GEOTHERMAL RESOURCE DEVELOPMENTS
State of Hawaii
Circular C-100

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Water and Land Development
Honolulu, Hawaii
March 1984
GEORGE R. ARIYOSHI
Governor

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Division of Water and Land Development
REFERENCES


PREFACE

The Geothermal Resources Development report was prepared to assist in the designation of geothermal resource subzones in the State of Hawaii as mandated by Act 296, SLH 1983, and contains a compilation of currently available information relating to geothermal development in Hawaii.

This report identifies the existing exploratory well sites, and outlines the current geothermal resource mining leases issued by the State Board of Land and Natural Resources. Also included is a list of geothermal exploratory drilling permits issued by the Department of Land and Natural Resources and special use permits issued by the County of Hawaii and the State Land Use Commission.

In order to demonstrate the feasibility of geothermal energy utilization, a brief outline of the HGP-A Well head Generator Project has been included. This information along with future contributions to the Department will be of valuable assistance in determining the location and quality of Hawaii's geothermal resources.

This publication was prepared by Dean Nakano, Geologist, with assistance from Edwin Sakoda, Geologist, and Neal Imada, Civil Engineer.
Silica Settling Pond where excess condensate water is combined with the liquid from the separator and travels to a concrete retention pond where silica is deposited and water is then percolated into the ground.

Production Data:

Production of enough electricity to displace 40,000 barrels of crude oil annually (approximately $1.6 million based on 1980 prices). Electricity sold to HELCO and revenue received to offset operating and maintenance costs.

Monthly operating figures received from RCUH outline amounts of geothermal fluids and electricity produced from HGP-A in addition to the gross revenue and calculations of the waived royalties pursuant to geothermal mining lease No. S-4602.

Summary:

Geothermal energy has demonstrated to be one of the more economical and one of the least polluting of all current fuels used for electrical production. If commercialized it would greatly reduce the millions of dollars spent annually for imported fuel.

Also, lower temperature steam development although not directly valuable for electricity production can be used for direct heat application in agriculture and aquaculture.

Geothermal energy production is a feasible alternative to fossil fuels and nuclear energy to supply HELCO's projected demand of an additional 25 megawatts by 1988.
Figure 8. Geothermal Power Plant Diagram.

ILLUSTRATIONS

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</tr>
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</table>

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on Campbell Estate's exploratory drilling program.

The Board is confident to conduct a preliminary boundary for the

Figure 1. Tax Map Showing Boundary of CEMP, S-6624.

Campbell Estate is authorized to conduct the boundary for Camp.-Mid-Pacific Geothermal Venture.

Area E-5042

Land Ownership: James Campbell Estate

Location: Kahaualea, Puna, Hawaii

TMK: 1-1-01

Area: 25,461.31 acres

Sublease To: True/Mid-Pacific Geothermal Venture

General Information:

Pending Sublease To: True/Mid-Pacific Geothermal Venture

Land Ownership: James Campbell Estate

Area: 25,461.31 acres

Sublease To: True/Mid-Pacific Geothermal Venture

Location: Kahaualea, Puna, Hawaii

Campbell Estate Geothermal Project (Kahaualea)
GEOTHERMAL RESOURCE MINING LEASES (GRML)

(1) Geothermal Resource Mining Lease: S-4602 (HGP-A) (1955 Flow)

Issued To: The Research Corporation of the University of Hawaii
Location: Kapoho, Puna, Hawaii
TMK: 1-4-01: Portion of 2 (currently indicated as parcel 82)
Area: 4.1 acres
Land Ownership: State of Hawaii
Effective Date: June 19, 1979
Term: 10 years primary, 35 years maximum

General Information:
- Well Drilled to Date: HGP-A
- Leased Area Zoned: Agriculture
- Mineral rights reserved to State of Hawaii
- See Figure 1
GEOTHERMAL EXPLORATORY WELLS

<table>
<thead>
<tr>
<th>Well Name</th>
<th>FNB No.</th>
<th>HGP-A</th>
<th>Status</th>
<th>Depth Drilled (ft.)</th>
<th>Driller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaihoku No. 1</td>
<td>3000</td>
<td>6450</td>
<td>Active</td>
<td>7000+ (prop.)</td>
<td>WRII</td>
</tr>
<tr>
<td>Lanipuna No. 2</td>
<td>7000</td>
<td>7000</td>
<td>Not drilled</td>
<td>7290 (prop.)</td>
<td>WRII</td>
</tr>
<tr>
<td>Lanipuna No. 3</td>
<td>7000</td>
<td>7000</td>
<td>Not drilled</td>
<td>8005 (prop.)</td>
<td>WRII</td>
</tr>
<tr>
<td>Lanipuna No. 6</td>
<td>7000</td>
<td>7000</td>
<td>Not drilled</td>
<td>50-00 (prop.)</td>
<td>WRII</td>
</tr>
<tr>
<td>Kapoho State No. 1</td>
<td>7000</td>
<td>8000+</td>
<td>Testing</td>
<td></td>
<td>WRII</td>
</tr>
<tr>
<td>Kapoho State No. 2</td>
<td>7000</td>
<td>8000+</td>
<td>Testing</td>
<td></td>
<td>WRII</td>
</tr>
<tr>
<td>Ashida No. 1</td>
<td>0000</td>
<td>6900</td>
<td>Abandoned (water)</td>
<td></td>
<td>WRII</td>
</tr>
<tr>
<td>Opihikao No. 1</td>
<td>0000</td>
<td>6800</td>
<td>Abandoned (converted to water well No. 4850-01)</td>
<td></td>
<td>WRII</td>
</tr>
</tbody>
</table>

Figure 2. Tax Map Key Showing Boundary of GMRL, R-1.
(2) Geothermal Resource Mining Lease: R-1  (SEEM KAMALI SECTION)

Issued To: Bishop Estate, Subleased to Puna Geothermal Venture (Thermal Power, Dillingham, Amfac)

Location: Puna, Hawaii

TMK:
1-3-01:  22, 23, 58, 59
1-3-02:  32, 33, 59, 79-84, 87
1-3-03:  5, 6, 41
1-3-08:  1, 2, 5, 8, 10

Area: 3,486.73 acres

Land Ownership: Bishop Estate

Effective Date: March 1, 1981

Term: 10 years primary, 65 years maximum

General Information:
- No exploratory drilling to date
- Portion of leased area zoned conservation (TMK: 1-3-09: Portion of 5), balance of area zoned agriculture
- Mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management
- See Figure 2
Figure 3. Tax Map Showing Boundary of GMRL, R-2.

Project: Lanipuna (6 wells)
Permit No.: SP 471
Effective Date: 12/16/80
Expiration: 12/31/87
Portion: 769.14 acres
TMK: 1-3-8: 6, 7, 19

Issued To: Barnwell Geothermal Corp.

General Information:
No exploratory drilling; the only
Land use change: Agriculture
Leased to GEDCO
No mineral reservations or mining lease. Mineral rights
Landowner: Daito Seiko of Hawaii, Inc.
No exploratory drilling; site only

Project: Daiichi No. 1
Permit No.: SP 80-347
Effective Date: 2/13/81
Issued To: GEDCO
Expiration: 12/31/87
Landowner: Daiichi Seiko of Hawaii, Inc.
No mineral reservations or mining lease. Mineral rights
Land use:
Zoning: Agriculture
No exploratory drilling; site only

Project: Kapoho State (2 wells)
Permit No.: SP 468
Effective Date: 10/15/80
Expiration: 10/15/86
Area: Portion of 815.99 acres
TMK: 1-4-02: 10

Issued To: Thermal Power Co. (PGV)

General Information:
Refer to GRML R-2
Testing Program underway
<table>
<thead>
<tr>
<th>Project: Puuwaawaa Steam Co.</th>
<th>Area: 143 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permit No.: SP 79-333</td>
<td>TMK: 7-1-5: 56</td>
</tr>
<tr>
<td>(LUC 411)</td>
<td></td>
</tr>
<tr>
<td>Effective Date: 6/1/79</td>
<td>Expiration: 7/1/82</td>
</tr>
<tr>
<td>Issued To: Geothermal Exploration and Development Co. (GEDCO)</td>
<td>General Information:</td>
</tr>
<tr>
<td></td>
<td>• Landowner: Mr. F. Newell Bohnett</td>
</tr>
<tr>
<td></td>
<td>• No mineral reservations or mining lease</td>
</tr>
<tr>
<td></td>
<td>• Land Use Zoning: Agriculture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project: HGP-A</th>
<th>Area: 4.1 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permit No.: SP 78-307</td>
<td>TMK: 1-4-01: Portion of 2</td>
</tr>
<tr>
<td>(LUC 392)</td>
<td>(currently noted as parcel 82)</td>
</tr>
<tr>
<td>Effective Date: 2/7/79</td>
<td>Expiration: ongoing</td>
</tr>
<tr>
<td>Issued To: Research Corporation of the University of Hawaii</td>
<td>General Information:</td>
</tr>
<tr>
<td></td>
<td>• Refer to GRML S-4602</td>
</tr>
</tbody>
</table>

| Project: Ashida No. 1         | Area: 120 acres |
| (Opihikao No. 1)              |                |
| Permit No.: SP 77-265         | TMK: 1-3-01: 24, 25 |
| (LUC 364)                     |                |
| Effective Date: 7/14/77       | Expiration: 12/31/87 |
| Issued To: GEDCO              |                |
| General Information:          | • Land Owner: Mr. Harold Ashida and Mr. Vern Yamanaka |
|                              | • No mineral reservations or mining lease; mineral rights leased to GEDCO. |
|                              | • Land Use Zoning: Agriculture |
|                              | • Drilling permit issued for only 49.6 acres (TMK 1-3-01: 24) |

(3) Geothermal Resource Mining Lease: R-2 (Kapoho Section)
Issued To: Kapoho Land Partnership, Subleased to Puna Geothermal Venture (Thermal Power, Dillingham, Amfac)
Location: Kapoho, Puna, Hawaii
TMK: 1-4-01: 1, 2, Portion of 3, 19, 58 (1-4-01: PD Not Continued in Lease R-2 )
Area: 815.789 acres
Land Ownership: Kapoho Land and Development Co., Ltd.
Effective Date: March 1, 1981
Term: 10 years primary, 65 years maximum
General Information:
• Wells Drilled to Date: Kapoho State No. 1 /KSN No. 1
Kapoho State No. 2
• Leased Area Zoned: Agriculture
• Mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management
• See Figure 3
Figure 4. Tax Map Key Showing Boundary of GMRL R-3

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Permit No.</th>
<th>Permit Date</th>
<th>Status</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNB No. 2</td>
<td>9/26/78</td>
<td></td>
<td>Expired (9/26/79)</td>
<td>Puuwaawaa Steam Co (partnership between GEDCO and F. Newell)</td>
</tr>
<tr>
<td>Ashida No. 1</td>
<td>9/10/79</td>
<td>1/10/80</td>
<td>Expired (9/26/81)</td>
<td>Daiichi-Ne.</td>
</tr>
<tr>
<td>Lanipuna No. 1</td>
<td>3/10/81</td>
<td></td>
<td>Expired (9/20/83)</td>
<td>Geothermal Research Corporation of Hawaii (in production)</td>
</tr>
<tr>
<td>Lanipuna No. 6</td>
<td>11/10/83</td>
<td></td>
<td>Expired (11/10/84)</td>
<td>Geothermal Research Corporation of Hawaii (in production)</td>
</tr>
<tr>
<td>Kapoho State No. 1</td>
<td>3/19/81</td>
<td></td>
<td>Expired (9/14/83)</td>
<td>Geothermal Research Corporation of Hawaii (in production)</td>
</tr>
<tr>
<td>Kapoho State No. 2</td>
<td>1/8/82</td>
<td></td>
<td>Expired (7/7/83)</td>
<td>Geothermal Research Corporation of Hawaii (in production)</td>
</tr>
</tbody>
</table>
(4) Geothermal Resource Mining Lease: R-3 (KAPoho Section)

Issued To: Barnwell Geothermal Corp.

Location: Pohoiki, Puna, Hawaii

TMK:
1-3-45: 9, 10, 14, 16-18, 21, 22, 25
1-3-46: 2-5, 13-25, 29, 30, 33-74, 76, 78, 79, 81, 82, 84
1-3-08: 6, 7, 19 (currently noted as TMK 1-3-08: 6, 7, 19, 22-32)
1-3-09: 7 (currently noted as TMK 1-3-09: 7-9, 13-25, 39-49)
1-4-01: Portion of 30 (currently noted as TMK 1-4-01: 1-13, 15, 18-27)

Area: 769.14 acres (177.36 ha)

Land Ownership: J.T. Trading Co., Ltd. and Auto Imports of Hawaii, Inc.

Effective Date: September 1, 1981

Term: 10 years primary, 65 years maximum

General Information:

- Wells Drilled to Date: Lanipuna No. 1 and Lanipuna No. 6
- Leased Area Zoned: Agriculture
- Mineral Rights: The following parcels, TMK: 1-3-08: 6, 7, 19, have no mineral reservations. All other parcels have mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management.
- See Figure 4
Tax Map Key Showing Boundary of GMRL, R-4

Geothermal Resource Mining Lease: R-4

Issued To: Puna Geothermal Venture (Thermal Power Co., Dillingham, Amsaint)

Location: Kapoho, Puna, Hawaii


Area: 279.38 acres

Land Ownership: Various owners who have executed an assignment

Effective Date: September 1, 1982 (lease document in preparation)

Term: 10 years primary, 65 years maximum

General Information:
- No exploratory drilling to date
- Leased area zoned: Agriculture
- Mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management
- Lease application is restricted to 425.28 acres. The owners of the following parcels declined to enter into leasing agreement:
  - TMK: 1-4-16: 3, 4, 7; 1-4-17: 4, 5; 1-4-18: 6, 7, 8, 9, 10, 11, 12, 13
  - TMK: 1-4-20: 1-5; 1-4-21: 1-5

See Figure 5
(5) Geothermal Resource Mining Lease: R-4 (Kapoho Section)

Issued To: Puna Geothermal Venture (Thermal Power Co., Dillingham, Amfac)

Location: Kapoho, Puna, Hawaii

TMK: 1-4-16: 1-3, 5-11, 13
     1-4-17: 2, 3, 6-12
     1-4-18: 1-5, 7-10, 13
     1-4-19: 1-3, 9
     1-4-20: 7, 8
     1-4-21: 2-4

Area: 279.38 acres

Land Ownership: Various owners who have executed an assignment of their occupier rights to PGV

Effective Date: September 1, 1982 (lease document in preparation)

Term: 10 years primary, 65 years maximum

General Information:
- No exploratory drilling to date
- Leased Area Zoned: Agriculture
- Mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management
- Lease application applies to 279.377 acres out of a total area covering 425.28 acres. The owners of the following parcels declined to enter into leasing agreement:
  TMK: 1-4-16: 3, 4, 7; 1-4-17: 4, 5; 1-4-18: 6, 11;
       1-4-19: 4-8, 11, 12; 1-4-20: 1-5; 1-4-21: 1-3-7
- See Figure 5

Figure 5. Tax Map Key Showing Boundary of GMRL, R-4.
Issued To: Barnwell Geothermal Corp.

Location: Pohoiki, Puna, Hawaii

TMK: 1-3-45: 9, 10, 14, 16-18, 21, 22, 25
1-3-46: 2-5, 13-25, 29, 30, 23-24, 76, 78, 79, 81, 82, 84
1-3-08: 6, 7, 19 (currently noted as TMK 1-3-08: 6, 7, 19, 22-22)
1-3-09: 7 (currently noted as TMK 1-3-09: 33-39)
1-4-01: Portion of 39 (currently noted as TMK 1-4-01: 1-13, 15, 18-27)

Area: 769.14 acres (177.3668)

Land Ownership: J.T. Trading Co., Ltd. and Auto Imports of Hawaii, Inc.

Effective Date: September 1, 1981

Term: 10 years primary, 65 years maximum

General Information:

- Wells Drilled to Date: Lanipuna No. 1 / LANIPUNA NO. 1 RE-DRILL
  Lanipuna No. 6

- Leased Area Zoned: Agriculture

- Mineral Rights: The following parcels, TMK: 1-3-08: 6, 7, 19, have no mineral reservations. All other parcels have mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management.

- See Figure 4
Figure 4. Tax Map Key Showing Boundary of GMRL, R-3.

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Permit Date</th>
<th>Status</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNB No. 2</td>
<td>9/26/78</td>
<td>Expired (9/26/79)</td>
<td>Puuwaswaa Steam Co. (partnership between GEDCO and F. Newell Bohnett)</td>
</tr>
<tr>
<td>HGP-A</td>
<td>9/10/79</td>
<td>Completed</td>
<td>Research Corporation of the University of Hawaii</td>
</tr>
<tr>
<td>Ashida No. 1</td>
<td>1/10/80</td>
<td>Expired (1/10/81)</td>
<td>GEDCO</td>
</tr>
<tr>
<td>Lanipuna No. 1</td>
<td>1/20/81</td>
<td>Expired (9/20/83)</td>
<td>Barnwell Geothermal Corp.</td>
</tr>
<tr>
<td>Daiichi No. 1</td>
<td>3/2/81</td>
<td>Expired (3/2/82)</td>
<td>GEDCO</td>
</tr>
<tr>
<td>Lanipuna No. 6</td>
<td>11/10/83</td>
<td>In progress (expires 11/10/84)</td>
<td>Barnwell Geothermal Corp.</td>
</tr>
<tr>
<td>Kapoho State No. 1</td>
<td>3/19/81</td>
<td>Expired (9/14/82)</td>
<td>Puna Geothermal Venture (PGV)</td>
</tr>
<tr>
<td>Kapoho State No. 2</td>
<td>1/8/82</td>
<td>Expired (7/7/83)</td>
<td>PGV</td>
</tr>
</tbody>
</table>
SPECIAL USE PERMITS ISSUED BY THE
COUNTY OF HAWAII AND THE STATE LAND USE COMMISSION

Project: Puuwasawaa Steam Co.  
Permit No.: SP 79-333  
(LUC 411)  
Effective Date: 6/1/79  
Expiration: 7/1/82  
Issued To: Geothermal Exploration and Development Co. (GEDCO)  
General Information:  
- Landowner: Mr. F. Newell Bohnett  
- No mineral reservations or mining lease  
- Land Use Zoning: Agriculture

Area: 143 acres  

Project: HGP-A  
Permit No.: SP 78-307  
(LUC 392)  
Effective Date: 2/7/79  
Expiration: ongoing  
Issued To: Research Corporation of the University of Hawaii  
General Information:  
- Refer to GRML S-4602

Area: 4.1 acres  

Project: Ashida No. 1  
(Ohindako No. 1)  
Permit No.: SP 77-265  
(LUC 364)  
Effective Date: 7/14/77  
Expiration: 12/31/87  
Issued To: GEDCO  
General Information:  
- Land Owner: Mr. Harold Ashida and Mr. Vern Yamanaka  
- No mineral reservations or mining lease; mineral rights leased to GEDCO.  
- Land Use Zoning: Agriculture  
- Drilling permit issued for only 49.6 acres (TMK 1-3-01: 24)

Area: 120 acres  

(3) Geothermal Resource Mining Lease: R-2  
(Kapoho Section)  
Issued To: Kapoho Land Partnership, Subleased to Puna Geothermal Venture (Thermal Power, Dillingham, Amfac)  
Location: Kapoho, Puna, Hawaii  
TMK: 1-4-01: 1, 2, 3, 19, 58  
Area: 815.799 acres  
Land Ownership: Kapoho Land and Development Co., Ltd.  
Effective Date: March 1, 1981  
Term: 10 years primary, 65 years maximum  
General Information:  
- Wells Drilled to Date: Kapoho State No. 1  
Kapoho State No. 2  
- Leased Area Zoned: Agriculture  
- Mineral rights reserved to State of Hawaii, subject to verification by Division of Land Management  
- See Figure 3
Figure 3. Tax Map Key Showing Boundary of GMRL, R-2.

Project: Lanipuna (6 wells)  Area: Portion of 769.14 acres (12 acres+)
Permit No.: SP 471  TMK: 1-3-8: 6, 7, 19
Effective Date: 12/16/80  Expiration: 12/31/87
Issued To: Barnwell Geothermal Corp.
General Information:
- Refer to GRML R-3

Project: Daiichi No. 1  Area: 180 acres
Permit No.: SP 80-347 (LUC 469)  TMK: 1-4-02: 10
Effective Date: 2/13/81  Expiration: 12/31/87
Issued To: GEDCO
General Information:
- Landowner: Daiichi Seiko of Hawaii, Inc.
- No mineral reservations or mining lease. Mineral rights leased to GEDCO
- Land Use Zoning: Agriculture
- No exploratory drilling; site only

Project: Kapoho State (2 wells)  Area: Portion of 815.99 acres (4 acres+)
Permit No.: SP 468  TMK: 1-4-01: Portion of 2 and 19
Effective Date: 10/15/80  Expiration: 10/15/86
Issued To: Thermal Power Co. (PGV)
General Information:
- Refer to GRML R-2
- Testing Program underway
See Figure 2

Geothermal Resource Mining Lease: R-1

Issued To: Bishop Estate, Subleased to

Location: 100 acres primary, 65 acres maximum

Effective Date: March 1, 1981

Description: Bishop Estate

Area:

<table>
<thead>
<tr>
<th>Portion</th>
<th>1-3-01</th>
<th>1-3-02</th>
<th>1-3-03</th>
<th>1-3-05</th>
<th>1-3-09</th>
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<td>1,094</td>
<td>9,601</td>
<td>8,110</td>
<td>1,247</td>
</tr>
</tbody>
</table>

Terms: 10 years primary, 65 years maximum

Mineral rights reserved to

Hawaii Power, subject to

Years primary, 65 years maximum

Puna Dillingham, Amfac)

Quadrangle: Pahoa South, Quadrangle Map Showing

Geothermal Resource Mining Lease: R-1 (SEE EXPLANATION SECTION)
### Geothermal Exploratory Wells

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Status</th>
<th>Driller</th>
<th>Depth Drilled (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNB No. 2</td>
<td>Abandoned (converted to water well No. 4850-01)</td>
<td>WRII*</td>
<td>6800</td>
</tr>
<tr>
<td>HGP-A</td>
<td>Completed (experimental production)</td>
<td>WRII</td>
<td>6450</td>
</tr>
<tr>
<td>Ashida No. 1 (Opilika No. 1)</td>
<td>Suspended</td>
<td>WRII</td>
<td>8000</td>
</tr>
<tr>
<td>Lanipuna No. 1</td>
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<td>WRII</td>
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*Water Resources International*
Geothermal Resource Mining Leases (GRML)

Geothermal Resource Mining Lease: S-4098 (HGP-A) (1955 lease)

Issued To: The Research Corporation of the University of Hawaii

Location: Kapoho, Puna, Hawaii

Area: 1.4 acres

Term: 10 years primary, 30 years maximum

Land Ownership: State of Hawaii

Mineral Rights Reserved to State of Hawaii

Well Drilled to Date: HGP-A

Issued Date: June 19, 1979

(1)

Geothermal Resource Mining Lease

Figure 7. Location Sketch of Proposed Campbell Estate Geothermal Project (Kahaualea) Showing Some of the 1983 Lava Flows.

PROPOSED CAMPBELL ESTATE GEOTHERMAL PROJECT WITH 1983 KILAUEA EAST RIFT LAVA FLOWS
Location: Kahuaalea, Puna, Hawaii

TMK: 1-1-01: 1
     1-2-08: 1

Area: 25,461.31 acres

Land Ownership: James Campbell Estate

Pending Sublease To: True/Mid-Pacific Geothermal Venture

General Information:

- Geothermal Mining Lease application to include 25,059 acres out of approximately 25,613 acres owned by Campbell Estate.

- Proposed lease area includes both Conservation zoned lands (22,533 acres) and Agriculture zoned lands (2,928 acres).

- Project site bordered on the west and southwest by Volcanoes National Park and on the east by the Puna Forest Reserve.

- Development plans to include access road construction, 5 power plant sites, and up to 35 multiple well drilling sites of approximately 3 to 5 acres each, assuming it is possible to conduct directional drilling of up to 6 wells per site.

- On February 25, 1983, the State Board of Land and Natural Resources granted conditional approval of a Conservation District Use Permit to Campbell Estate. The Board’s decision allows Campbell Estate to drill up to 8 exploratory wells within a restricted area of the Conservation district or cease exploration when 4 wells show indication of geothermal resource potential.

- The Board set forth conditional requirements to study air quality, meteorological data and noise monitoring to provide the public with safeguards on geothermal emissions.

- Campbell Estate has not applied to the Board of Land and Natural Resources for a mining lease or drilling permit to date.

- Volcanic eruptions have occurred throughout 1983 to present and lava flows have since covered lands within the approved designated area.

- The Board is scheduled to conduct a supplementary hearing for the limited purpose of obtaining data about the effect of these lava flows on Campbell Estates’ exploratory drilling plans.
Figure 8. Geothermal Power Plant Diagram.
GEOTHERMAL ENERGY PRODUCTION (HGP-A)

Project: HGP-A Well head Generator Project

Project Funding: U.S. Department of Energy
State of Hawaii
County of Hawaii
Hawaii Electric Light Co. (HELCO)

Design Consultants: Rogers Engineering Co., Inc. of San Francisco
W.A. Hirai and Associates, Inc. of Hilo

Project Management: Research Corporation of the University of Hawaii (RCUH) for the HGP-A Development Group

Facility Operation: HELCO personnel to provide daily routine maintenance and operated remotely from HELCO's control room in Hilo.

Power Plant Design:

Generator electrical output of 3 megawatts (3,000 Kilowatts) based on steam flow rate of 60,000 lb/hr at 160 psig and 350°F. 2.8 megawatts appropriated for HELCO distribution to approximately 2,500 residents in the Puna district.

Well head assembly and specific equipment designed for protection or easy removal to avoid lava flows.

Installation of environmental controls to limit air, water and noise pollution.

Major Plant Components:

Steam Supply System consisting of wellhead, steam flash cyclone separator to separate steam and water phases, and additional in line separator to remove residual liquids.

Turbine-Generator producing 3.0 megawatts of electricity of which 0.2 megawatts allotted for plant auxiliary equipment.

Hydrogen Sulfide Abatement using a caustic soda system for removal of H$_2$S and other non-condensable gases that are extracted and burned in an incineration system.

Condenser where exhausted steam from the turbine is separated into liquid and non-condensable gases. Part of this condensate is used to replenish the cooling water lost by evaporation.

Cooling Water System where heat is absorbed through a closed water system and dissipated into the atmosphere by evaporative cooling. The process occurs when warm water is sprayed down the cooling tower and is contacted by cool air flowing through the water.
Silica Settling Pond where excess condensate water is combined with the liquid from the separator and travels to a concrete retention pond where silica is deposited and water is then percolated into the ground.

Production Data:

Production of enough electricity to displace 40,000 barrels of crude oil annually (approximately $1.6 million based on 1980 prices). Electricity sold to HELCO and revenue received to offset operating and maintenance costs.

Monthly operating figures received from RCUH outline amounts of geothermal fluids and electricity produced from HGP-A in addition to the gross revenue and calculations of the waived royalties pursuant to geothermal mining lease No. S-4602.

Summary:

Geothermal energy has demonstrated to be one of the more economical and one of the least polluting of all current fuels used for electrical production. If commercialized it would greatly reduce the millions of dollars spent annually for imported fuel.

Also, lower temperature steam development although not directly valuable for electricity production can be used for direct heat application in agriculture and aquaculture.

Geothermal energy production is a feasible alternative to fossil fuels and nuclear energy to supply HELCO's projected demand of an additional 25 megawatts by 1988.
### SUMMARY OF MONTHLY HGP-A OPERATING FIGURES

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*Waived by the BLNR (6/19/79)
REFERENCES


PREFACE

The Geothermal Resources Development report was prepared to assist in the designation of geothermal resource subzones in the State of Hawaii as mandated by Act 296, SLH 1983, and contains a compilation of currently available information relating to geothermal development in Hawaii.

This report identifies the existing exploratory well sites, and outlines the current geothermal resource mining leases issued by the State Board of Land and Natural Resources. Also included is a list of geothermal exploratory drilling permits issued by the Department of Land and Natural Resources and special use permits issued by the County of Hawaii and the State Land Use Commission.

In order to demonstrate the feasibility of geothermal energy utilization, a brief outline of the HGP-A Well head Generator Project has been included. This information along with future contributions to the Department will be of valuable assistance in determining the location and quality of Hawaii's geothermal resources.

This publication was prepared by Dean Nakano, Geologist, with assistance from Edwin Sakoda, Geologist, and Neal Imada, Civil Engineer.