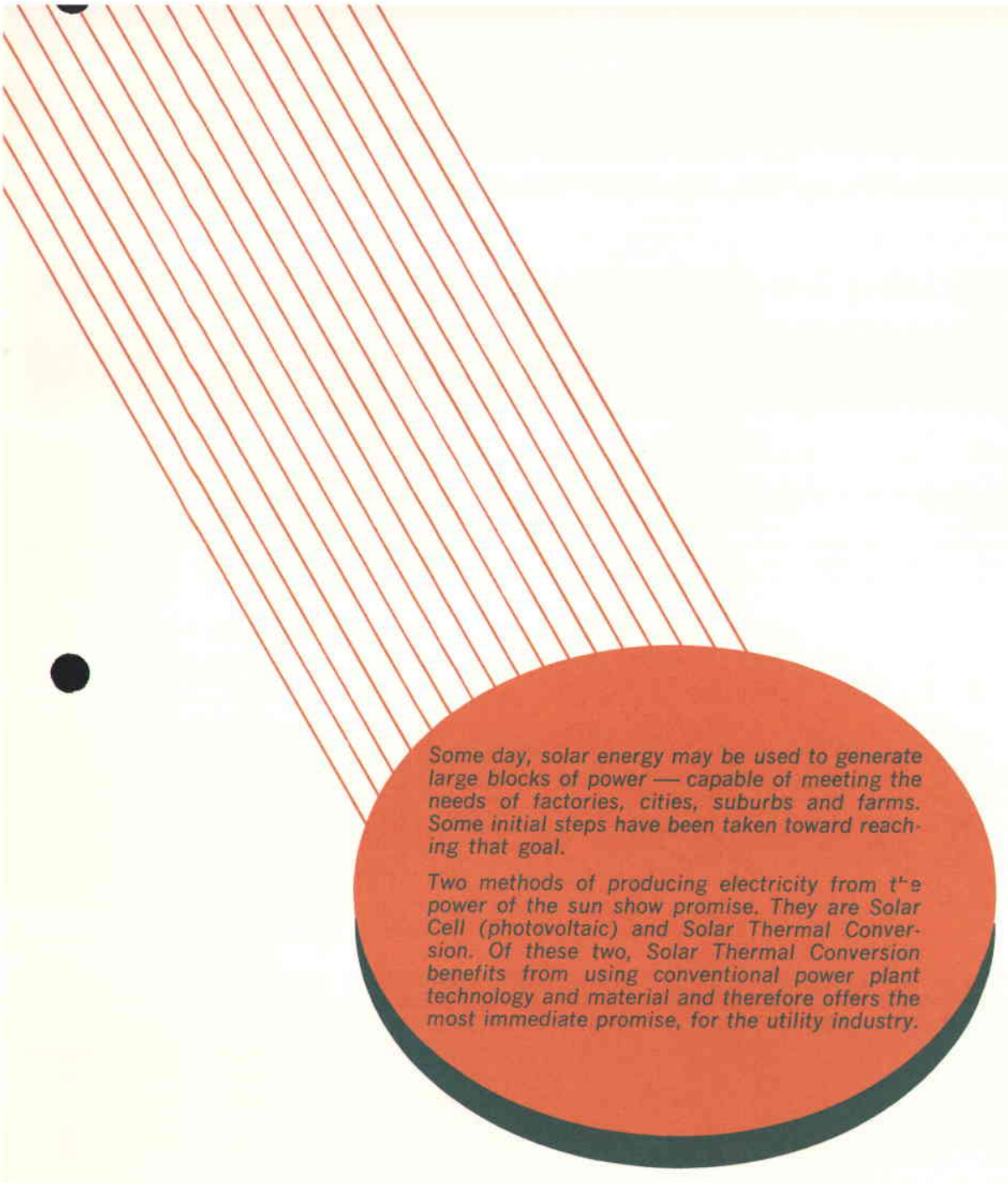
DOE/SF/10501-004
(STMPO-040)

SOLAR ONE

A 10-MEGAWATT SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT
A cooperative effort between the U.S. Department of Energy and
Southern California Edison Company, L.A. Department of Water and Power,
California Energy Commission.



Some day, solar energy may be used to generate large blocks of power — capable of meeting the needs of factories, cities, suburbs and farms. Some initial steps have been taken toward reaching that goal.

Two methods of producing electricity from the power of the sun show promise. They are Solar Cell (photovoltaic) and Solar Thermal Conversion. Of these two, Solar Thermal Conversion benefits from using conventional power plant technology and material and therefore offers the most immediate promise, for the utility industry.

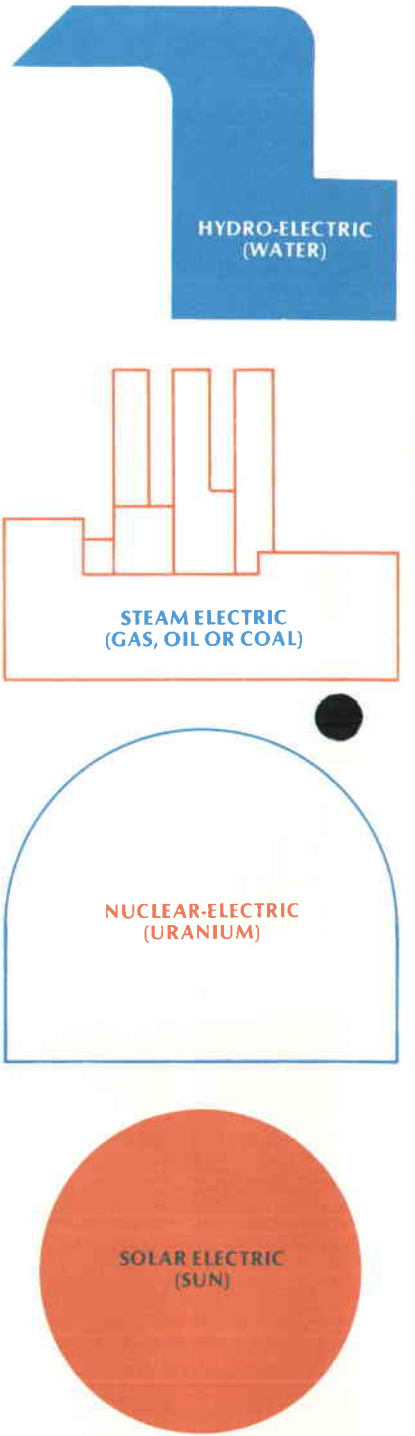
HOW ELECTRICITY IS GENERATED

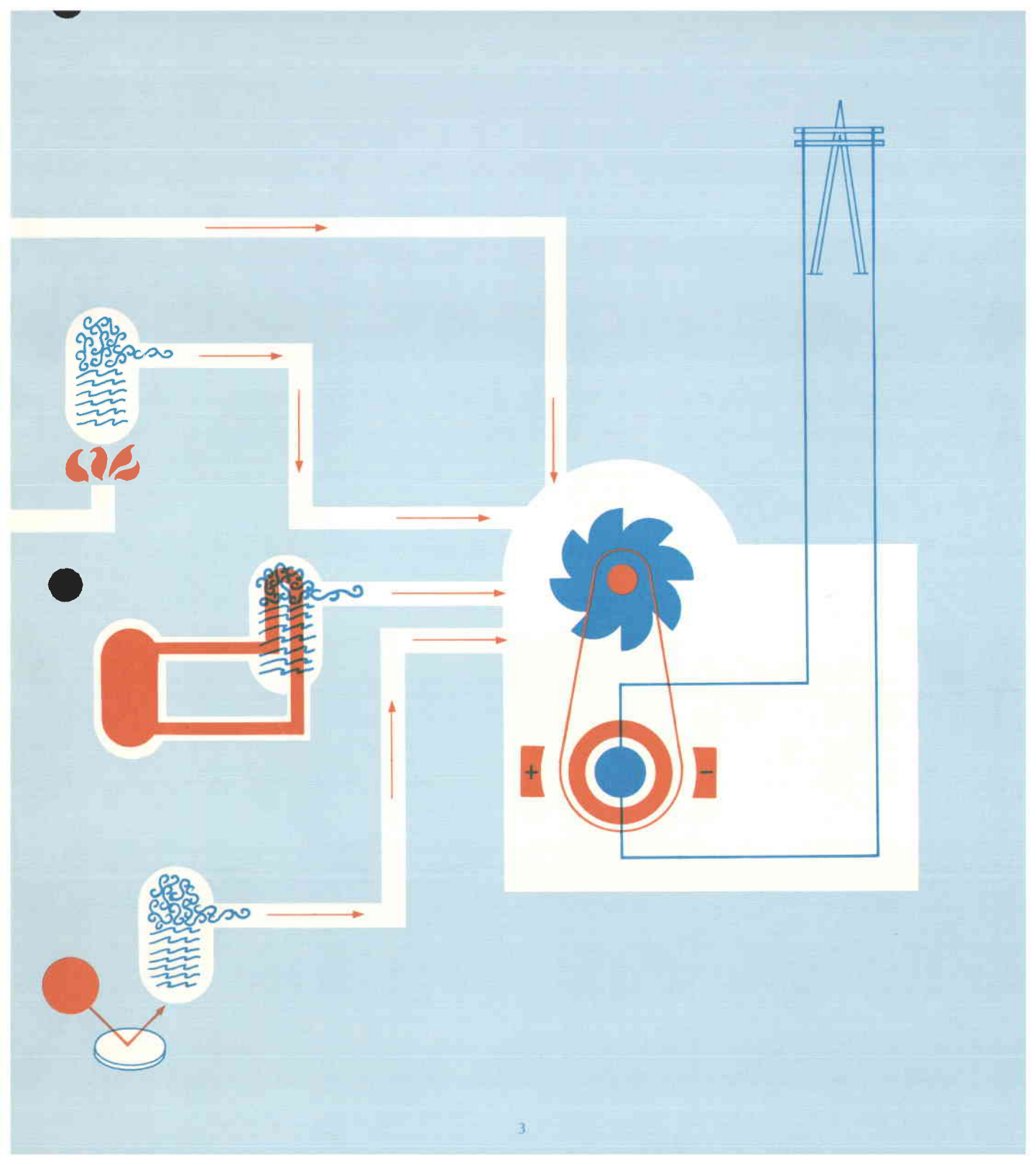
At present, all electric power supplied to Southern and Central California is produced by turbine-generators. The only differences in method are the power sources used to drive the turbines. There are two basic methods of doing this... hydroelectric and steam-electric.

The hydroelectric method utilizes the power of falling water. Water, stored in a reservoir, is released as needed and directed against turbine blades which spin a generator to produce electricity.

The second method, which is used to produce most electricity in Southern California, is steam-electric generation. In this system, water is heated to form high-pressure steam; which, in turn, provides the energy for the turbine that drives the generator.

Steam-electric generation traditionally has utilized the heat from the combustion of fossil fuels (oil, gas or coal) or the heat from nuclear fission to produce steam. In solar thermal conversion, heat from the sun is used to produce the steam. Shown at right is a diagram illustrating these methods of generating electricity.





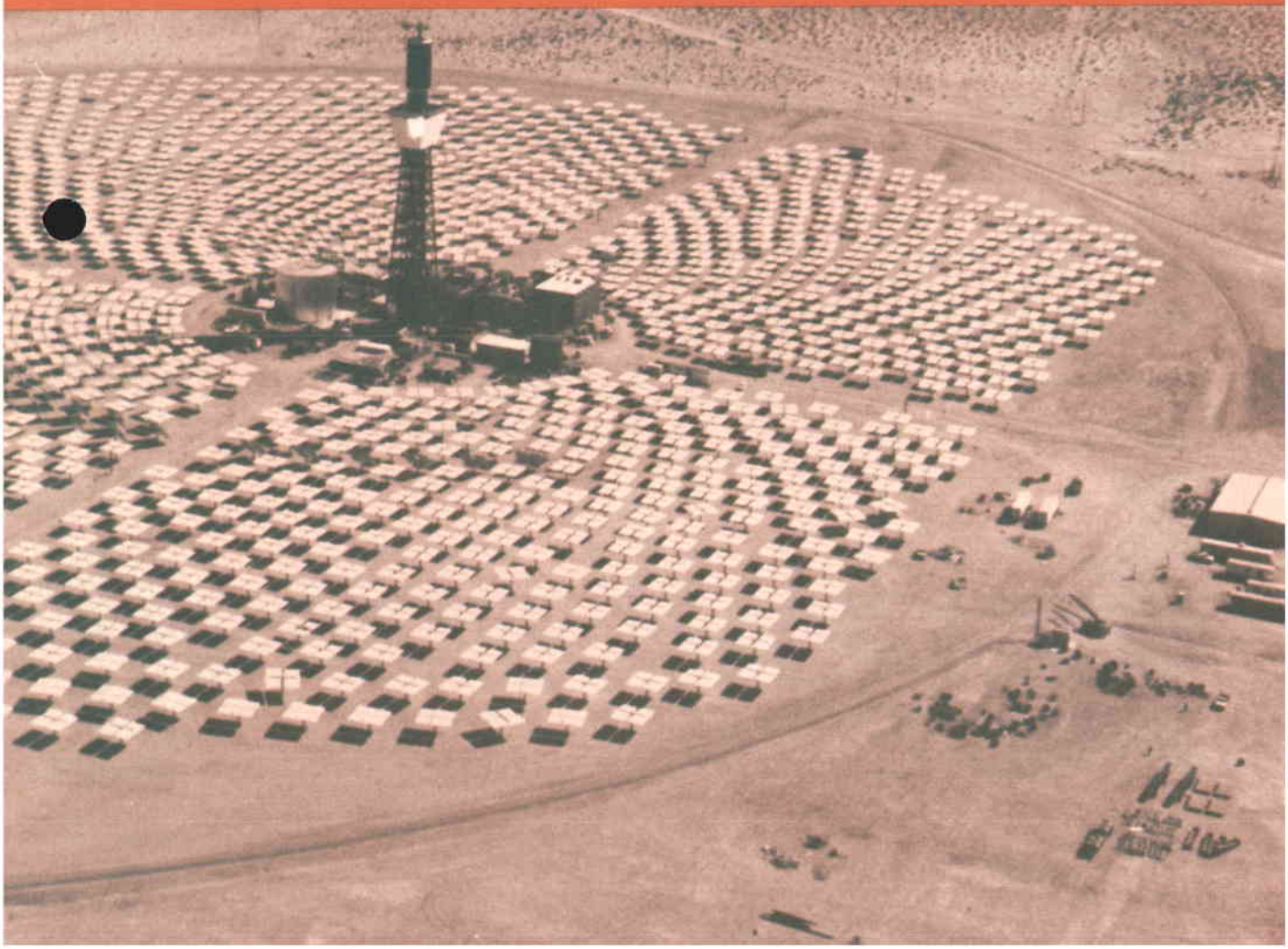
CONVERSION

In mid-1974, a national goal was established to have a pilot-scale solar thermal central receiver plant operating by the early 1980's. The need for early utility company experience with solar electric technology was apparent to the managers of the Federal program. So in 1976, the U.S. Department of Energy (DOE), formerly the Energy Research and Development Administration, selected Edison, the

southeast of the city of Barstow, California. The construction of the experimental generating facility is costing project participants approximately $142 million.

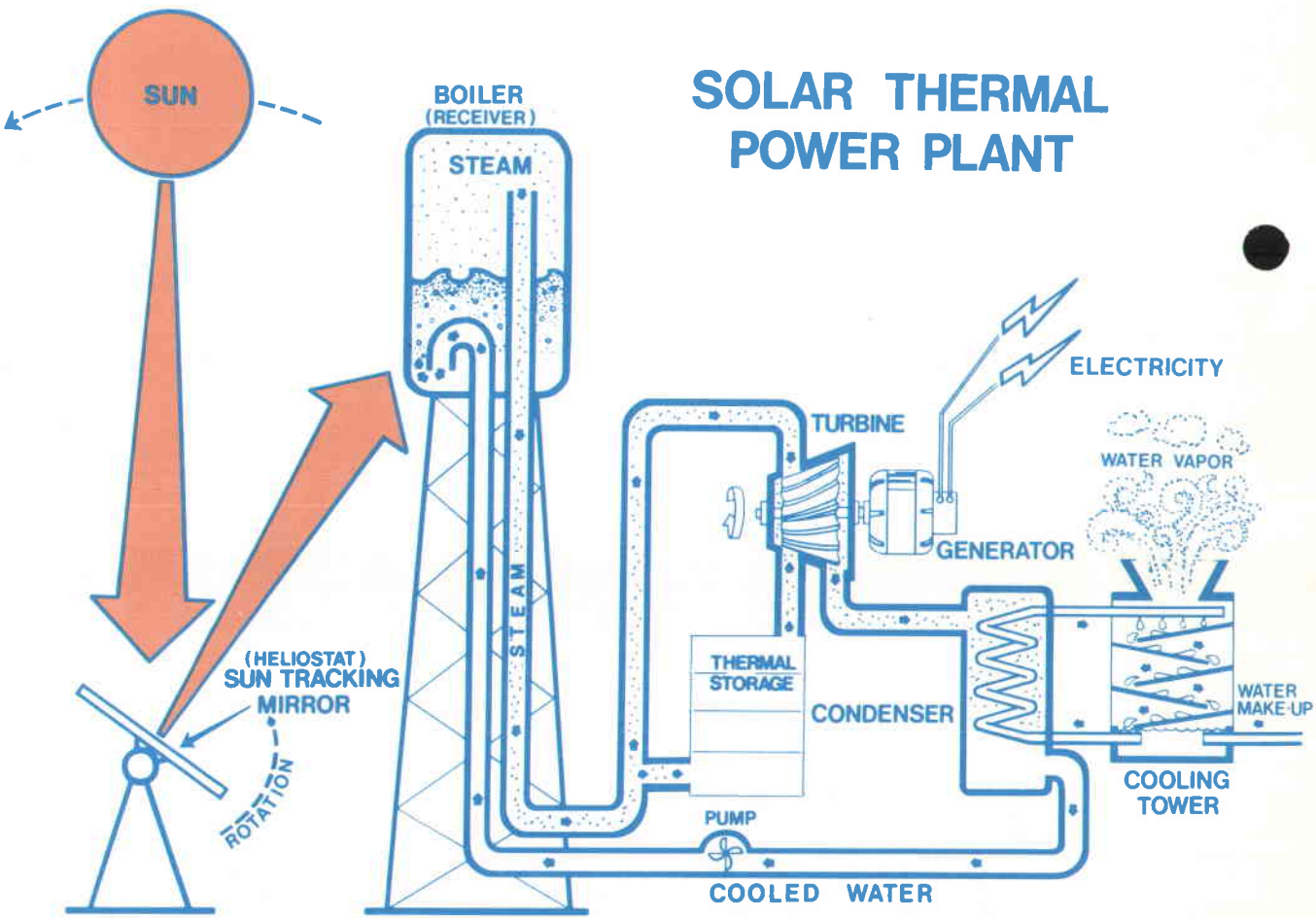
Solar thermal power generation systems collect solar energy as heat and deliver it in the form of receiver concept. Sunlight is reflected from tracking mirrors to reflect and concentrate sunlight on a centrally located receiver/boiler that produces steam.

The pilot plant experiment will be used to develop information towards future commercial plants of similar design.

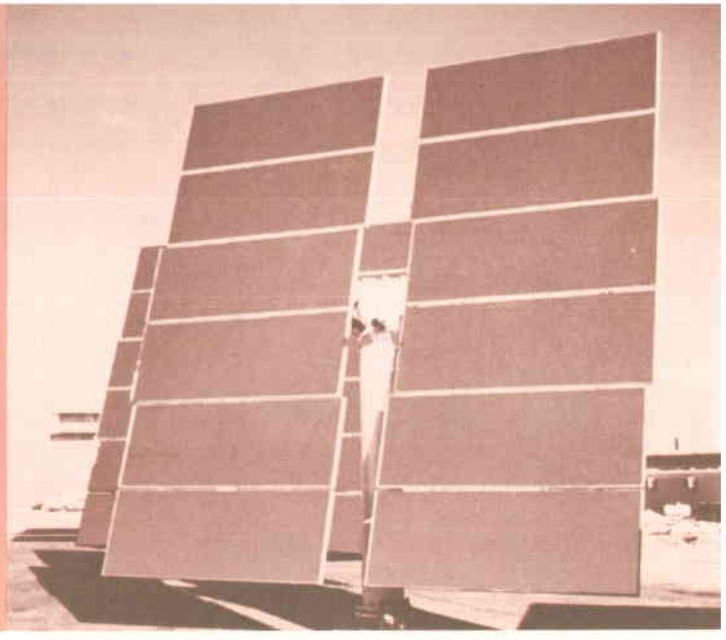


HERE'S HOW THE SYSTEM WORKS

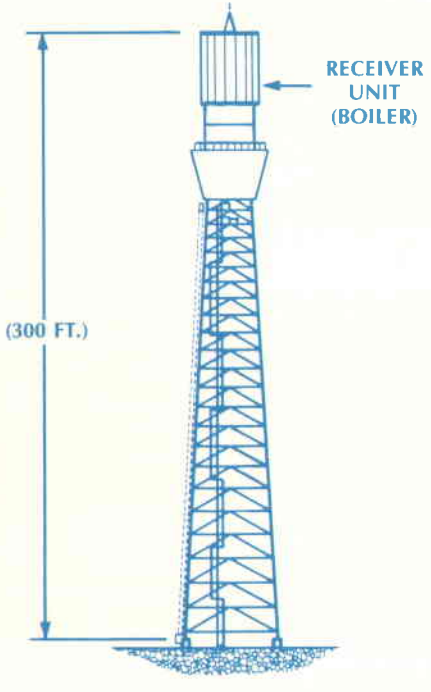
Sunlight strikes the heliostat (a sun-tracking mirror) and is reflected to the elevated receiver/boiler that absorbs the heat and turns water to steam. The steam is then directed to a conventional turbine generator where electrical power is produced. During periods when excess steam is available, it is directed to a system for storage and later extracted during periods when no sun is available. After use, the steam is cooled and condensed back to water so that it can be pumped back up to the tower to be reheated to steam and put to work again. A conventional cooling system (consisting of a wet cooling tower, piping and condenser) is used to cool the exhaust steam.

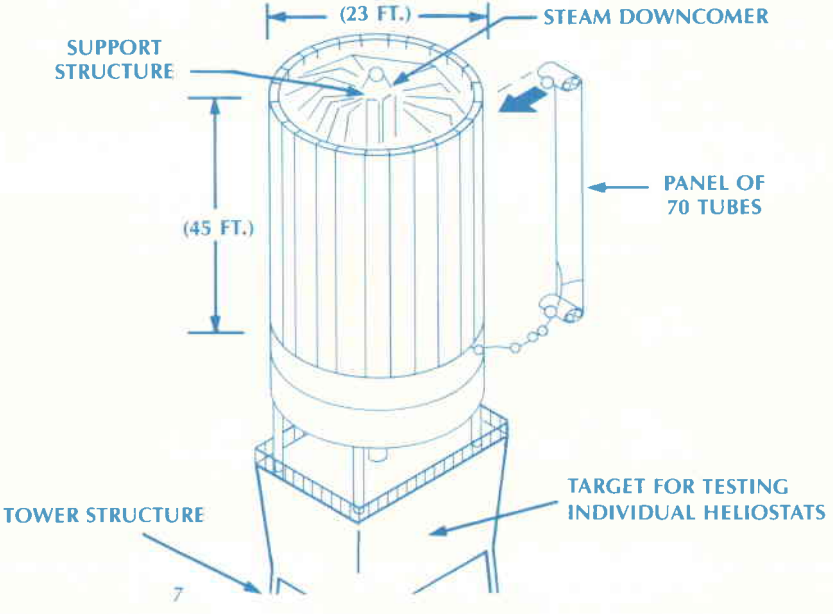


The design for the collector field calls for 1,818 mirror modules, called heliostats, with a reflective area of 430 square feet per heliostat. The overall size of each heliostat is nearly 23 feet wide by 23 feet high. The field of heliostats surrounds the receiver tower with the tower set off center in the southern portion of the field. To focus the sunlight, the heliostats adjust continuously as the sun moves. The mirrors track the sun using two axes of rotation, azimuth and elevation. Each heliostat is supported on one central foundation and is capable of being stowed in a face-down, horizontal position during adverse weather conditions.



The receiver/boiler is a once-through (without a boiler drum) design with rated steam conditions of 960 degrees F. and 1515 psia (pounds per square inch absolute). It will produce enough steam to run the turbine generator at 10 megawatts for 8 hours on a summer day and for 4 hours on a winter day. The diameter of the boiler is 23 feet and the tube panels are 45 feet tall. Each of the tube panels contain seventy ½" outside diameter nickel alloy steel tubes. The tower itself is steel.

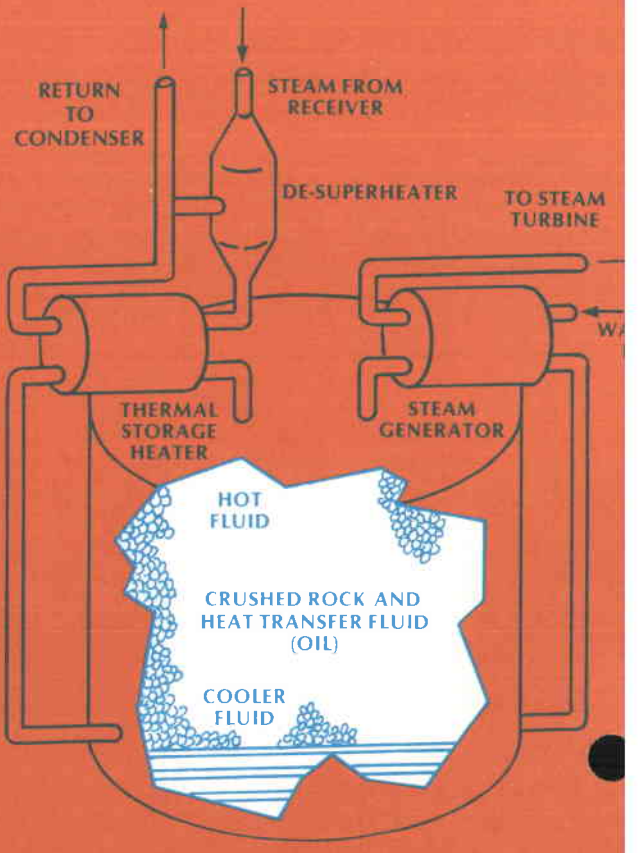




ERMAL
ORAGE SYSTEM

rmal storage subsystem utilizes an oil/rock cline principle for storing thermal energy. red thermal energy is capable of producing o power the turbine-generator at a reduced 7 megawatts for 4 hours. The thermal storage gives the pilot plant the flexibility of generat- tricity during periods of cloud cover and in ly evening hours following sunset.

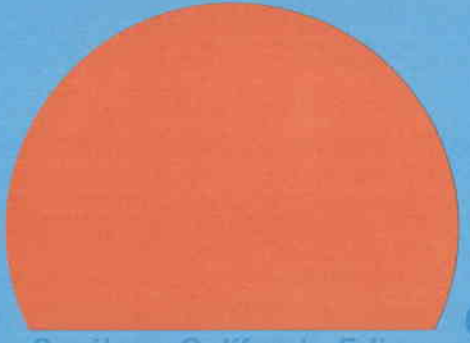
rock thermocline principle uses a tank filled cks, and an oil capable of withstanding high atures (575°F). Oil is taken from the bottom ank, heated in a heat exchanger with steam e receiver, and then pumped into the top of k. As sufficient quantities of hot oil are d into the top of the tank, the rocks are and the heat is retained in the oil and rocks. im heat from storage, hot oil is withdrawn e top of the tank, passes through heat ex- rs to produce steam, and is pumped back to tom of the tank. The steam produced is o the turbine to generate electricity.



THE FUTURE OF SOLAR ELECTRIC POWER

The project described in this booklet, and other projects Edison is supporting on its own and through its contributions to the Electric Power Research Institute and its technical assistance to the Department of Energy, will help put solar technology to use in Southern California.

Solar electric power plants may be available as proven commercial technology by the early 1990's. Edison takes pride in the pioneering role it is playing in developing this energy option for the future.



Southern California Edison SCE

DOE F 1325.8
(7-79)

STMPO-040

U.S. DEPARTMENT OF ENERGY (1)

memorandum

DATE: SEP 10 1984

REPLY TO ATTN OF: S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT: Transmittal of Five Documents Prepared under Cooperative Agreement DE-FC03-77SF 10501 for Patent Review and Clearance, OSTI Processing and Forwarding to NTIS

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

Enclosed are five documents prepared by the various parties to Cooperative Agreement DE-FC03-77SF10501 in connection with the 10-MWe Solar Thermal Central Receiver Pilot Plant Project ("Solar One"):

DOE Number	Secondary No.	Brief Title
DOE/SF/10501-004	(STMPO-040)	"Solar One" Brochure, Revision 2
DOE/SF/10501-061	(STMPO-539)	Safety Plan: 10-MWe...Pilot Plant"
DOE/SF/10501-062	(STMPO-062)	Maintenance Program: 10-MWe...Pilot Plant"
DOE/SF/10501-063	(STMPO-964)	..Operational Test Management Plan: Three-Year Power Production Phase
DOE/SF/10501-064	(STMPO-598)	..Project Summary Report and Lessons Learned

One copy of each report, with accompanying SAN Form 70, is forwarded to DOE/SAN Office of Patent Counsel for patent review and clearance. Please return a copy of the clearance form for each document to this office when completed; review copies of all documents may be discarded except for STMPO-598, which should be returned to SAN/FGS, Attn. M. Lopez.

Two copies of each document, with accompanying DOE Form RA-426, are forwarded to DOE Office of Scientific and Technical Information for archiving, announcement, microcopying and forwarding to the National Technical Information Service, as appropriate.

Encls.: 5 Documents:
1 ea. to SAN/OPC w/ SAN Form 70
2 ea. to DOE/OSTI w/ DOE Form RA-426

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

cc: M. Lopez, DOE/SAN (FGS)
P. Skvarna/J. Wells, SCE R&D
D. Holz, DOE/SAN (ISEA)
M. Soderstrum, Burns & McDonnell

SAN FORM 70 10/80

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.	DOE/SF/10501-004 (STMPO-040)
Date of Report	4/78; Rev. 2 5/81
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

FROM: DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327
ATTEN.: S. D. Elliott, Jr.

1. Document Title:
"SOLAR ONE"

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

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine) 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 by me.

6. Remarks:
Return copy of Patent Clearance to Project Office; Document may be Destroyed

Reviewing/Submitting Official: Name (Print/Type) _____
Title S. D. Elliott, Jr., Director, DOE Solar One Proj. Off
Signature S.D.Elliott Jr. Date 10 Sept., 1984

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 OFFICE OF PATENT COUNSEL (OPC)

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10501-004 (STMPO-040)	DE-FC03-77SF10501	UC-62, -62c, -62d

4. Title
"SOLAR ONE" (Revision 2, 5/81; orig. publication 4/78)

5. Type of Document ("x" one)
- ☐ a. Scientific and technical report
- ☐ b. Conference paper: Title of conference _____
  Date of conference _____
  Exact location of conference _____ Sponsoring organization _____
- ☒ c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.) Informationa Brochure

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☐ d. within DOE. ☐ e. to those listed in item 13 below.

- ☒ f. Other (Specify) Archive/issue on request

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- ☒ a. Normal procedure may be followed. ☐ b. Recommend the following announcement limitations:

9. Reason for Restrictions Recommended in 7 or 8 above.
- ☐ a. Preliminary information. ☐ b. Prepared primarily for internal use. ☐ c. Other (Explain)

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14. Submitted by (Name and Position) (Please print or type)

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

Organization

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

Signature	Date
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SAN FORM 70 10/80

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Signed Harold W. Dixon Date Mailed 9/17/84

2

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

MEMO TO Doug Elliott

September 6, 1984
DATE PREPARED

Doug:

These 2 are the only ones I have extra copies of. The rest are a one-of-a-kind file copy that I hesitate to part with. The 1st brochure had a different cover page and an artist rendering inside the centerfold picture. I zeroed it for you.

FROM Joyce Wells

SCE 50-1-3 NEW 9/74

Solar One Brochures

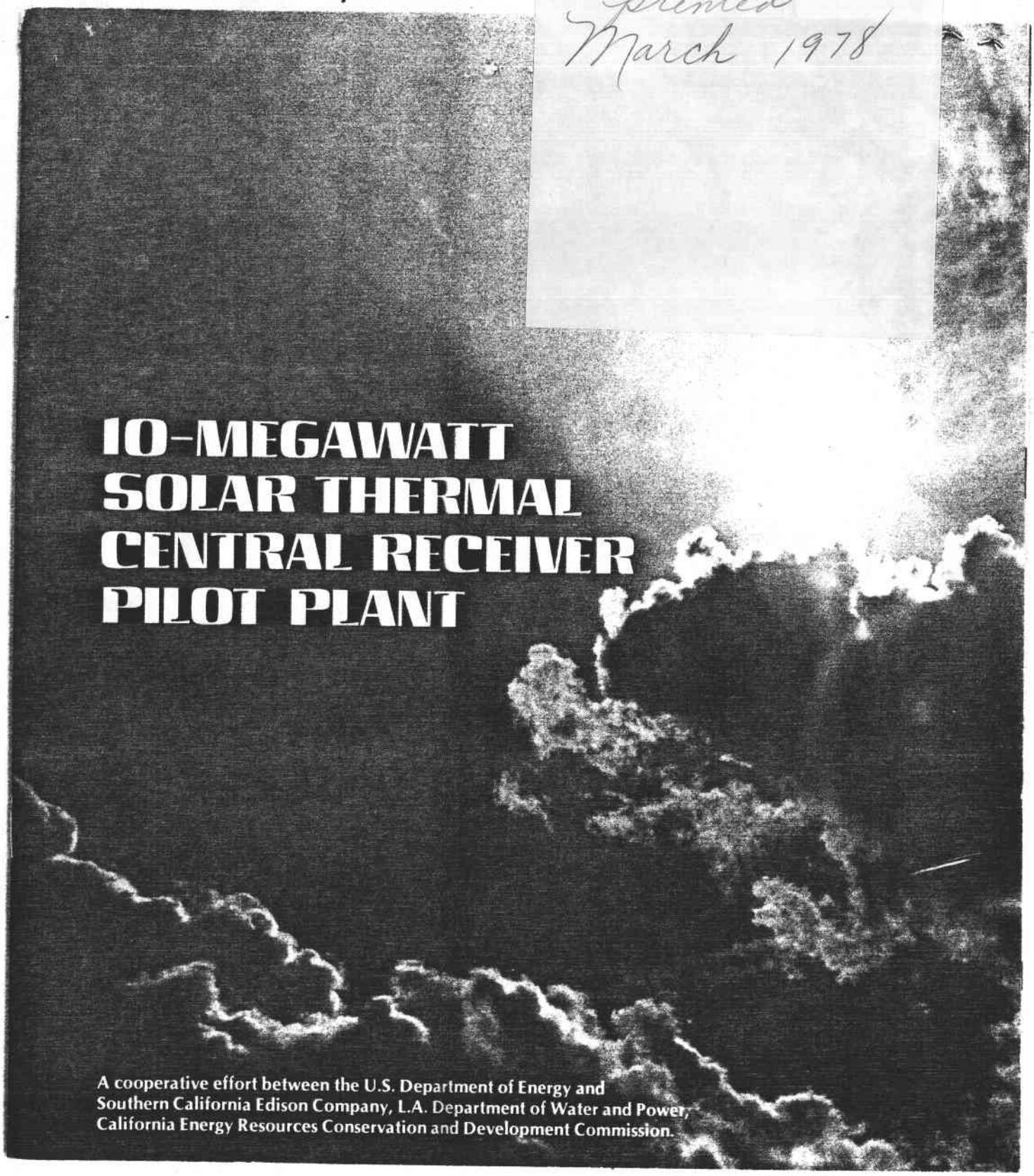
1. March	1978	15,000 printed
2. April	1978	15,000 printed
3. July	1978	15,000 printed
4. July	1980	25,000 printed
5. November	1981	25,000 printed
6. April	1983	30,000 printed

purple cover

15,000 2/78

This was the first cover page

15,000 printed March 1978



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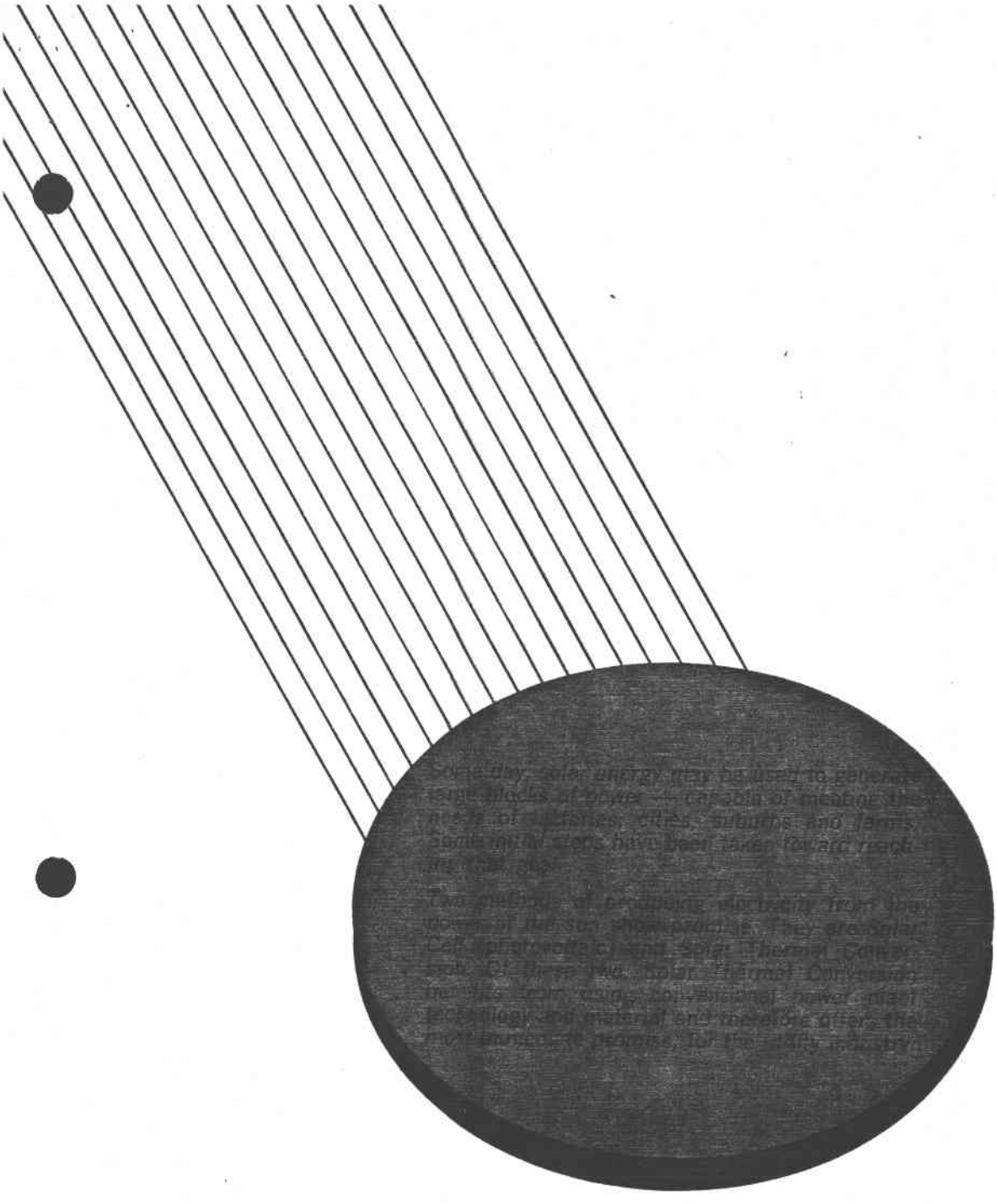

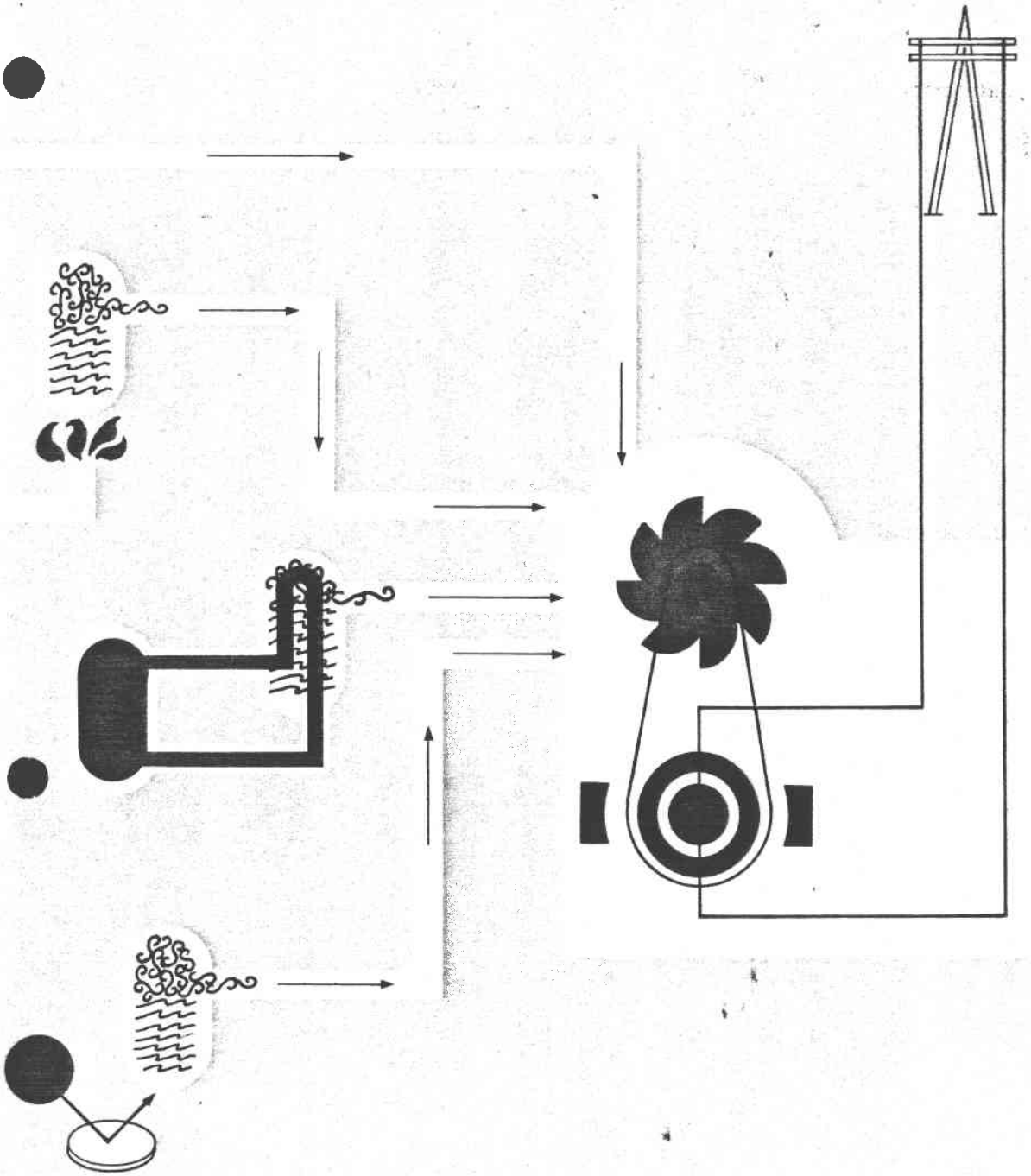

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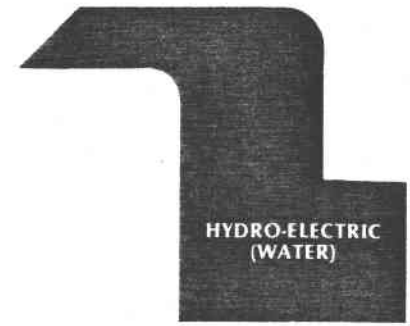

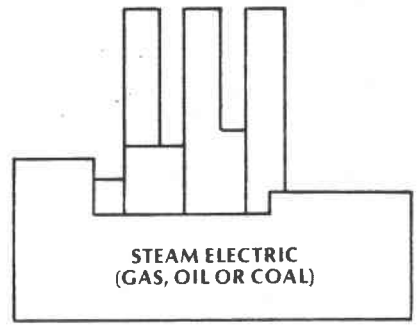

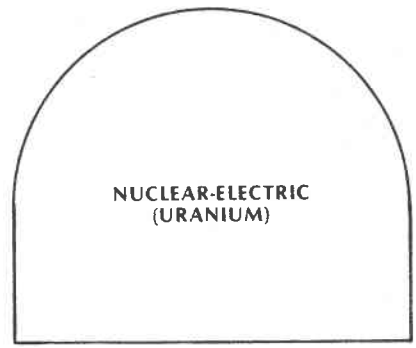

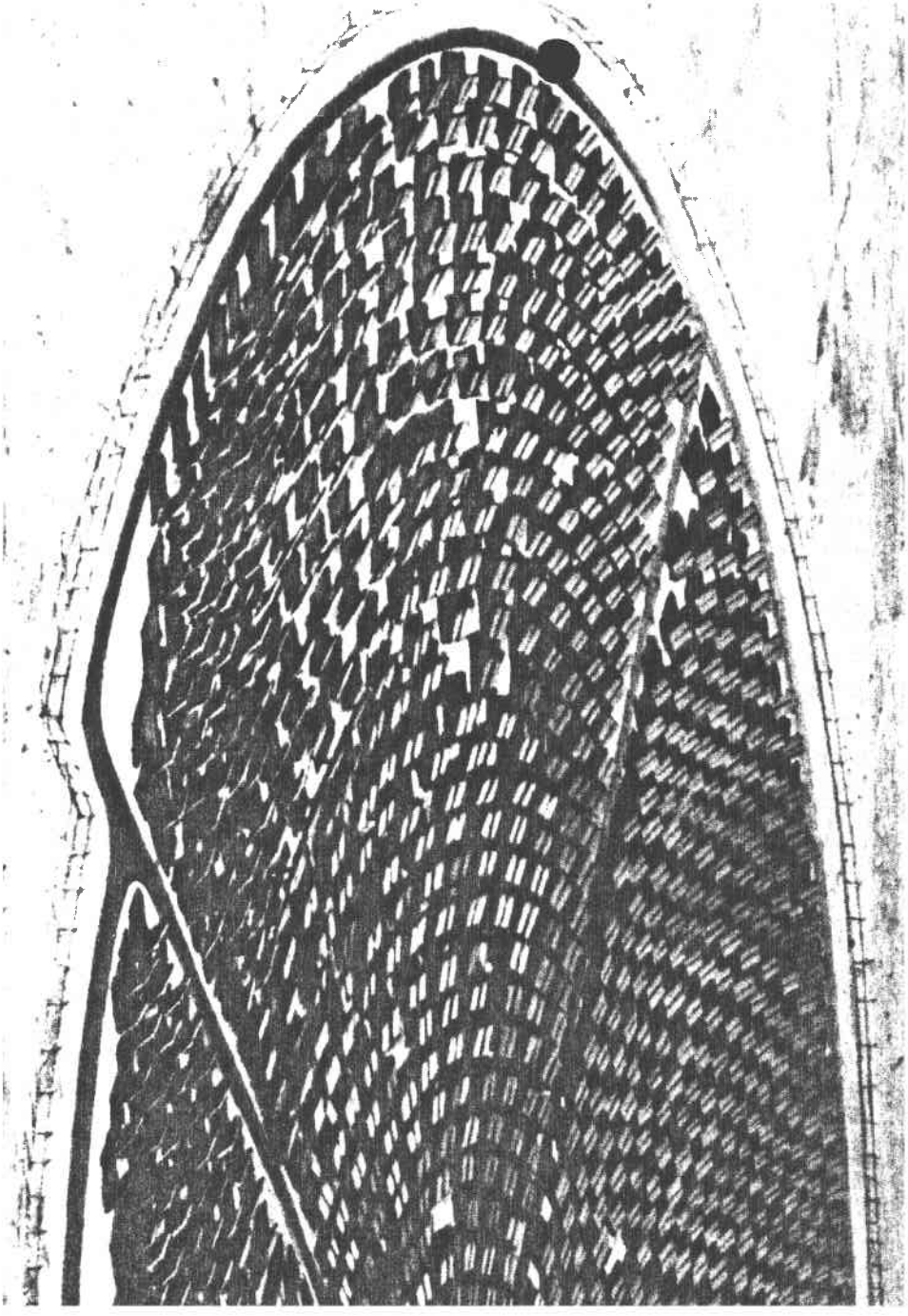

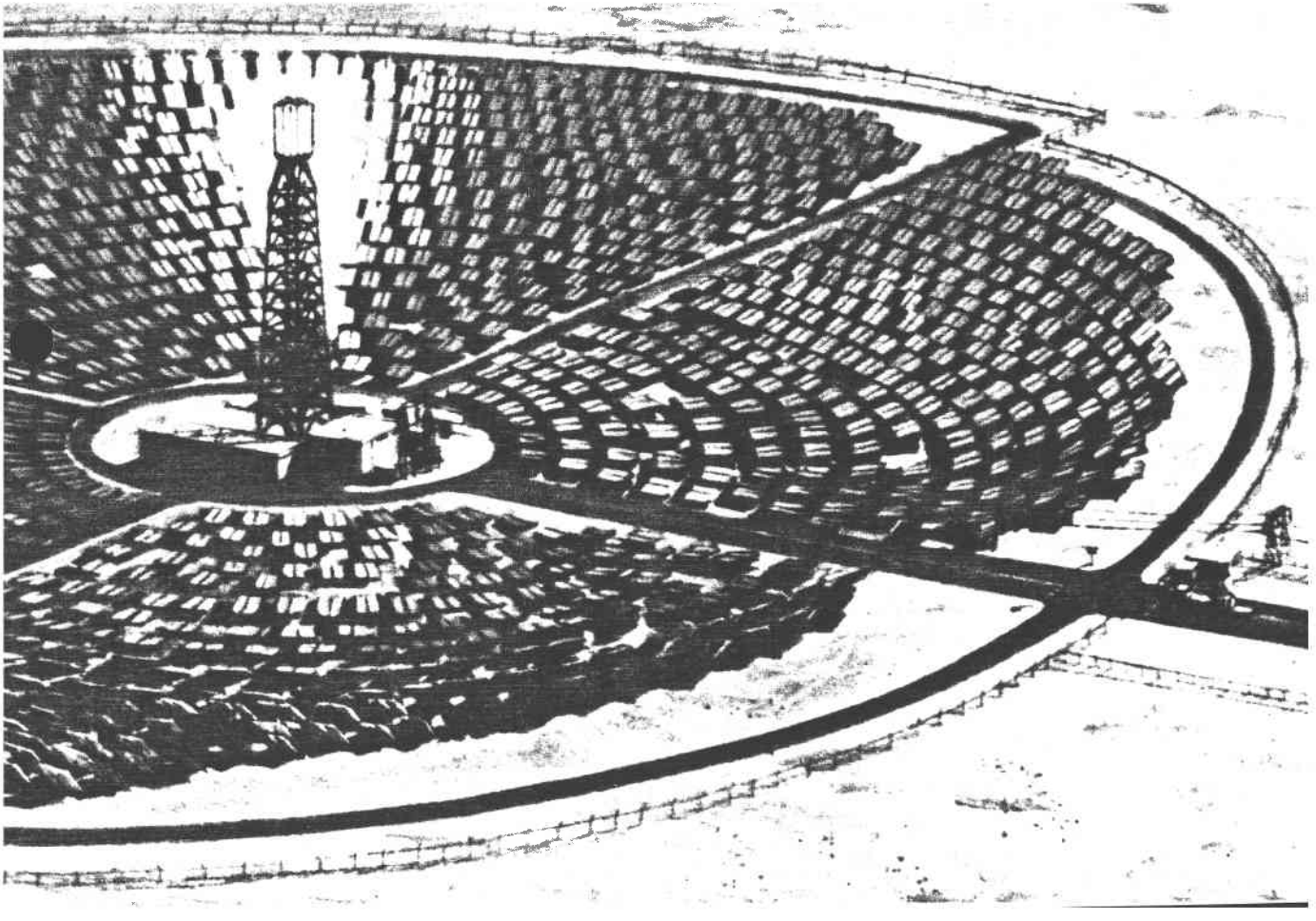

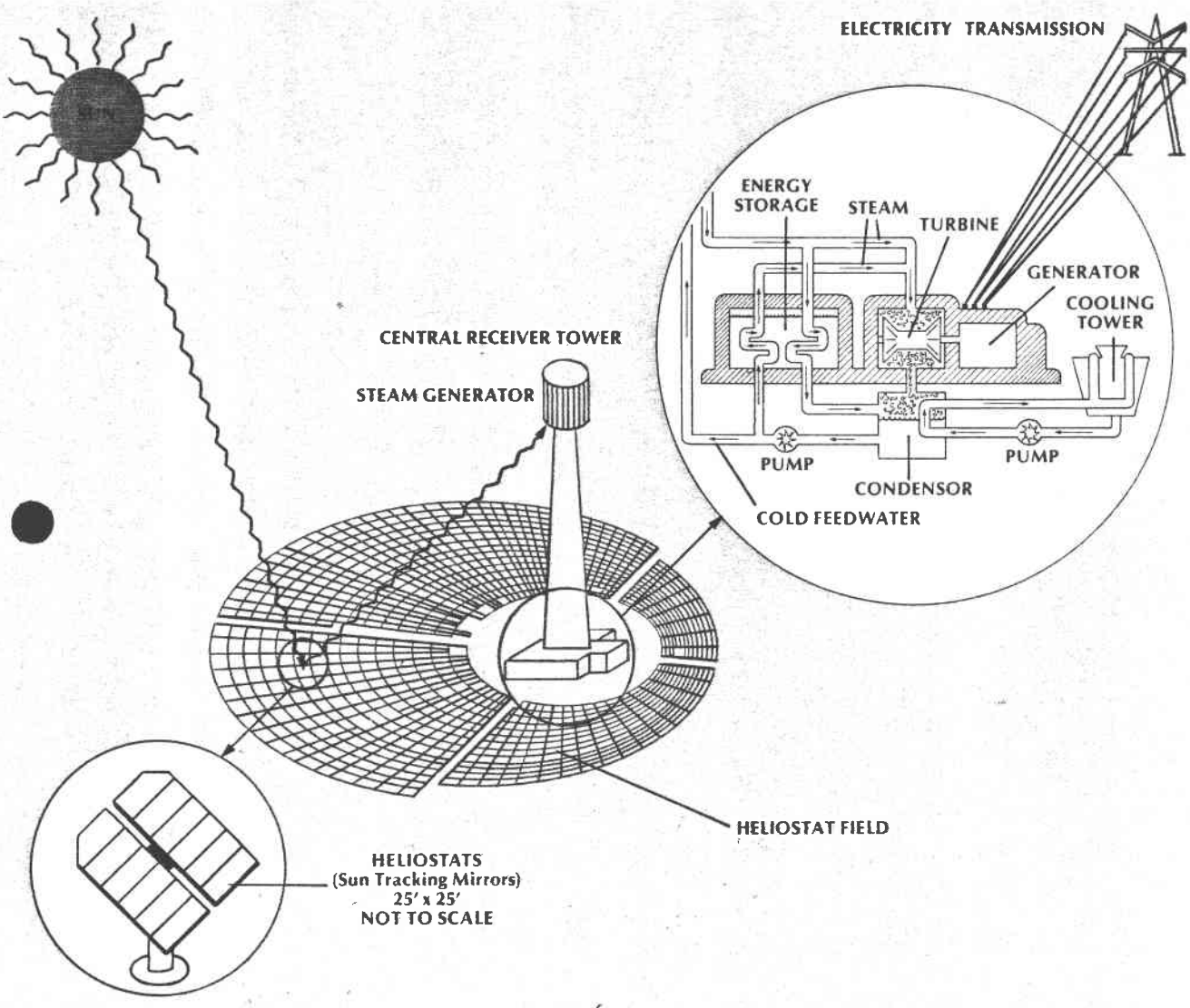
SUN
ELECTRICITY TRANSMISSION
ENERGY STORAGE
STEAM
TURBINE
GENERATOR
COOLING TOWER
CENTRAL RECEIVER TOWER
STEAM GENERATOR
PUMP
PUMP
CONDENSOR
COLD FEEDWATER
HELIOSTAT FIELD
HELIOSTATS
(Sun Tracking Mirrors)
25' x 25'
NOT TO SCALE

HELIOSTAT SYSTEM

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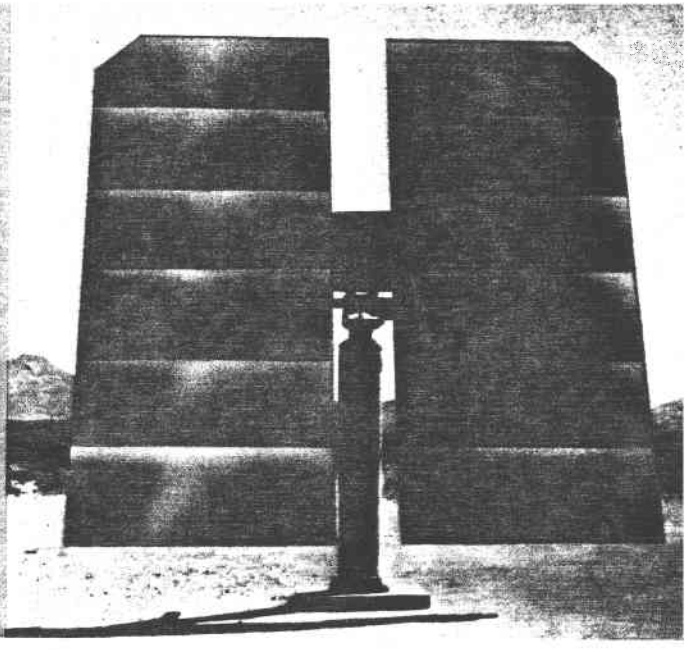
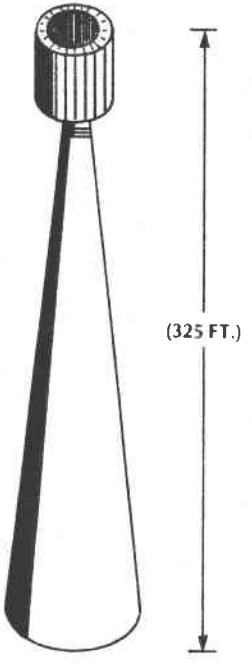
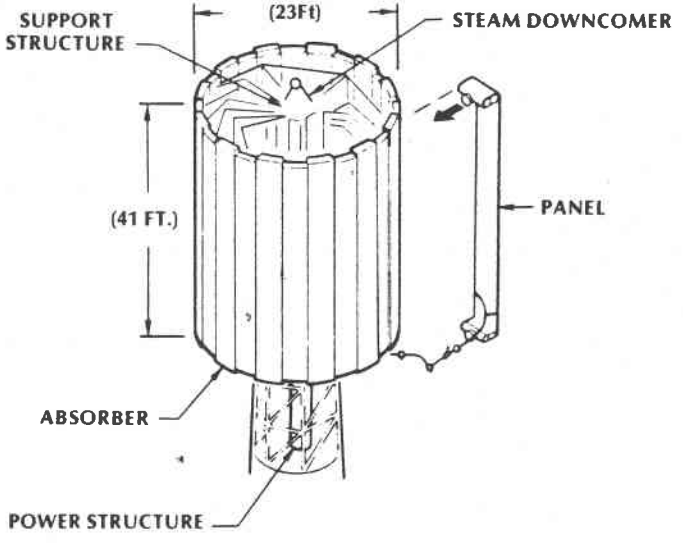
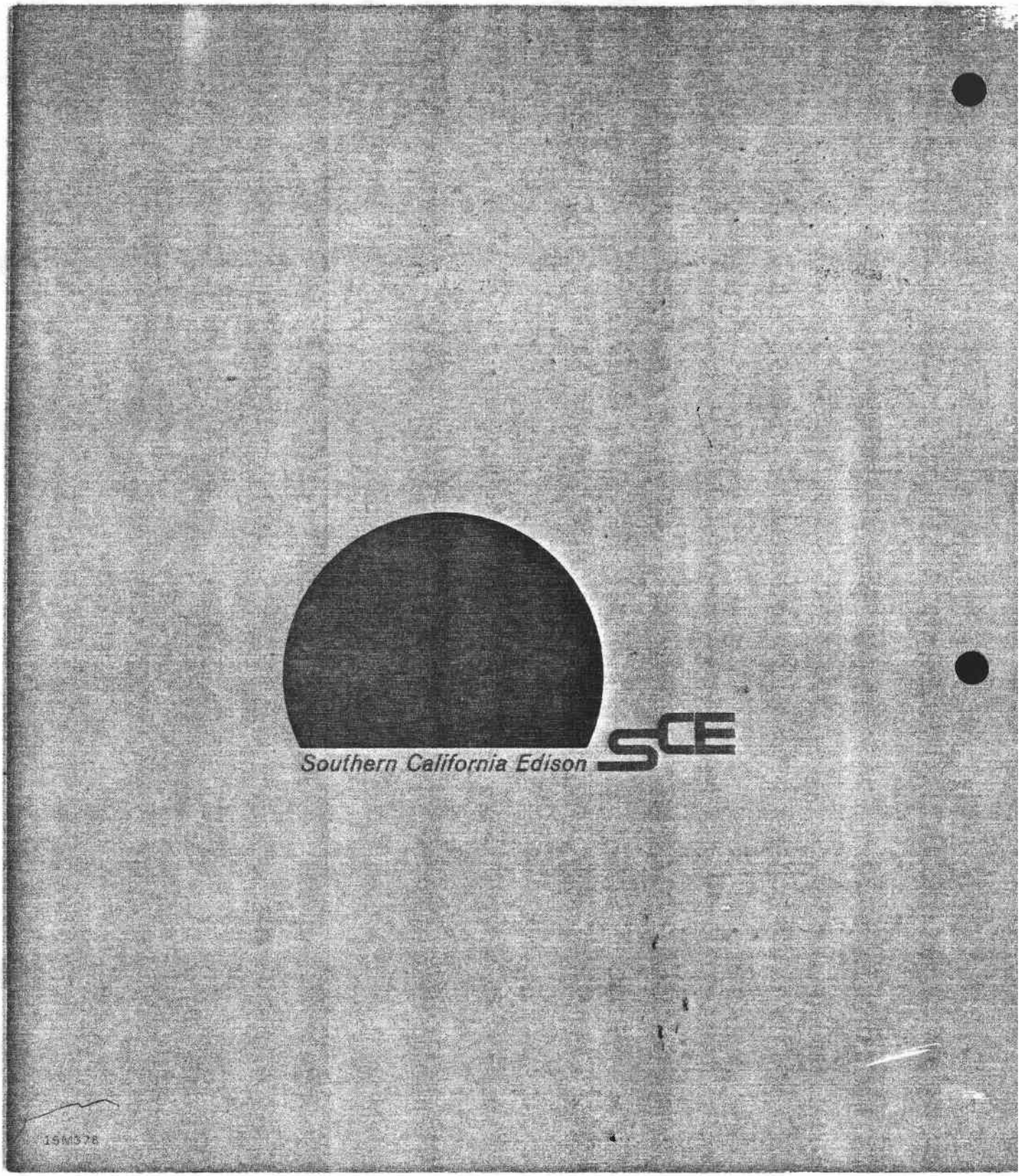


RECEIVER/BOILER TOWER



The receiver/boiler tower will be a once-through (without a boiler drum) design with rated steam conditions of 960 degrees F. and 1515 psia (pounds per square inch absolute). The diameter of the boiler will be 23 feet and the tube panels will be 41 feet tall. Each of the tube panels will contain seventy ½" outside diameter nickel alloy steel tubes. The tower itself will be steel.




Southern California Edison
SCE
1SM378

Southern California Edison SCE

15M478

15000 printed April 1978

Cover changed to SOLAR ONE

SCE ED 26 NEW 2/68

Bob O'Neil

INTER-DEPARTMENT ORDER

DATE PREPARED: 7-17-78

REFERENCE: 8335

TO: K. ~~D.~~ Conterman
Corp. Comm./Advertising

FROM: E&C Project Management Org.

DIST. DIV. DEPT.:

JOB ORDER NO.:

DELIVER TO:

DATE WANTED: 8-31-78

AD 415 X REQUIRED: YES ☐ NO ☐

DATE WORK COMPLE

PREV. ED26 | ASSOC. J.O. | DATED

ESTIMATED EXPENDITURES
PLANT $ 3,000
EXPENSE $

FUNCTION ☐ PLANT X

BUDGET IDENTITY NO.: ORG. | YR. | ITEM NO.

DESCRIPTION OF ACCOUNTS TO BE USED	TRANSPORTATION LOCATION NO.	SERVICE CODE	LOCATION	FUNCTION OR WORK ORDER NO.	CHARGE LABOR TO ACCOUNT	CHARGE MATE TO ACCOU
DOE Category #5 Technology Transfer (Solar One Project)			3430	9202	134.04	134.0

SERVICES REQUESTED: Please provide 15,000 copies of brochure entitled "10-Megawat Solar Thermal Central Receiver Pilot Plant" as discussed in a meeting on 7-11-78 with Annette Myers and Bob O'Neill. Use "Solar One" brochure, replacing the title, omitting SCE logo on back cover, and making correctic on pages 5 and 7. Questions may be directed to Annette Myers on PAX 2-371

ORIGINAL—WHITE—TO BE RETAINED BY DEPARTMENT RENDERING SERVICE OR DELIVERING GOODS.
DUPLICATE—PINK—TO BE RETURNED TO THE DEPARTMENT REQUESTING THE SERVICE WHEN WORK IS COMPLETED. WHEN USED FOR SHIPMENT OF MATERIAL THIS COPY TO GO WITH GOODS.
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SIGNED _____
SUPT. OR DEPARTMENT HEAD

17255

July 1978
15,000 Copies
printed

July 10, 1978

MR. KEN GONTERMAN

SUBJECT: Brochure Entitled "10-Megawatt Solar Thermal Central Receiver Pilot Plant"

The Department of Energy's Solar Project Director has asked that Edison supply brochures on the Solar Project to DOE's various public information offices. This request is in keeping with our agreed-to role to disseminate information on this project; and, therefore, we would appreciate your assistance in distributing brochures to the enclosed list of offices.

Inasmuch as their preference is the originally-printed brochure (with subject title and purple coloring), we feel they can be sufficiently supplied from our on-hand stock of these brochures. If you have any questions, please contact Annette Myers on PAX 2-3714.

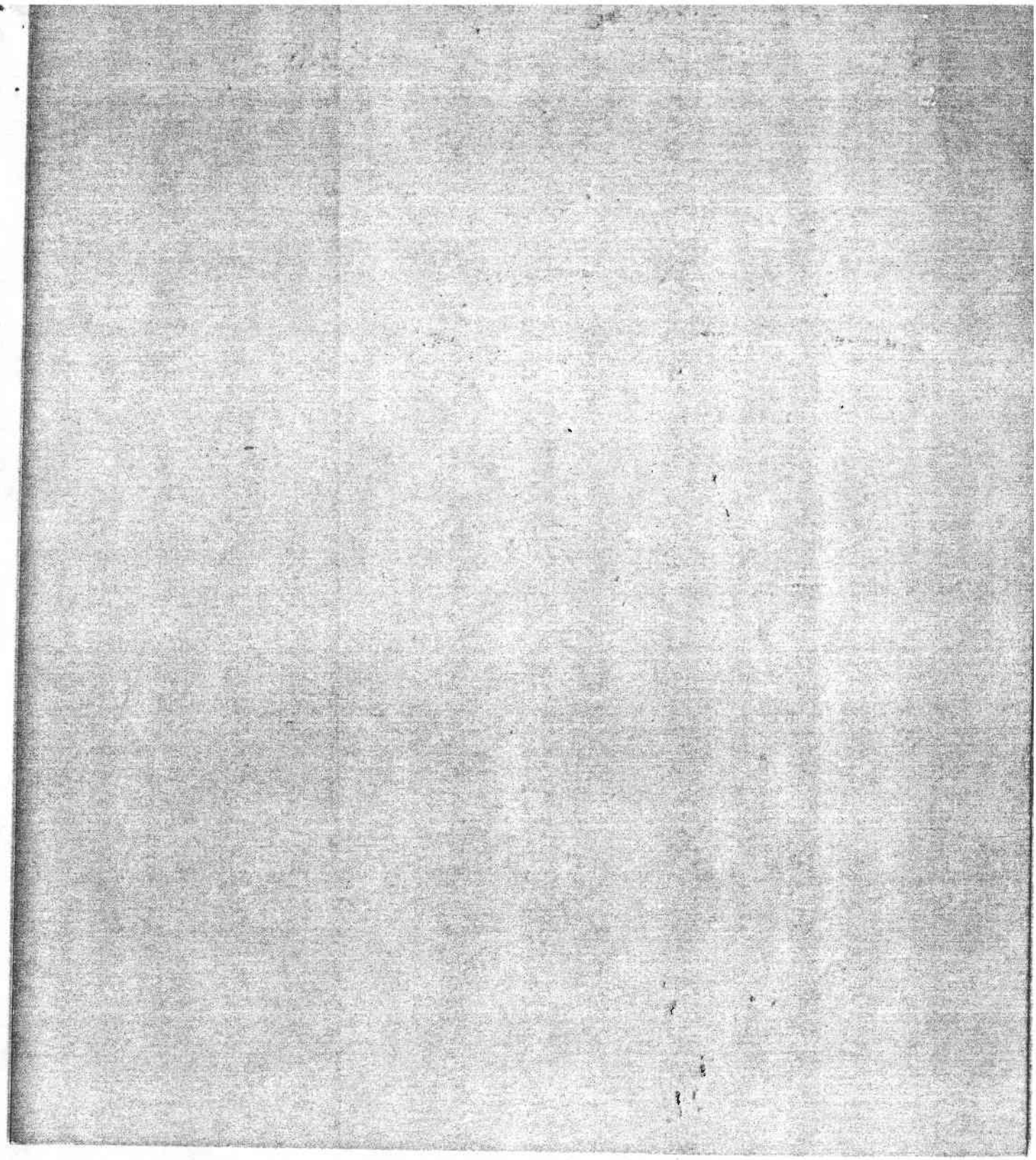
am

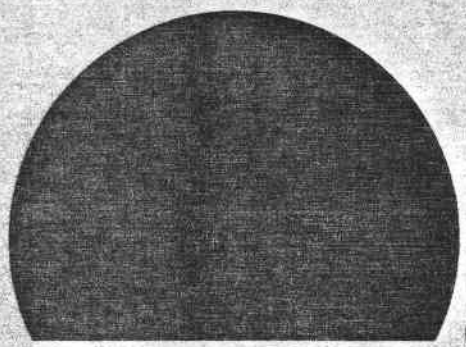
J. L. RASBAND

AMM:sm

Enclosure

o'neill 21295





Southern California Edison SCE

25M780

July 1980

25,000

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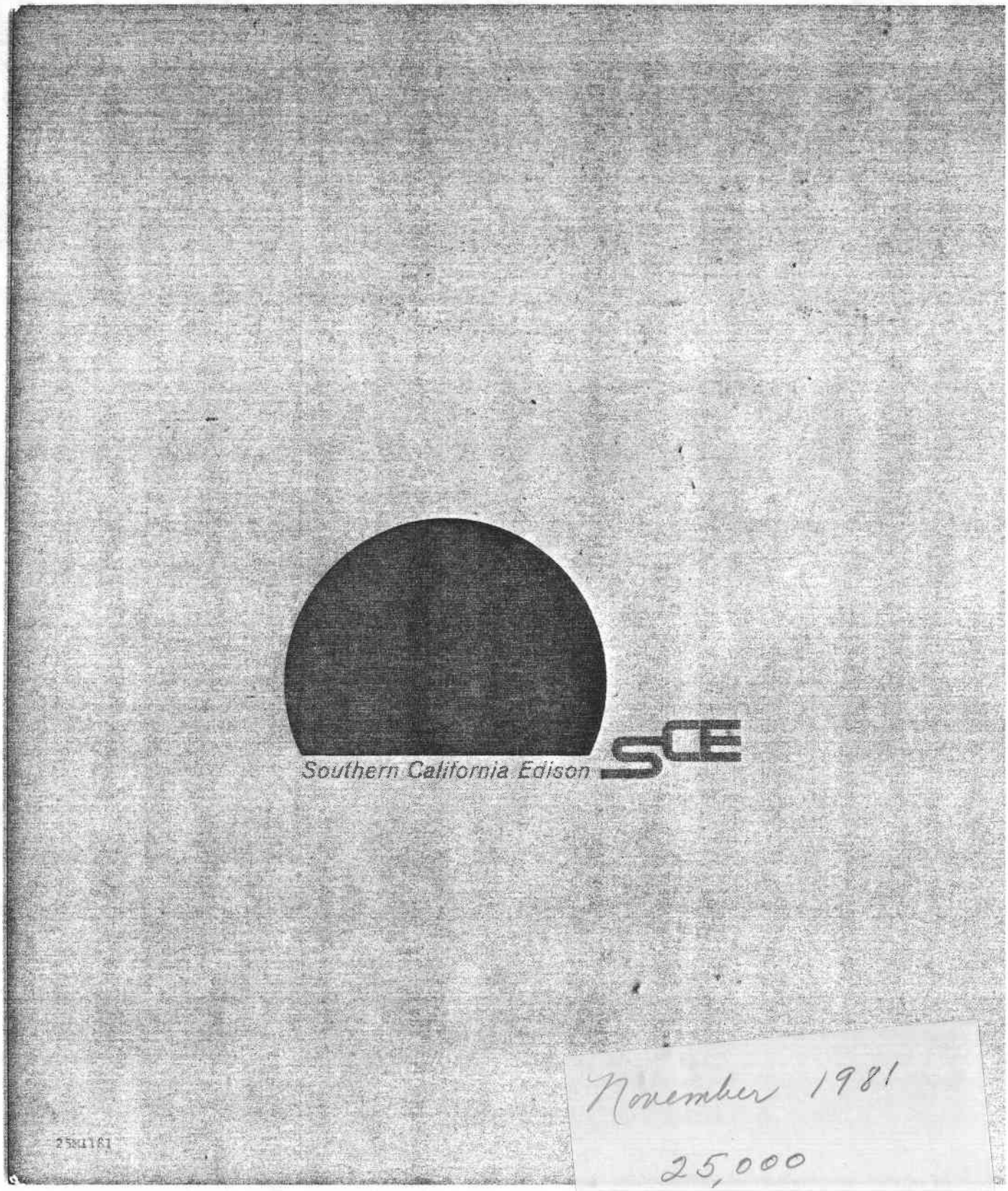

25M1181

November 1981
25,000
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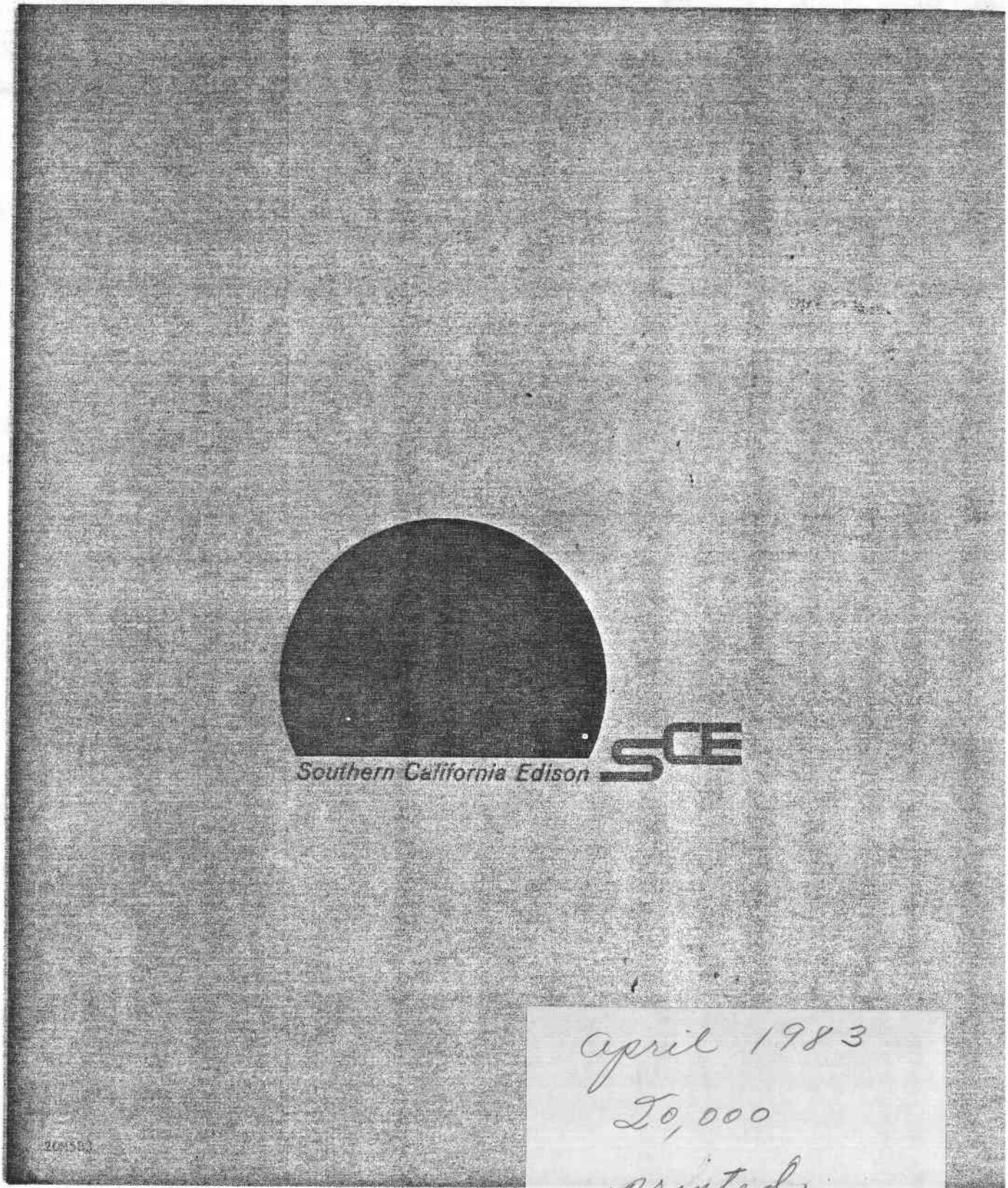

April 1983
20,000
printed