GL03088

Fact sheet
East Mesa Test facility
1979 Westec Co.

F.

GEOTHERMAL TEST WELLS, EAST MESA TEST SITE

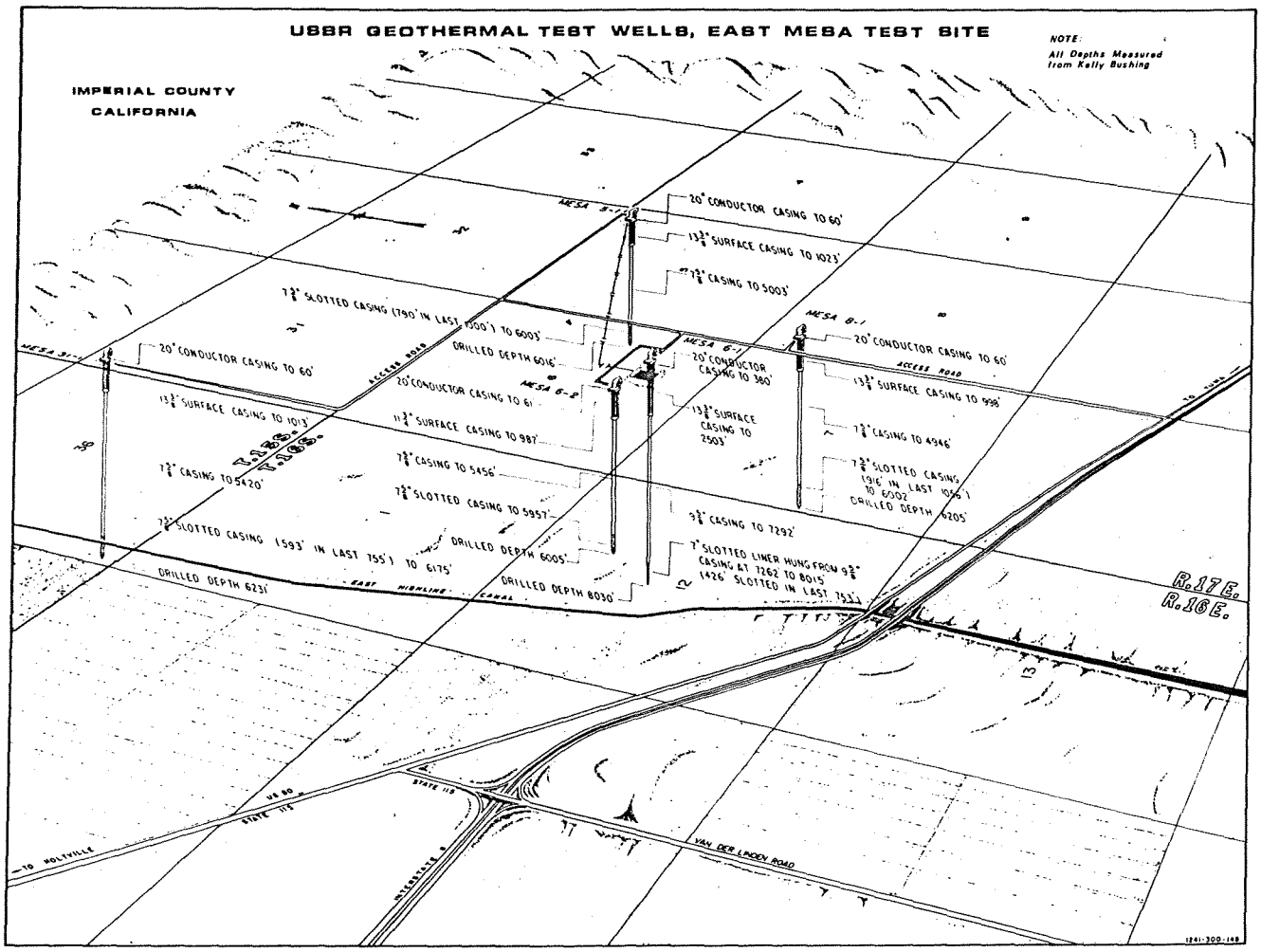


Figure 1. Phantom View of East Mesa Test Wells
(Courtesy of Bureau of Reclamation)

AREA
CA
Imperial
East Mesa
Test

INTRODUCTION

The U.S. Department of Energy Geothermal Test Facility (GTF) has been established by DOE to assist in more rapid commercialization of the geothermal energy potential by providing geothermal fluid and supportive services for tests of heat extraction and energy conversion equipment and materials. The Facility also actively promotes the exchange of reliable information among investigators within the energy community, and with the general public.

The Facility is located in the East Mesa area of California's Imperial Valley, 20 miles east of El Centro, California. It is operated for the U.S. Department of Energy by WESTEC Services, Inc., San Diego, California. Three geothermal fluid wells (Mesa 6-1, Mesa 6-2 and Mesa 8-1) have been piped to the test pad to provide experimenters with a range of chemical characteristics for flexibility in testing. Mesa 5-1 is used for reinjection. The wells, shown in Figure 1, were originally drilled by the Bureau of Reclamation for desalination research. Since then, BUREC has turned the wells and site over to DOE for use in DOE's geothermal programs.

Below is a partial list of companies and institutions who have used or plan to use the GTF at East Mesa:

- Aerojet Energy Conversion Company
- Allied Chemical Corporation
- Ampco Metal Division
- Argonne National Laboratory
- Austral-Erwin Engineering Company
- Barber-Nichols Engineering
- Battelle Memorial Institute, Pacific Northwest Laboratories
- Bi-Phase Energy Systems
- Brookhaven National Laboratory
- Daedalean Associates, Inc.
- Denver Research Institute
- Dowell
- DSS Engineers, Inc.
- General Ener-Tech, Inc.
- GeoThermal Services, Inc.
- Horst Power Systems, Inc.
- Hydrodynamics Corp. (CWC Products)
- Hydrothermal Power Co., Inc.
- Jet Propulsion Laboratory
- Johns-Manville, Inc.
- Lawrence Berkeley Laboratory
- Los Alamos Scientific Laboratory
- LFE Environmental, LFE Corp.
- McEvoy Oilfield Equipment
- Oak Ridge National Laboratory
- Occidental Research Corporation
- Peerless Manufacturing, Inc.
- Sperry Research Center
- Terra-Tek
- Turbines International
- United Wireline
- University of California, Berkeley
- University of Utah

LOCATION

The East Mesa GTF is located about 20 miles east of El Centro, about 140 miles east of San Diego, and 10 miles north of the Mexican border in the Imperial Valley of California. Its location is pinpointed on Figure 2, below.

The Imperial Valley is supported mainly by agriculture with some heavy industry. The weather of the area is typified by hot summers and pleasant winters. Average annual rainfall is about 3.5 inches. About half the rain usually precipitates in high intensity summer showers and about half in gentle winter rains.

A four lane freeway, Interstate 8, traverses Imperial Valley from San Diego to Yuma, Arizona. It runs adjacent to El Centro and about 2 miles from the GTF. To the north, State Highway 111 connects El Centro to Indio and Palm Springs. The Van Der Linden Road exit from Interstate 8 provides access to Even Hewes Road which parallels the freeway on the north side. East of Van Der Linden Road on Even Hewes Road is the Test Facility sign located by the access road to the Facility; the Facility is located 1.7 miles north of this sign. All roads to the Facility are paved. The GTF is also accessible by regularly scheduled airline flights to the airport in El Centro where rental cars are available. Transportation is not ordinarily provided by the GTF.

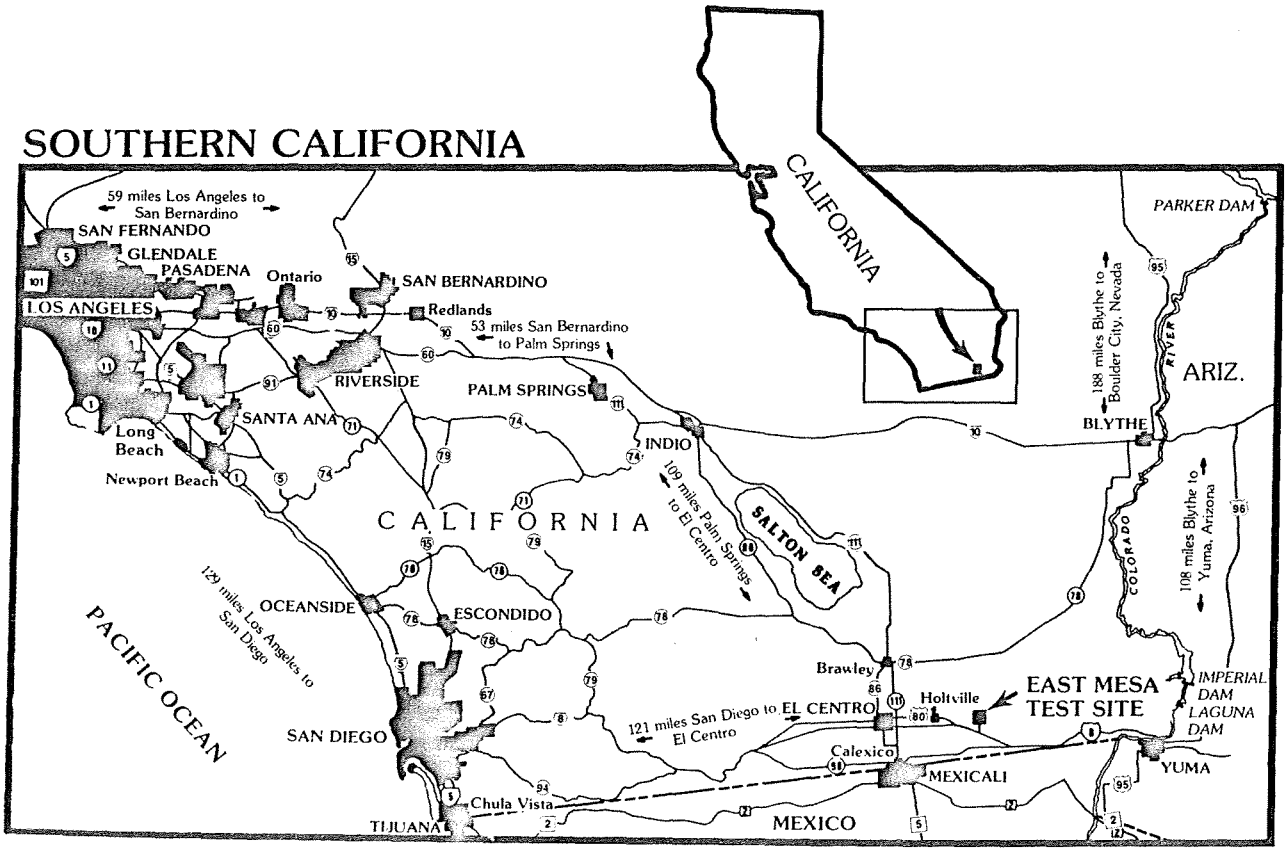


Figure 2. The Geothermal Test Facility is located at the Department of Energy, East Mesa Test Site.

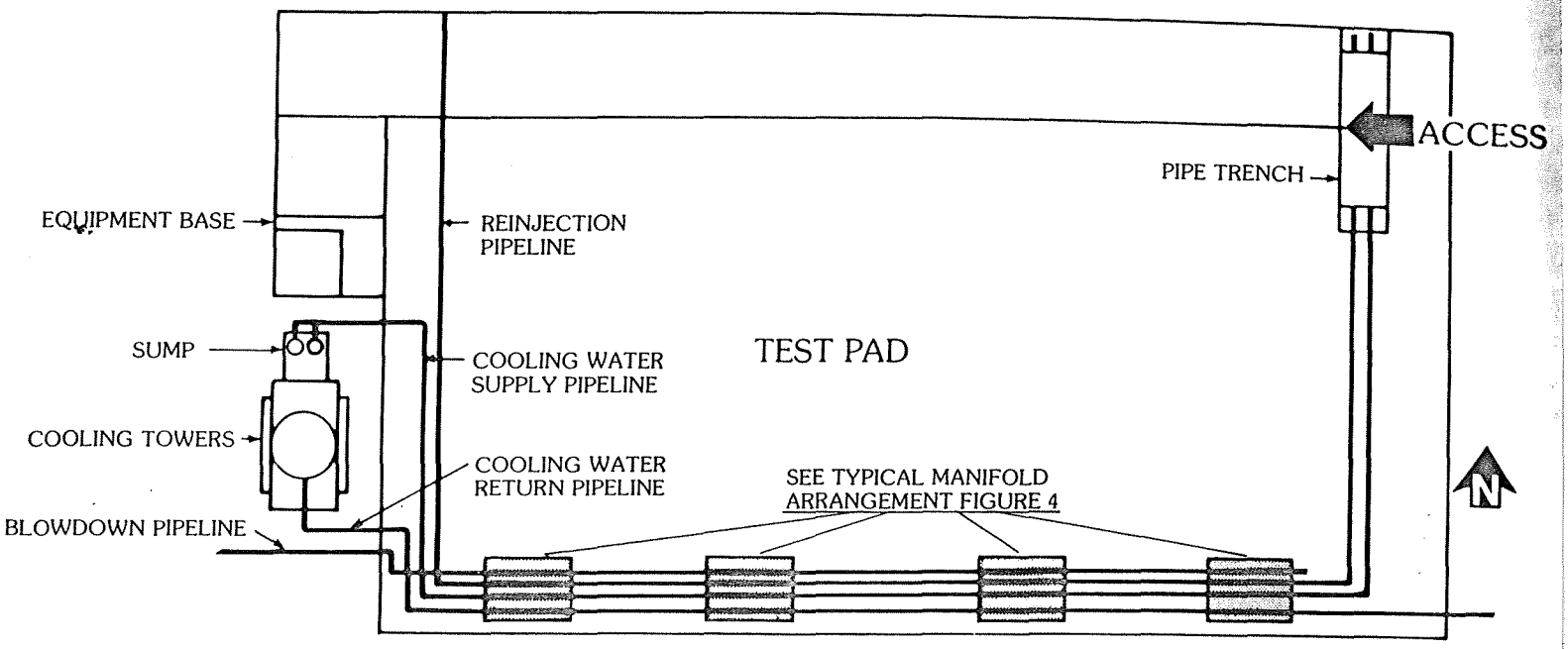


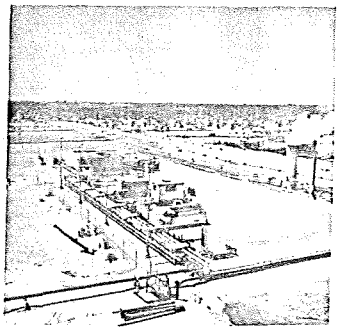
Figure 3. Test Pad Plot Plan

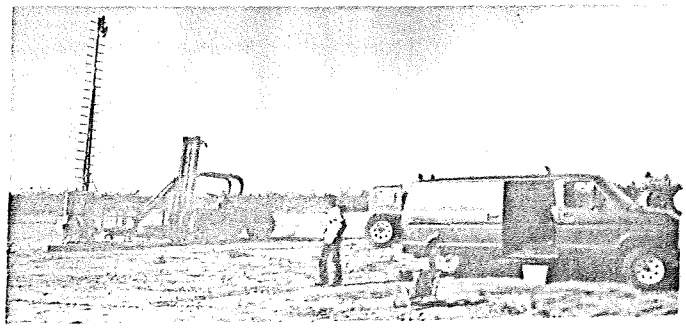
DESCRIPTION OF TEST FACILITY

Test Pad

The usable space on the concrete pad designed for the placement of test equipment is about 80 feet by 160 feet, with a 15 foot wide access strip adjacent to the pad. There are four manifold arrangements for use by investigators, as shown in Figure 3. The number of experiments which could be in progress concurrently is limited only by the physical size of the equipment and the amounts of geothermal fluid, cooling water and electrical power required by each experiment. All experiments which share pad space whether cooperative or individual will be tested as separate experiments and must apply as separate experimenters. The manifold arrangement shown in Figure 4 is typical of the four stations on the test pad. As shown, the manifold consists of 9 valves: flud supplies from each of the three wells, reinjection, blowdown, cooling water supply and return, compressed air and industrial water.

Experiments whose requirements are such that use of the formal test pad is precluded, may be accommodated as necessary at a well head or other "remote" site convenient to the experimenter.





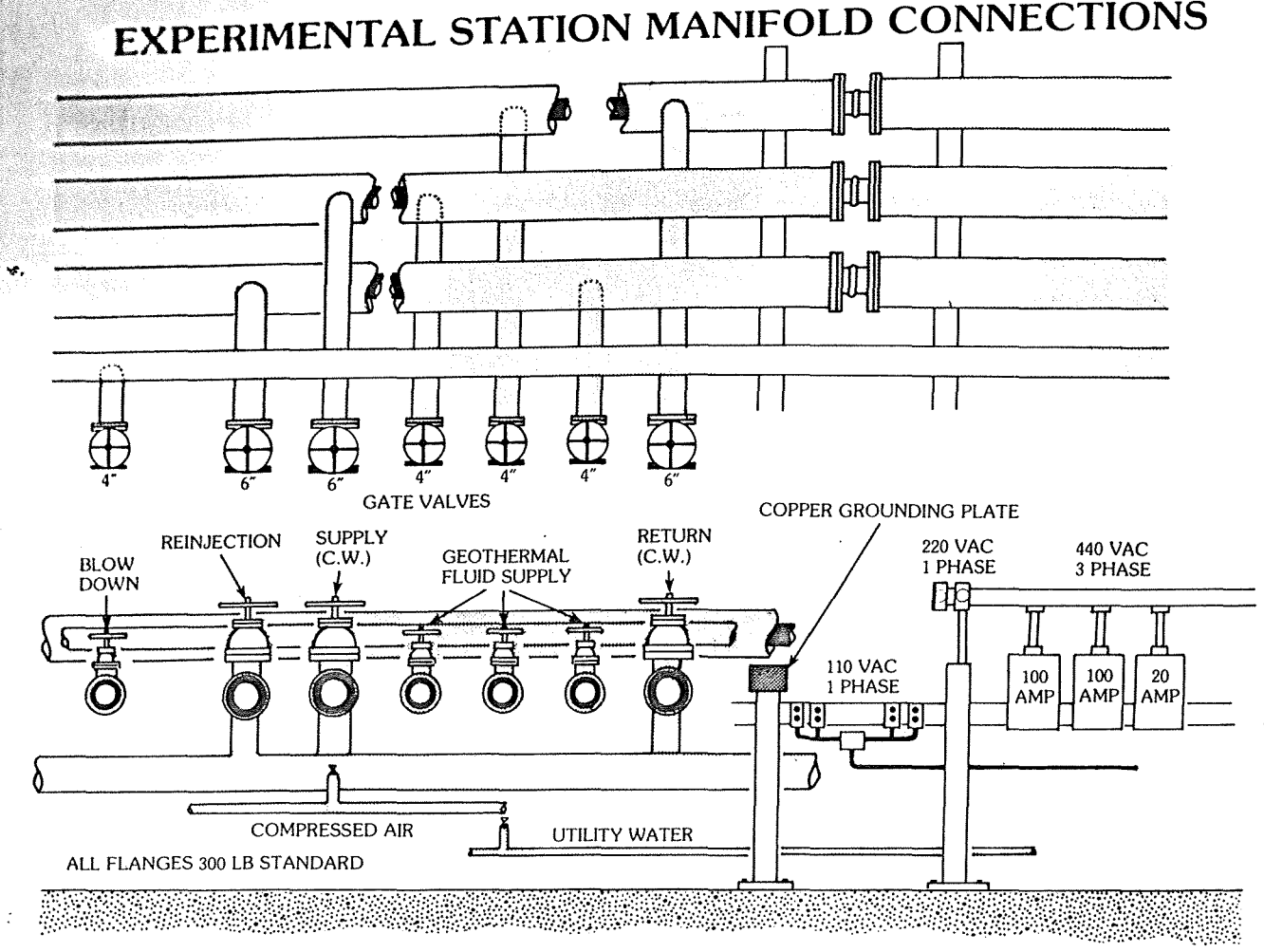


Figure 4. Test Pad Manifold (Typical)

Geothermal Fluid

As previously stated, the geothermal fluid is available from three wells: Mesa 6-1, Mesa 6-2 and Mesa 8-1. The basic data from each of these wells is shown in Table 1.

Reinjection of geothermal fluids is accomplished through a transfer system to a remote well site. Fluid disposal from the test pad is to a holding pond adjacent to the Facility.

Cooling

Cooling water is available from a cooling tower located adjacent to the test pad. It has a rated heat rejection capacity of 5 MW (thermal) with provisions for future expansion to 10 MW when needed. A total flow of about 700 gpm is available at a maximum temperature of 90°F during summer months. Lower cooling water temperatures may be expected during nighttime and winter operations.

Instrument Air and Utility Water

Instrument air is available at 100 psig and a total flow of 50 scfm. Utility water is available for cleaning the test pad area and equipment. Since the water is not potable, bottled water is provided for drinking.

Electrical Service

The power supply to the Facility has a total capacity of 430 kVA via transmission lines from the local utility. The following services are available at each of the four test manifolds, as shown in Figure 4:

- 440 volts AC, three-phase, two 100 amp switches and one 20 amp switch.
- 220 volts AC, single-phase, two 20 amp receptacles (up to 100 amps available).
- 110 volts AC, single-phase, eight 20 amp receptacles.

Other configurations and receptacle adaptations can be made by onsite personnel.

Other configurations and receptacle adaptations can be made by onsite personnel.

Table 1

EAST MESA PRODUCTION WELL DATA

Well	Single-Phase, Liquid Flow				TDS (June, 76) (mg/L)
	Temp.		Press. (psig)	Max. One Phase Flow (gal/min)	
	°F	°C			
Mesa 6-1	331	166	95	[3]Unk.	26,300
Mesa 6-2	338	170	145	~ 200	5,000
Mesa 8-1	306	152	100	~ 275	1,600
[1]Mesa 5-1	315	157			2,390
[2]Mesa 31-1	309	154			2,900

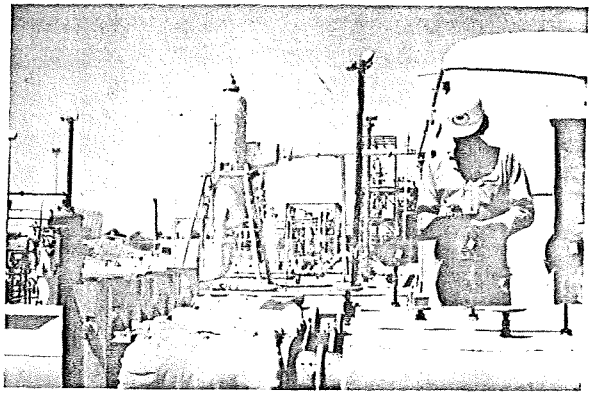
1 — Reinjection Well
2 — Well not currently used for production purposes.
3 — No maximum rate flow test has been performed.

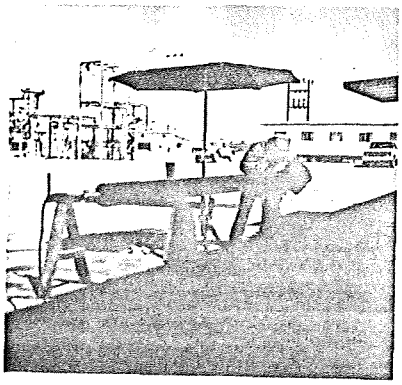
SUPPORT SERVICES

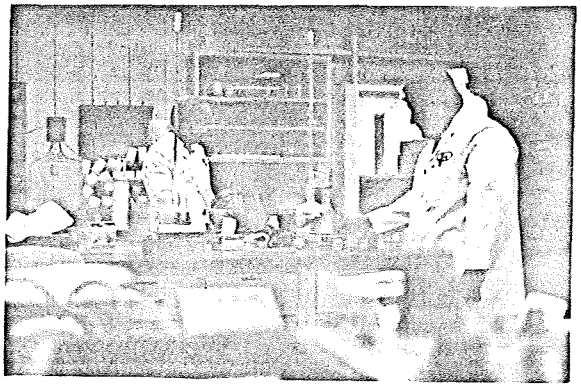
The GTF is managed, operated and maintained by WESTEC Services, Inc. The Facility is operated 24 hours per day every day of the year to enable experimenters to perform endurance runs on equipment. Onsite personnel will make the appropriate connections to all test equipment to the test pad manifold. The GTF has equipment to offload and locate the experimenters' equipment on the test pad. If the test equipment is of sufficient size that onsite equipment is unable to handle it, heavier equipment is available from a local independent crane rental firm.

While the experimenter's test system should not require construction other than the connection of components to pad services, onsite craftsmen have the experience and capability to assist in trouble-shooting as well as to make minor modifications to the experimenters' equipment. Onsite maintenance craftsmen have extensive experience in each of their respective fields. Maintenance facilities include a complete machine shop, electrical support equipment, a storehouse for hardware and supplies, and an extensive tool crib. The machine shop has lathes, a milling machine, power saw, radial drill press, automatic pipe threader, welding equipment, and other miscellaneous items. Tools are available for loan to visitors on an individual basis. Private industry and comprehensive agricultural interests in the surrounding community support a variety of services and suppliers which have proven helpful to experimenters.

The experimenters are solely responsible for the operation, maintenance and performance of tests on their respective equipment. The onsite personnel are responsible for the supply of fluid, cooling water, electricity, compressed air and utility water, and are available to gather data in the absence of the investigators.







OTHER FACILITIES AVAILABLE

GTF visitors have access to a limited amount of air conditioned office space with telephones in a mobile office close to the test pad.

A chemical laboratory is also located at the GTF. In addition to the standard laboratory array, it is equipped with the following:

- Atomic absorption spectrophotometer equipped for flame work with air-acetylene and nitrous oxide-acetylene.
- Principal metal analysis with HGA furnace capability for various trace metal analysis.
- Gas chromatograph equipped with hot wire detector for non-condensable gases, i.e., CO^2, air, etc. Equipped also with flame ionization detector capability for various hydrocarbon and trace hydrocarbon analyses, e.g., isobutane.
- Scanning ultraviolet/visible dual beam spectrophotometer for various cation and anion determinations.

All chemical laboratory analyses are performed or supervised by the Facility staff chemist.

The GTF is a Government installation situated in an area regulated by the Department of the Interior with all the security such a designation provides. Space is available for temporary storage of test equipment before or after use or during extended shutdowns.

Perimeter lighting is provided for the running of experiments beyond daylight hours.

The GTF also furnishes a dumpster for rubbish disposal by the Facility as well as its guests.

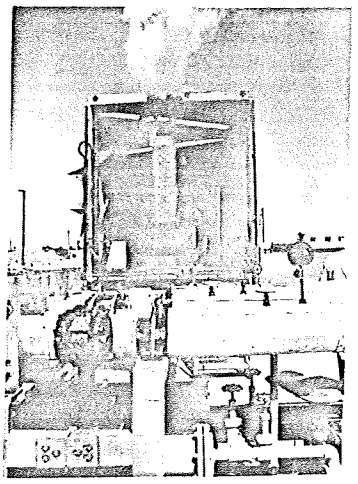
The United Parcel Service (UPS) will deliver packages to the GTF as a part of its regular service. Another service available is the delivery of bottled gases. However, one week is usually required for the arrival of bottled gases from a local supplier. Most other services are available locally.

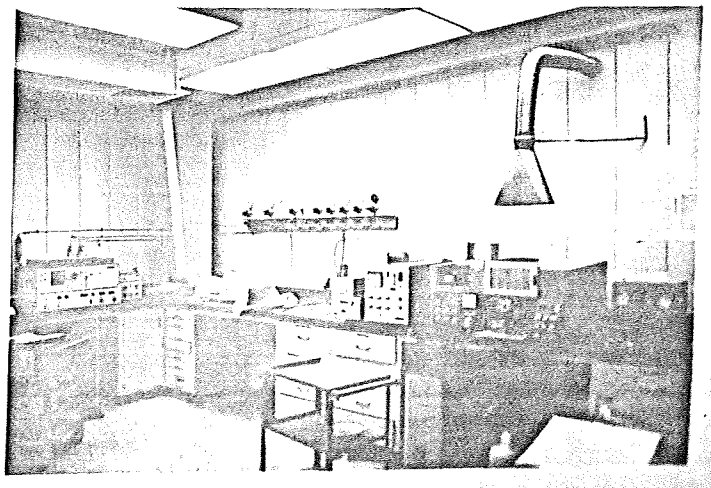
The shipping address of the GTF is:

U.S. Department of Energy
c/o WESTEC Services, Inc.
Geothermal Test Facility
(10 miles east of Holtville)
Holtville, California 92250

COSTS

Nominal charges may be assessed to experimenters after October 1, 1979. A schedule of fees and charges is available on request. (See "Who to Contact".)





GENERAL

A GTF representative is available to visit the prospective experimenter's location. The purpose of such a visit would be for an examination of test equipment if required to determine compatibility with the GTF, and the provision of any additional data and information a prospective experimenter may require. The experimental equipment must meet current OSHA standards.

WHO TO CONTACT

Formal requests for use of the GTF should be made to A. J. Adduci, U.S. Department of Energy, San Francisco Operations Office, 1333 Broadway, Oakland, California 94612, Telephone (415) 273-7943, using the attached application.

Parties interested in more technical information about the East Mesa GTF or about how to arrange for use of the Facility may write or call K. L. Newman, or B. S. Boswell, GTF Engineers, WESTEC Services, Inc., 3211 Fifth Avenue, San Diego, California 92103, Telephone (714) 294-9770.

APPLICATION PROCEDURE

1. Fill out the Application and mail the completed Application to Mr. A. J. Adduci.

2. Contact Mr. K. L. Newman or Mr. B. S. Boswell for aid in completing the Application on the facing page and to arrange for tentative scheduling of the experiment.

3. It is recommended but not required that you visit the GTF before arriving for testing. Contact Mr. R. C. Sones for an appointment at (714) 356-2956.

4. Mr. Adduci will send you 2 copies of the Use Agreement. After examining it, if you agree with its terms, fill it in, sign it and return both copies to him. He will sign one copy and return it to you with a letter approving you as an experimenter. If you have any questions about the agreement please contact Mr. Adduci.

5. If you are approved as an experimenter, contact Mr. Newman or Mr. Boswell, and Mr. Sones to arrange the logistics of your arrival and testing at the GTF.

U.S. DEPARTMENT OF ENERGY
EAST MESA GEOTHERMAL TEST FACILITY
Holtville, California 92250

TEST APPLICATION

GTF Test No.: _____ (Office Use Only)

Organization: Contact:
Address: Phone:

Test Name:

This experiment is (check one):
☐ Government funded (Contract No. _____)
☐ Privately funded
☐ Other _____

Technology Under Study:

Test Objective:

Equipment Type:

Chemistry Requirements:

Resources Required:

1. Elect. Power:
   110V, 1 ph _____ amps; _____ KW
   220V, 1 ph _____ amps; _____ KW
   440V, 3 ph _____ amps; _____ KW
2. Cooling Water:
   Press. _____ psig
   Flow _____ GPM
   Temp. Rise _____ ΔT, °F
3. Geothermal Fluid:
   Flow _____ GPM
   Desired Temp. _____ °F
   Inlet Press. _____ psig
   Specific Well _____
4. Instrument Air Flow: _____ SCFM; _____ psig

Schedule (Best Estimate):

1. Arrival Date: _____
2. Test Start Date: _____
3. Test Completion Date: _____
4. Equipment Removal Date: _____

Equipment Size/Weight:

Special Hazards:

Support Equipment Required:

Signed: _____ Date _____
Principal Investigator

INTRODUCTION

Southern California Edison and its preceding companies have been interested in the development of geothermal resources for several decades. The geothermal program began to accelerate dramatically in the early 1970s when oil supplies became uncertain and prices began to rise.

One of the greatest geothermal energy potentials is in the Imperial Valley, California. Four major resource areas have been identified in the Imperial Valley: the Brawley, East Mesa, Heber, and Salton Sea Known Geothermal Resource Areas (KGRA).

The Edison Brawley Unit 1 plant utilizes geothermal energy from the Brawley KGRA. Wells drilled in the Brawley KGRA have been found to be capable of producing geothermal fluid with a static reservoir temperature of approximately 246° to 274°C (475° to 525°F). Total dissolved solids (TDS) is approximately 100,000 mg/l. It is estimated that the reservoir is large enough to support 1000 MW capacity for 30 years.

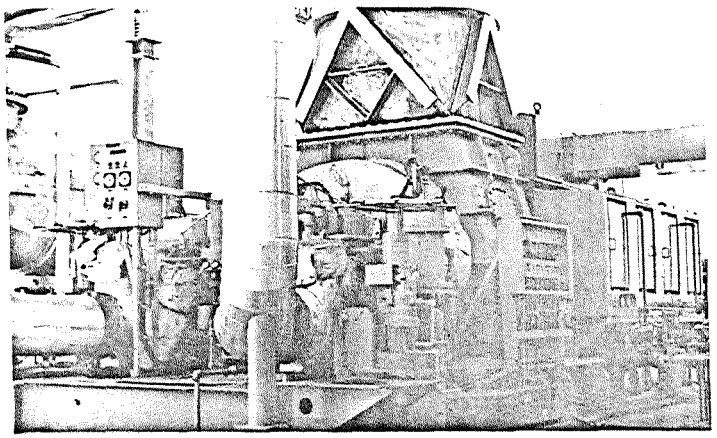
BRAWLEY 10 MW(e) GEOTHERMAL PROJECT, UNIT 1

The objective of the Brawley Geothermal Power Plant Unit 1 program is to assess the technical feasibility of generating electricity utilizing the high salinity Brawley geothermal resource. The plant design is similar to proven geothermal units — simple, reliable, and where possible, designed for low capital cost. It is intended to be a model of a full scale commercial plant, using systems and components which likely will be utilized in large scale follow-on units.

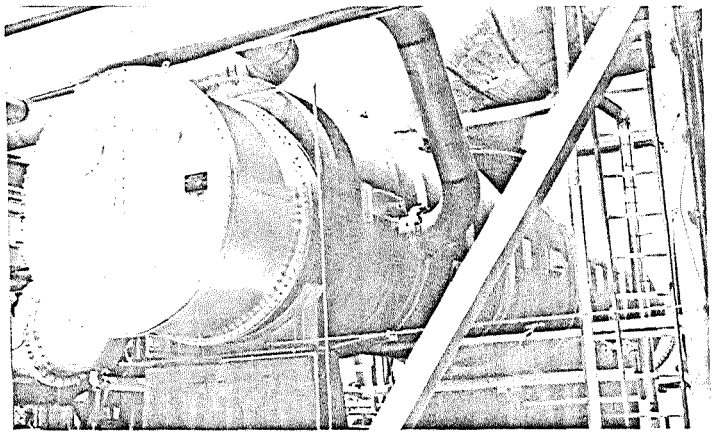
STEAM CONDITION AND TURBINE: The Brawley Geothermal Project production facility utilizes a flashed steam system to provide geothermal steam to the turbine. The steam from the supplier is expected to be delivered at a rate of 94,800 kg/hr (209,000 lb/hr) at a single pressure, 800 kPa (115 psia) at approximately saturation temperature of 170°C (340°F) with a maximum average 0.25% moisture, a maximum noncondensable gas level of 2% by weight of steam, and a maximum of 50 ppm TDS, including mostly chlorides with some silica.

These are obviously very different steam conditions than those associated with high pressure fossil units.

TURBINE GENERATOR



SURFACE CONDENSER

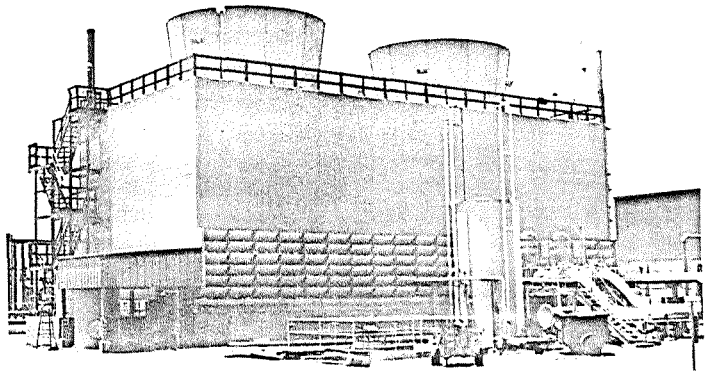


The turbine is a 10,000 kw, 3600 rpm, single flow, single cylinder unit with five impulse stages, and a design back pressure of 13.5 kPa (4 in. Hg abs.). The last stage blade length is 280 mm (11.2 in.). The unit was first conceived as portable; thus the turbine generator was built as a single skid mounted unit installed at grade with a top exhaust and overhead crossover exhaust duct to a side located condenser.

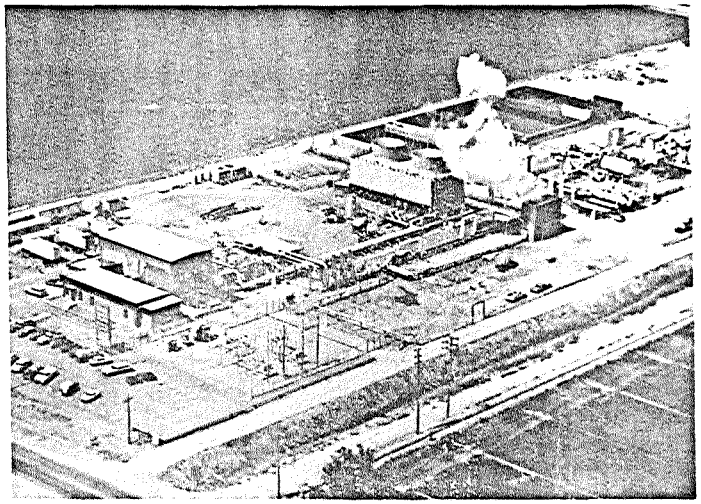
CONDENSER AND STEAM-JET AIR EJECTORS: As it is desired to retain the steam condensate for process use, a shell and tube condenser is provided. It is a cylindrical vessel with three passes on the water side and a single pass on the steam side. Corrosion resistant stainless steel materials are used because of the oxidation potential of the air, oxygen, and H_2S present in the system.

A steam jet air ejector requiring 7200 kg/hr (16,000 lb/hr) or about 8% of the motive steam is used to remove approximately 1800 kg/hr (4000 lbs/hr) of air and noncondensable gasses from the condenser. One 200 hp (149.2 kW) Nash vacuum compressor with ceramic case and coated impellers is provided to remove the noncondensables from the first stage ejector intercondenser. A second stage ejector is provided as a backup to the vacuum pump.

COOLING TOWER



FACT SHEET



BRAWLEY 10 MWe GEOTHERMAL PROJECT

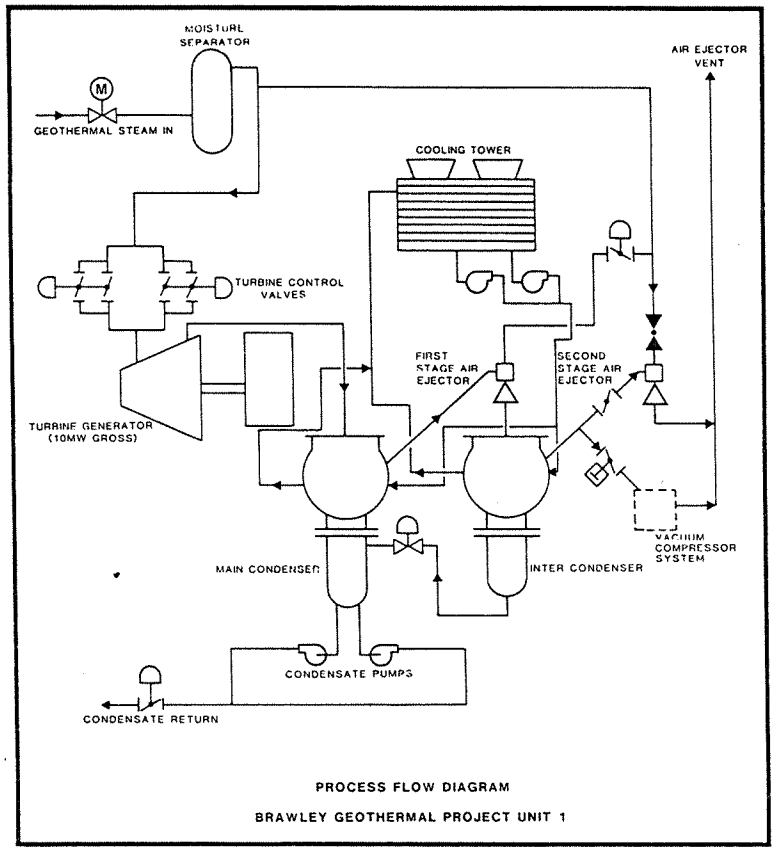
SOUTHERN CALIFORNIA EDISON COMPANY
RESEARCH AND DEVELOPMENT ORGANIZATION

COOLING WATER SYSTEM: A conventional two cell, induced draft, counterflow, wet cooling tower with a rated heat load of 200 MM Btu/hr provides 0.908 m^3/sec (14,400 gpm) cooling water with a 5.5°C (10°F) approach to wet bulb temperature.

The tower basin is epoxy coated for protection in the event that the acidic condensate is used for makeup at a later date. Initially, makeup at a rate of about 740,000 m^3/yr(600 acre ft/yr) will be Colorado River water provided to the plant via two alternate irrigation canals operated by the local water district.

PLANT ECONOMICS: Plant auxiliary loads total about 1 MW. The net plant heat rate is approximately 28,000 Btu/kwhr. The capital cost of the plant is approximately $11 million and the total project cost including some costs for prior research work is approximately $16.3 million. The cost of power generated by the plant is forecast to be about 17¢/kwhr (30 year levelized).

The net plant output is connected to and sold to the local electric utility. Evaluation of this plant will help determine the design of planned future 50 MW or 100 MW commercial power plant at Brawley.



PROCESS FLOW DIAGRAM

BRAWLEY GEOTHERMAL PROJECT UNIT 1

Southern California Edison Company

PHOTOGRAPHS-COURTESY WESTEC Services, Inc.