruptible Power Source), failed to vent the receiver. Subsequently the receiver flash tank relief valve vented the receiver to atmosphere relieving pressure consequent to heliostat beams remaining on the receiver after flow stopped.

When power was restored, there were problems in reestablishing control of the heliostat field. Approximately 650 heliostats responded to commands and approximately 1050 did not respond. As a result, their beams remained on the receiver. The beams drifted down the receiver tower due to the sun's movement. The beams cleared the receiver in about 20 minutes, and then cleared the BCS targets after 30 minutes. Inspection of the receiver, BCS targets, and receiver target did not evidence any damage.

Review of this incident found the failed logic module to constitute a potential single point failure which could continue to cause future plant outages. Since the software logic is redundant to the hardwired logic provided on all electrical circuit breakers, it was decided to remove this software logic from the circuit breaker's control scheme and thereby eliminate this potential single point failure source.

Improved methods of regaining collector field control following plant power losses are being developed by SCE and SNLL.

Maintenance Highlights

- o Modern Alloys Inc. started installing additional mirror module vents on Monday, March 5. A total of 10,546 mirror modules which are most susceptible to water intrusion due to defective edge seals were selected for the additional vents. The additional vents will minimize water intrusion as well as facilitate drying out the modules and thereby minimize reflective surface corrosion.
- o SCE maintenance personnel washed heliostat mirror modules using a borrowed SCE electrical transmission line insulator wash vehicle.
- o A logic change to keep the auxiliary boiler feed pump from starting when the auxiliary steam is not in service was completed.
- o Thermal Storage System (TSS) extraction train #1 was out of service to allow removal of a failed steam inlet check valve, which will be repaired off site.
- o The turbine logic was changed so that the turbine trips the turbine speed load control inlet pressure regulator and the inlet pressure control pots will automatically run to the "0" or closed position when the OCS computer is enabled.
- o Make-up 8 inch water line to the cooling tower ruptured. A temporary fix was made with a full circle clamp. Material has been ordered to make final repairs.
- o The plant was shut down at 10:14 a.m., Wednesday, March 28, due to a cooling water leak under the auxiliary bay concrete floor slab. Initial investigation

indicated the leak was from the 8 inch fibercast pipe (Vinylester), circulating water return line from the cooling water heat exchanger.

The plant was shut down Thursday and Friday, March 29 and 30, for repair of the failed pipe joints.

o Miscellaneous maintenance work accomplished during the month of March is as follows:

- Replaced bad aftercooler core on east air ocmpressor CP-901.
- Replaced bad aftercooler core on west air compressor CP-902.
- Repaired leak by installing a new graphite seal gasket on TSS flowmeter FE 3105.
- Repaired leak on TSS charging train #1 inlet strainer.
- Replaced and calibrated TSS charging system inlet flowmeter FE 3102.
- Removed TSS charging train #2, steam flowmeter (FE 3305) for repair by manufacturer.
- Calibrated inlet steam flowmeter FE 3106 on TSS charging system.
- Insulated sensing lines PDT 2902 and PDT 2949 on the receiver.
- Replaced cable, and safety switch on the receiver tower elevator door.
- Replaced closing coil and adjusted bracket on generator field breaker.
- Repaired leak on main steam sample cooler.

<u>Plant Statistics</u>	<u>Mar. '83</u>	<u>Mar. '84</u>	<u>Turbine Roll To Date</u>
Energy Production MWH	-157.5	169.8	-3879.3
Energy Production (MWH net while connected to the grid)	397.2	481.4	7744.2
Hourly Peak MW (Net)	10.3*	8.8*	10.4*
On-Line Hours	66.1	96.9	1553.1
Test Hours	25.5	58.0	1362.7
Total Plant Outage Hours	72.5	49.5	1778.8
Scheduled	63.0	29.0	750.0
Unscheduled	9.5	20.5	1028.8
Weather Outage Hours	152.9	129.8	2263.3

*Receiver Generated Steam Only

- o Inclement weather of 129.8 hours precluded significant power production and plant testing. March was a positive output month, 169.8 MWH (Attachment 3).
- o The daily and cumulative energy production while Solar One was on-line for the year-to-date and the three previous months are shown on Attachments 4 and 5.

Operation and Maintenance Costs

o A summary of the O&M labor, material, contract, and other costs for the month of March 1984 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.

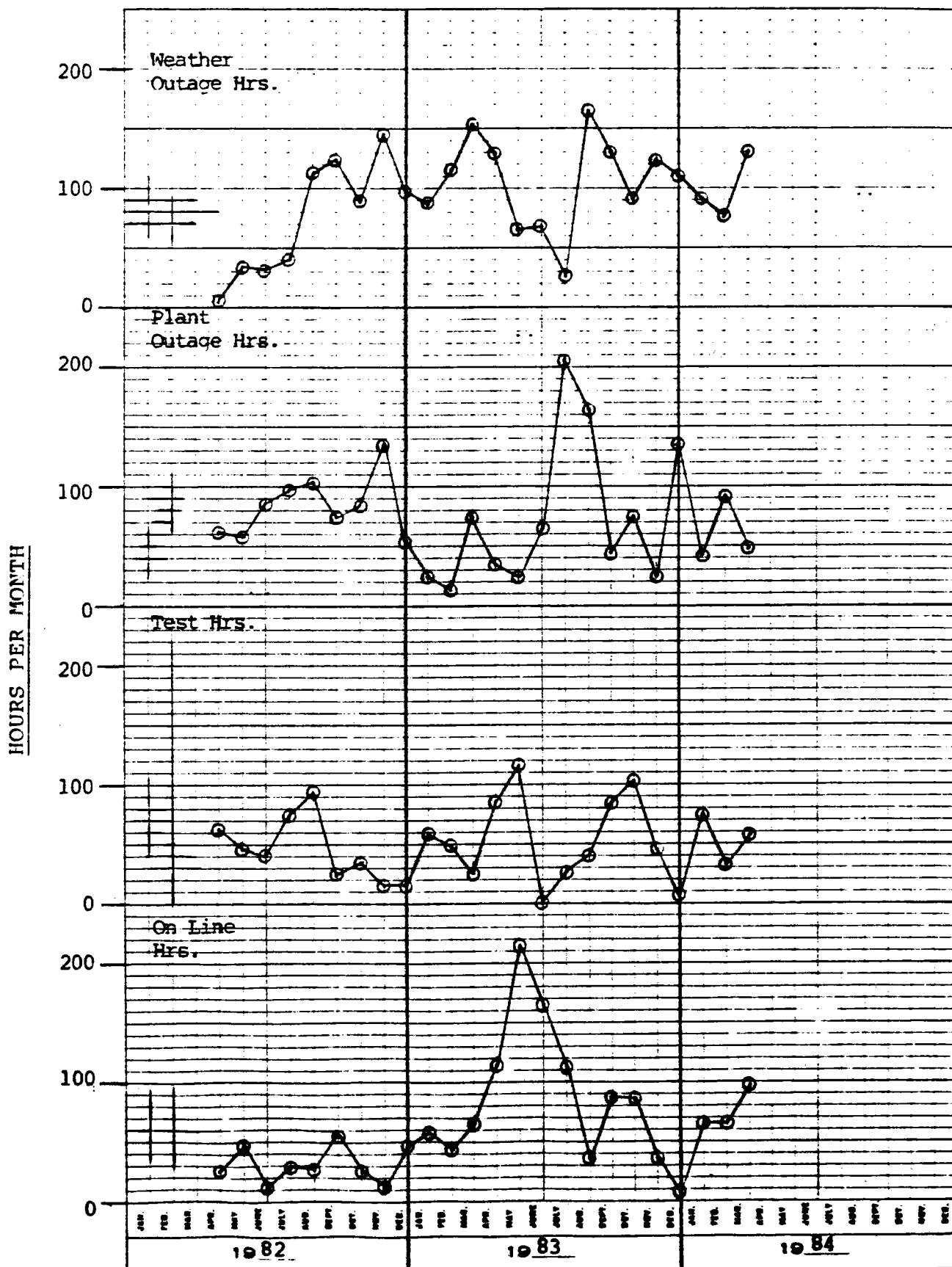
SOLAR ONE
MONTHLY O&M COST SUMMARY
(\$ X 1000)
MONTH OF MARCH 1984

	LABOR	MATERIAL	CONTRACT	OTHER	TOTAL
FIELD OFFICE	12.9	.4	.1	2.6	16.0
OPERATIONS	49.2	22.3	1.0	.1	72.6
MISC. SUPPORT	7.0	.3	4.0	1.2	12.5
MAINTENANCE					
Supervision/Indirects	12.4	5.0	.2	.2	17.8
Control System	3.9	3.4	6.3	-	13.6
Receiver System	4.2	7.9	1.1	.3	13.5
Thermal Storage System	2.8	.3	5.7	.2	9.0
Collector System	3.5	.1	.7	-	4.3
EPGS System	4.7	4.1	3.1	.3	12.2
Misc.	2.2	1.9	3.4	-	7.5
Total Maintenance	<u>33.7</u>	<u>22.7</u>	<u>20.5</u>	<u>1.0</u>	<u>77.9</u>
SUB TOTAL	102.8	45.7	25.6	4.9	179.0
Division O.H.					21.3
TOTAL DIRECT					<u>200.3</u>
Workman's Compensation					.8
Payroll Tax					8.2
Pension & Benefits					24.5
Administrative & General					37.1
GRAND TOTAL					<u>270.9</u>

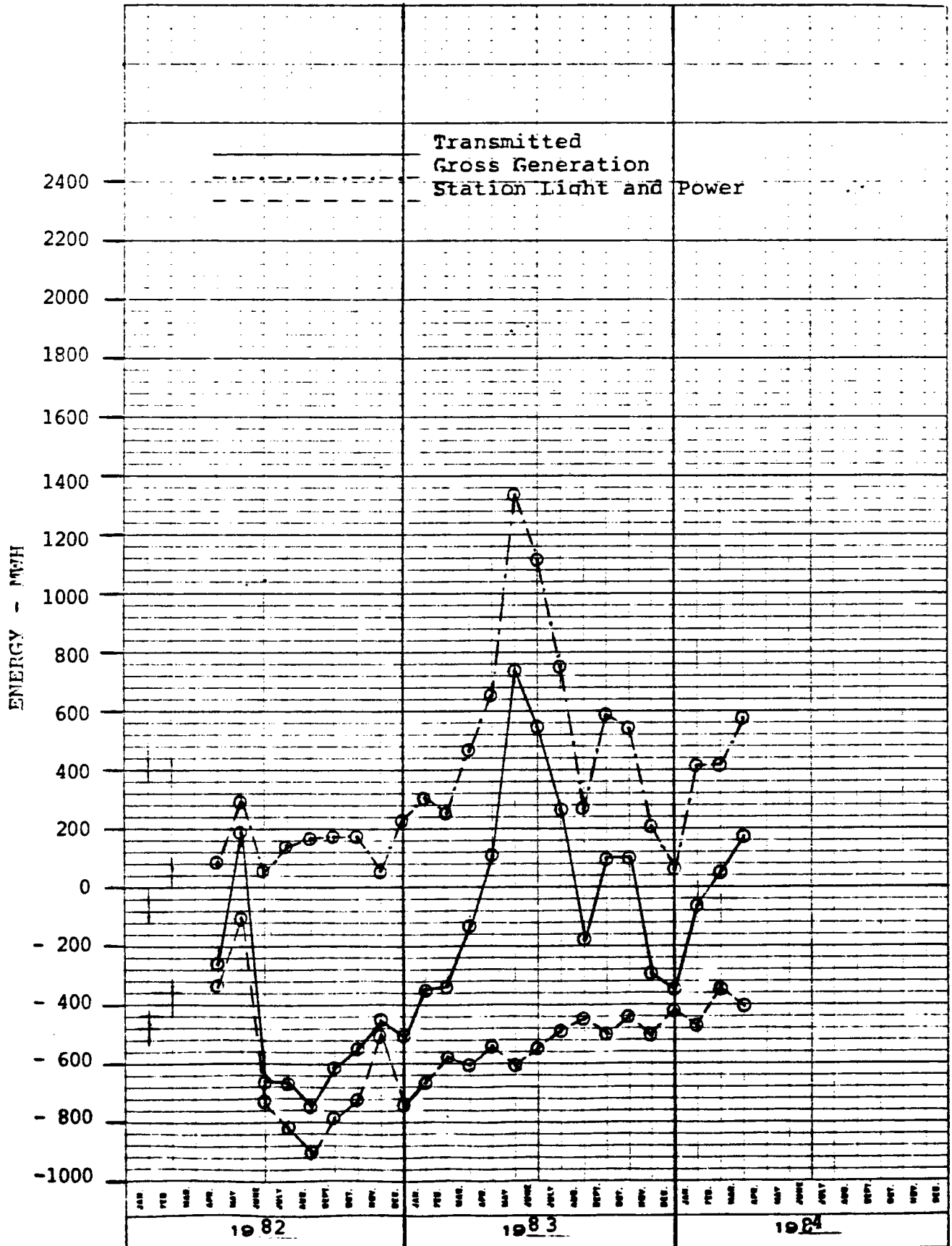
SOLAR ONE GENERATING STATIONChronological Summary of
Receiver Tube Defects

<u>DATE</u>	<u>DESCRIPTION OF TUBE DEFECT</u>	<u>LOCATION</u>
Jul 15, 1983	Interstitial weld leak	tube 30, panel 18
Jul 26, 1983	Interstitial weld leak	tube 41, panel 18
Aug 2, 1983	Bend leak	tube 70, panel 11
Aug 18, 1983	Repair/removal of sample Repair, grind & fill	tube 30, panel 18 tube 41, panel 18
Aug 19, 1983	Replaced cracked tube section	tube 70, panel 11
Sep 8, 1983	Crack indication	tube 30, panel 19
Oct 26, 1983	Crack indication Interstitial weld leak found & repaired Interstitial weld crack	tube 1, panel 18 tube 41, panel 12 tube 41, panel 13
Nov 1, 1983	Interstitial weld crack on: Surface irregularity	tube 41, panel 4 tube 41, panel 6 tube 30, panel 7 tube 41, panel 8 tube 41, panel 9 tube 30, panel 17 tube 41, panel 10
Nov 16, 1983	Bend leak Bend crack Bend crack Bend crack	tube 1, panel 15 tube 1, panel 16 tube 3, panel 16 tube 1, panel 17
Dec 1983	Outage - Removal of sample Repair of cracks	tube 1, panel 4 tube 1, panel 6 tube 1, panel 15 tube 1, panel 16 tube 2, panel 16 tube 3, panel 16
Jan 1984	Outage - Interstitial weld crack repair	tube 41, panel 13
Feb 1984	Outage - Interstitial weld crack repair Interstitial weld crack repair Bend crack Bend crack Bend crack Bend crack Surface polished	tube 41, panel 8 tube 41, panel 9 tube 70, panel 9 tube 70, panel 10 tube 70, panel 11 tube 70, panel 12 tube 41, panel 10

SOLAR ONE STATISTICS



SOLAR ONE
MONTHLY METER REPORT SUMMARY

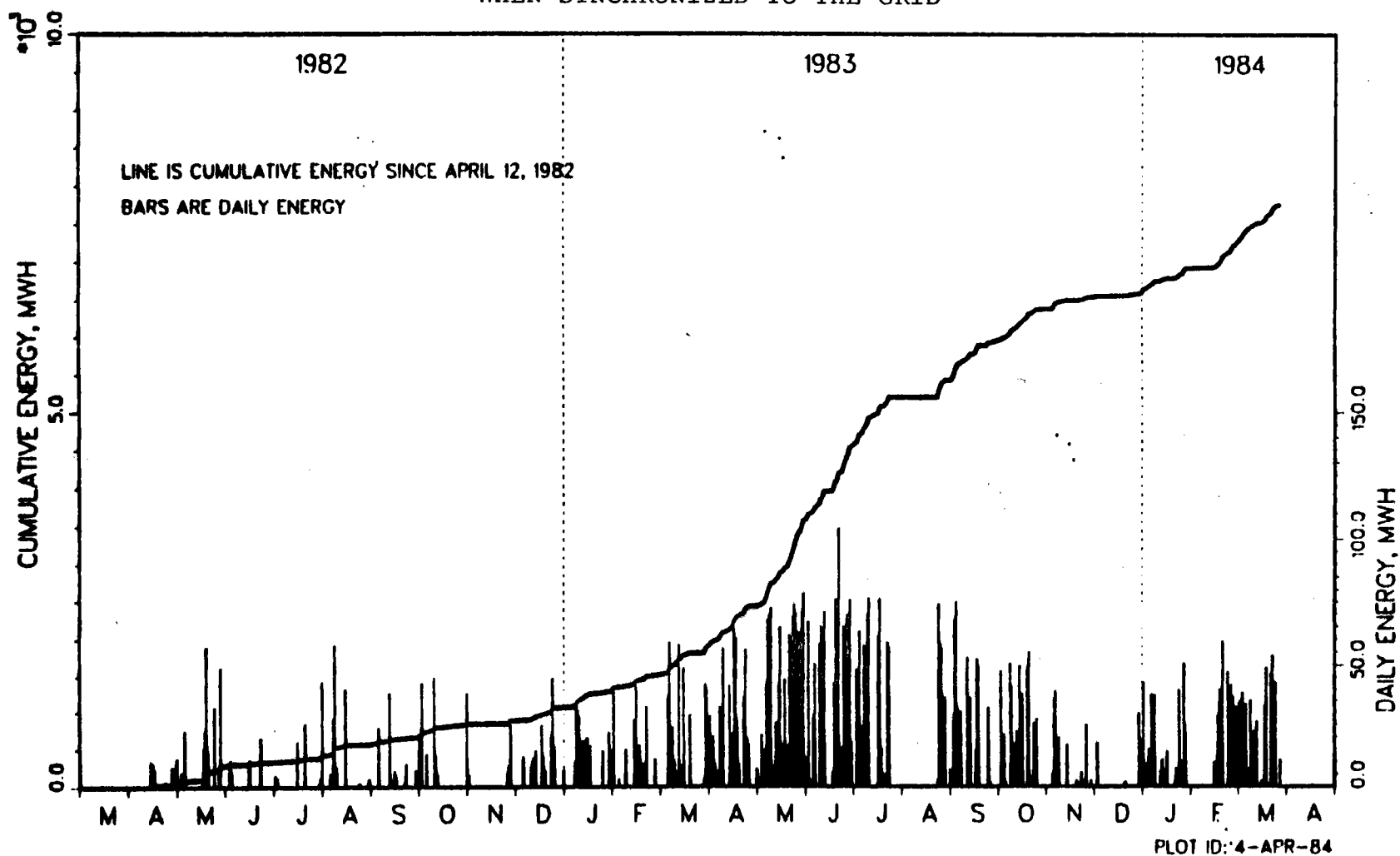


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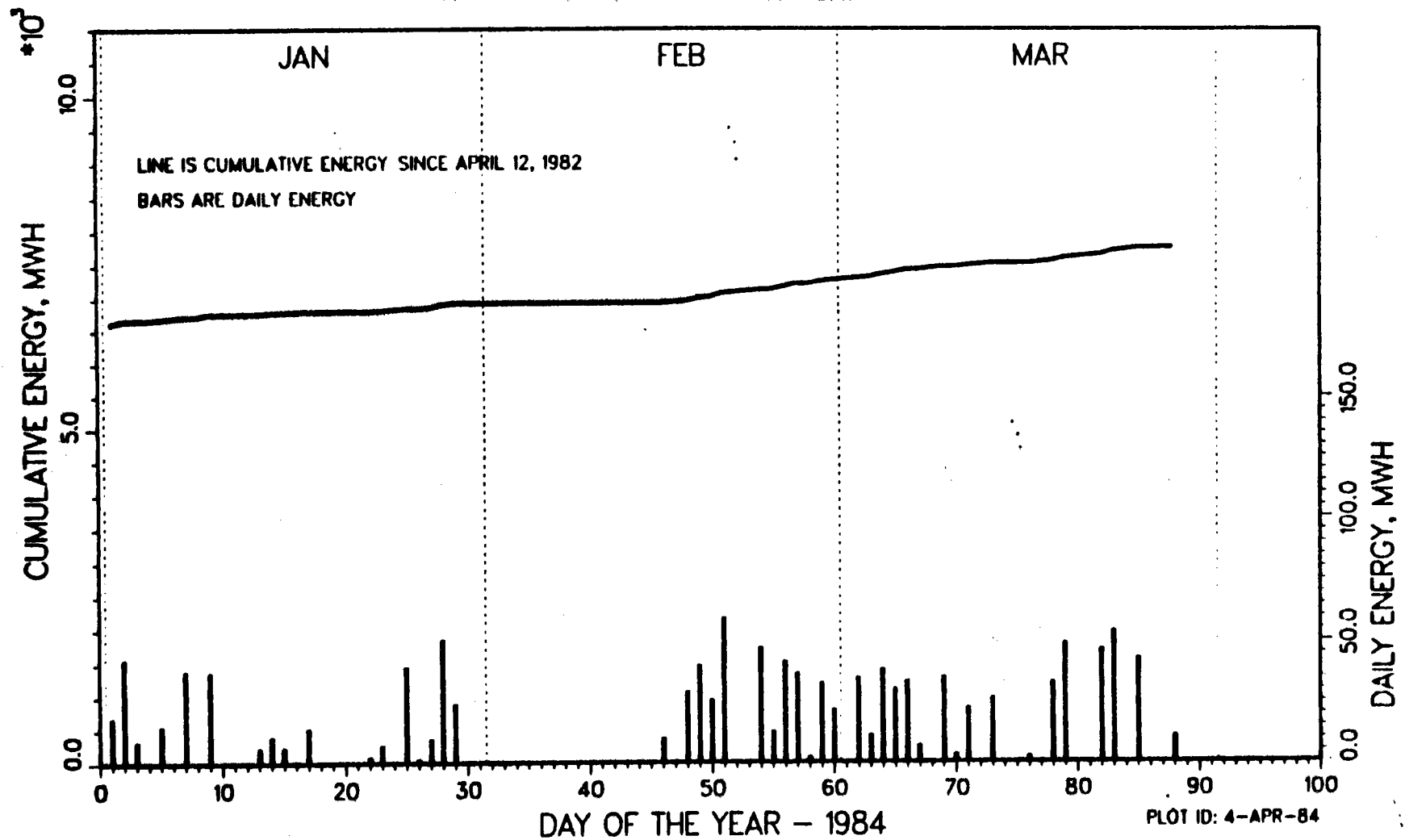
SOLAR ONE NET ELECTRICAL PRODUCTION

WHEN SYNCHRONIZED TO THE GRID



SOLAR ONE NET ELECTRICAL PRODUCTION

WHEN SYNCHRONIZED TO THE GRID



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memorandum

DATE **MAY 24 1984**

REPLY TO
ATTN OF

S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT

Submission of Monthly Operation & Maintenance Reports, October 1983 through March 1984, under Cooperative Agreement DE-FC03-77SF10501 for OPC and TIC Processing

TO

Roger S. Gaither, DOE/SAN (OPC)
William D. Matheny, DOE/TIC Document Control

Enclosed are the monthly Operation and Maintenance reports for the Solar One Project covering the period October 1983 through March 1984:

<u>Primary Document No.</u>	<u>Secondary No.</u>	<u>Title</u>
DOE/SF/10501-219	(STMP0-819)	Solar One O&M Report #19, October 1983
DOE/SF/10501-220	(STMP0-820)	Solar One O&M Report #20, November 1983
DOE/SF/10501-221	(STMP0-821)	Solar One O&M Report #21, December 1983
DOE/SF/10501-222	(STMP0-822)	Solar One O&M Report #22, January 1984
DOE/SF/10501-223	(STMP0-823)	Solar One O&M Report #23, February 1984
DOE/SF/10501-224	(STMP0-824)	Solar One O&M Report #24, March 1984

One copy of each report, accompanied by a completed SAN Form 70, is provided for SAN Office of Patent Counsel review and clearance. Please return a copy of the clearance to the Project Office; the documents may be destroyed.

Two copies of each report, accompanied by a completed DOE Form RA-426, are provided to DOE Technical Information Center for processing, archiving, announcement and forwarding to the National Technical Information Center.

Encls.: six monthly reports:
1 copy ea., w/SAN Form 70
2 copies ea., w/ DOE Form RA-426


S. D. Elliott, Jr.

cc: M. Lopez, DOE/SAN (FGS)
D. Holz, DOE/SAN (ISEA)
M. Soderstrum, Burns & McDonnell
C. W. Lopez, SCE

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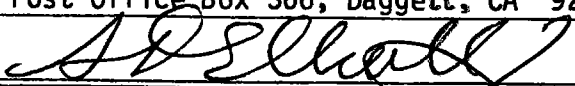
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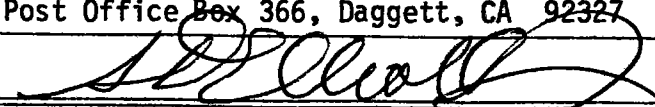
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S. D. Elliott, Jr., Director, DOE Solar One Project Office
Organization
Post Office Box 366, Daggett, CA 92327 (619) 254-2672
Signature S. D. Elliott, Jr. Date MAY 24 1984

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

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See Instructions on Reverse Side

1. DOE Report No. DOE/SF/10501-224 (STMP0-824)	2. Contract No. DE-FC03-77SF10501	3. Subject Category No. UC-62
---	--------------------------------------	----------------------------------

4. Title
"SOLAR ONE OPERATION & MAINTENANCE REPORT #24, MARCH 1984"

5. Type of Document ("x" one)
☒ a. Scientific and technical report
☐ b. Conference paper: Title of conference _____

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Organization
Post Office Box 366, Daggett, CA 92327 (619) 254-2672
Signature S. D. Elliott, Jr. Date MAY 24 1984



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

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

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

ATT: S. D. Elliott

19 DOE/SF/10501-219 (STMP0-819)
20 DOE/SF/10501-220 (STMP0-820)
21 DOE/SF/10501-221 (STMP0-821)
22 DOE/SF/10501-222 (STMP0-822)
23 DOE/SF/10501-223 (STMP0-823)
24 DOE/SF/10501-224 (STMP0-824)

Prime Contract No.
DE-FC03-77SF10501
Subcontract No.
(N/A)
Report No. (see to left)
Monthly Operation & Maintenance Reports 19 - 24
Date of Report
October 1983 thru March 1984
Name & Phone No. of DOE Technical Representative
S. D. Elliott, Jr.
(619) 254-2672

1. Document Title:

"SOLAR ONE OPERATION & MAINTENANCE REPORT (6 issues, #19, Oct. 1983 thru #24, March 1984

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Reviewing/Submitting Official: Name (Print/Type) C. W. Lopez

Title S&E R&D Site Manager

Signature *C. W. Lopez* Date 5/24/84

TO: INITIATOR OF REQUEST

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

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DEPARTMENT OF ENERGY
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CONTRACTOR REQUEST FOR PATENT CLEARANCE
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Prime Contract No. DE-FC03-77SF10501
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Reviewing/Submitting Official: Name (Print/Type) C. W. Lopez

Title SEE R&D Site Manager

Signature *Charles W. Lopez* Date 5/24/84

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Signed *L. E. Carnahan*

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