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AN UPDATE OF THE COST OF GEOTHERMAL
POWER CURVES UTILIZING THE
GELCOM MODEL

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ABSTRACT

Recognizing that the choice between building a conventional versus a hydrothermal power plant typically hinges on the busbar cost of electricity for each option, DGHT commissioned the development of the GELCOM Model in 1977. This cost of energy model was subsequently used for developing curves for cost of hydrothermal electricity at a number of known reservoirs in 1979. Due to the dynamic nature of energy economics and technical advances in identifying, retrieving, converting, and delivering various energy types, DGHT decided it would be prudent to run the model again utilizing the most recent information available. In addition to gathering new data concerning the resource, engineering design and financial characteristics, EER checked and, where appropriate, revised assumptions used in GELCOM. The potential impacts of a number of R&D programs on the parameter of the model were also estimated. The cost of power curves, generated from data derived from this run of the model, indicate that approximately 10,000 MWe of hydrothermal electric power can be generated with a levelized busbar cost below 40 mills/Kwh (in constant 1981). When the benefits of a successful R&D program are considered, about 13,000 MWe of hydrothermal electric power can be expected to be generated for a levelized busbar cost below 40 mills/Kwh. At below 40 mills/Kwh, hydrothermal energy is competitive with coal and nuclear energy on the West Coast, where it is most abundantly found, and significantly less expensive than oil.

1.0 COST OF ENERGY MODEL - STRUCTURE AND ASSUMPTIONS

The cost curves for hydrothermal electric power could be developed by utilizing a number of available cost of energy models. A comparison of these models (recently conducted by EER) indicated that the GELCOM model is one of the better tools available for computing the cost of hydrothermal electricity at individual sites. Since DGHT has utilized the output of this model in many of its planning documents and benefit/cost analyses of its program, EER decided to exercise the GELCOM model for generating the new cost of power curves presented in this document. However, it was concluded that some changes in the model logic and structure would be required to reflect the advances made in hydrothermal energy extraction and conversion technology. These changes were made prior to the utilization of the model.

Since the generation of the cost of power curves presented in the Fourth Annual Report of the IGCC, a number of significant changes have occurred in the economic environment (e.g., required rates of return, cost of capital, type and debt/equity ratios, tax regulations, etc.) as well as the general energy supply/demand/price scenario. In addition, the results of extensive exploration activities necessitates revisions in the site specific resource characteristics data base. To ensure that the cost of power estimates generated by the GELCOM model were valid in the context of the current and projected economic scenario. EER utilized the best sources of information available to update underlying assumptions employed in the model. These assumptions may be generically grouped into three categories: (1) producer financial data, (2) utility financial data, and (3) technical assumptions.

2.0 PRODUCER FINANCIAL ASSUMPTIONS

In running the model, the user may either choose to proceed in an interactive mode, where data are edited on a site-by-site basis, or in a batch mode, where data are edited prior to running the model for all sites. While the flexibility afforded by running the model in an interactive mode is desirable, the expense is significantly greater. Batch mode is appreciably less expensive because line connection charges are minimized. EER determined that the most cost effective manner in which to run the model was to proceed in a batch mode on a state-by-state basis. This enabled staff members to change certain assumptions from state-to-state, while holding other assumptions constant throughout the run. Several assumptions that did not vary from state-to-state are presented in Exhibit 1.

Other assumptions did vary by state. These assumptions included the effective total income tax fraction (a combination of Federal, state, and local taxes) and property taxes. These assumptions are detailed in Exhibit 2.

3.0 UTILITY FINANCIAL ASSUMPTIONS

The financial assumptions applicable to utilities involved in generating and distributing hydrothermal electricity are shown in Exhibit 3. Although many of the assumed parameter values are identical to those adopted for producers, sizeable differences exist between the cost of capital data for utilities and producers. For

EXHIBIT 1

PRODUCER FINANCIAL ASSUMPTIONS

<u>CATEGORY</u>	<u>RATE</u>
Debt Fraction	40%
Annual Interest Rate on Debt:	16%
Required Rate of Return on Equity:	25%
Revenue Tax Rate on Royalty:	10%
Effective Investment Tax Credit:	12%
Escalation Factor for O&M Costs:	7%
Escalation Factor for Energy Costs:	7%
Escalation Factor for Capital Costs:	7%
Life Span for Production Wells:	10 years
Life Span for Injection Wells:	10 years
Life Span for Producer Plants:	30 years
Start Up Cost Multiplier:	1.036
Geothermal Depletion Allowance Rate:	10%

EXHIBIT 2

EFFECTIVE TOTAL INCOME AND PROPERTY TAX RATES

<u>State</u>	<u>Effective Total* Income Tax Rate</u>	<u>Property Tax Rate</u>
Alaska	51%	3.000%
Arizona	50%	4.340%
California	57%	1.000%
Colorado	51%	1.940%
Hawaii	58%	1.378%
Idaho	53%	10.910%
Nevada	50%	1.274%
New Mexico	52%	0.885%
Oregon	50%	1.977%
Utah	50%	4.000%
Washington	50%	0.045%

* The effective total corporate income tax rate is the composite of federal, state and local taxes.

example, in most cases utilities may issue tax free bonds to raise necessary capital; producers may not. This effectively lowers the interest rate utilities have to offer on the open market to attract investors. Income and property tax assumptions are the same for the producer and utility categories, as presented in Exhibit 2.

4.0 TECHNICAL ASSUMPTIONS

In addition to updating the financial assumptions employed in the model, EER researched changes in technical parameters, as well. The majority of the updated technical information utilized came from a report prepared by EER and published by DOE in March 1982, entitled Hydrothermal Industrialization; Electric Power Systems Development (DOE/ID/12186). Updated parameters include reservoir temperature estimates, flow rates (when available), resource size, fluid salinity, rock type, and the year during which power is projected to come on-line at each site. Six additional sites were added to bring the total to 55 high quality reservoir locations. While site-specific technical assumptions utilized by the model are too numerous to list here, they are detailed in the listing of each reservoir location.

Certain general, or "default", assumptions are generated by GELCOM if site-specific technical data are not available. These assumptions are based on the best technical information available. Default assumptions are available for the type of energy conversion cycle (Binary or Flash), production and injection well costs, number of production and injection wells required, and well flow rates. It should be reiterated that the default values are utilized only when site specific information is not available.

EXHIBIT 3

UTILITY FINANCIAL ASSUMPTIONS

<u>Category</u>	<u>Rate</u>
Debt Fraction:	40%
Annual Interest Rate on Debt:	12%
Required Rate on Equity:	14%
Revenue Tax Rate on Royalty:	0%
Effective Investment Tax Credit:	12%
Escalation Factor for O&M Costs:	7%
Escalation Factor for Energy Costs:	7%
Escalation Factor for Capital Costs:	7%
Life Span of Utility Plant	30 years
Ultimate Capacity Factor	80%
Start Up Cost Multiplier	1.016

With regard to the type of energy conversion cycle, GELCOM supports two alternatives, binary or flash. The default assumption is based on the reservoir temperature. For a reservoir temperature in excess of 180°F, a flash plant is assumed. Conversely, for plants below that threshold, binary technology is presumed. These assumptions are based on the economics of the technologies with the end objective of minimizing the cost of power.

Production and injection well costs are determined by default in the model according to the nature of the rock formations through which a well is drilled. Exhibit 4 presents the assumptions utilized in the model if actual costs are not available. EER updated the costs used in a prior run of GELCOM by multiplying the earlier figures by a factor based on the inflation of well drilling and completion costs. The number of production and injection wells is automatically determined by the model as a function of plant size, fluid temperature, energy conversion efficiency and the well flow rate.

If actual well flow rates are not known (this is generally the case), the model assumes certain flow rates based on the reservoir temperature. A basic well flow of 296,000 kgm/hr for a 95/8 inch casing at a 290°C bottom hole temperature is assumed. The other well flow rates, at temperatures of 230°C and 180°C, are assumed to be 268,000 kgm/hr and 260,000 kgm/hr, respectively. Injection wells were assumed to have the same well flow limitations. Appendix A contains the site-specific hydrothermal resource data which were utilized as the input to the cost of energy model.

EXHIBIT 4

ASSUMED WELL DRILLING COSTS (1981 DOLLARS)

Rock Type	Cost (\$/Foot)	
	< 5000 Feet	> 5000 Feet
Soft	111.00	222.00
Medium	139.00	278.00
Medium-Hard	173.00	346.00
Hard	277.00	554.00

5.0 ESTIMATES FOR THE COST OF HYDROTHERMAL ELECTRICITY

The estimates for the bus bar cost of hydrothermal electricity at 55 known sites in the United States are presented in Exhibit 5. The energy cost estimates are based on the technical and economic parameters which were discussed earlier. An updated version of the GELCOM model was utilized for generating these estimates. The figures in the bus bar cost columns of Exhibit 5 are indicative of the wide range of cost of energy annotated with individual reservoirs in the set of geothermal sites.

The lowest estimated bus bar cost estimate is 15 mills/Kwh for the first plant at Salton Sea (this estimate is the levelized bus bar cost in 1981 dollars). The highest estimated levelized bus bar cost estimate is 232 mills/Kwh at the Trout Creek Reservoir in Oregon. These figures are based on the assumption at the first plant at each site will be utilizing the current technology. If the future benefits of the on-going R&D are reflected in the values of the technical parameters of the model, the site-specific estimates of the

EXHIBIT 5
SUMMARY OF COST OF HYDROTHERMAL ELECTRICITY ESTIMATES

SITE/RESERVOIR NAME	ACTUAL/ PROJECTED DATE OF FIRST PLANT ON LINE	TOTAL ESTIMATED RESERVOIR CAPACITY MW FOR 30 YRS.	ESTIMATED LEVELIZED BUSBAR COST MILLS/KWHR (1981 \$)		REMARKS
			WITH CURRENT TECHNOLOGY	WITH FULL BENEFITS OF R&D	
Bailey Bay Hot Springs, AK	1987	26	92	79	1st Plant on-line date uncertain
Geyser Bight, AK	1985	136	47	41	
Hot Springs, AK	1988	27	136	115	
Power Ranches, AZ	1987	23	171	142	
Border, CA	1989	31	143	120	
East Mesa, CA	1981	360	77	77	
Brawley, CA	1980	640	36	36	
Coso, CA	1984	650	39	34	
The Geysers, CA (Flash)	1983	100	30	30	
Heber, CA	1984	500	68	59	1st Plant on-line date uncertain
Lassen, CA	1995	133	24	22	
Mono-Long Valley, CA	1985	2100	44	38	
Morgan-Springs, CA	1989	116	36	32	
Randsburg, CA	1985	84	62	55	
Salton Sea, CA	1983	3400	15	15	
Surprise Valley, CA	1986	1490	115	98	
Sulphur Bank Mine, CA	1987	75	67	57	
Wendel-Amedee, CA	1985	500	153	131	
Westmorland, CA	1984	1710	43	39	
Paradise Hot Springs, CO	1990	24	143	120	
Kamaili Homesteads, HI	1985	210	33	29	
Puna, HI	1981	500	55	55	
Big Creek Hot Springs, ID	1989	26	174	148	
Crane Creek - Cove Creek, ID	1987	340	104	91	
Raft River, ID	1981	100	133	133	
Beowawe, NV	1983	127	40	40	
Bradey Hot Springs, NV	1990	157	108	90	
Desert Peak, NV	1983	750	53	53	
Fernley, NV	1987	33	76	64	
Great Boiling Spring, NV	1987	32	81	68	

EXHIBIT 5
SUMMARY OF COST OF HYDROTHERMAL ELECTRICITY ESTIMATES (Concluded)

SITE/RESERVOIR NAME	ACTUAL/ PROJECTED DATE OF FIRST PLANT ON LINE	TOTAL ESTIMATED RESERVOIR CAPACITY MW FOR 30 YRS.	ESTIMATED LEVELIZED BUSBAR COST MILLS/KWHR (1981 \$)		REMARKS
			WITH CURRENT TECHNOLOGY	WITH FULL BENEFITS OF R&D	
Hot Sulphur Spring, NV	1987	27	88	74	
Humboldt House, NV	1985	47	40	36	
Kyle Hot Springs, NV	1988	97	114	96	
Leach, NV	1991	77	89	76	
Lee Hot Springs, NV	1990	28	167	140	
Pinto Hot Springs, NV	1984	32	134	113	
San Emidio, NV	1988	28	113	94	
Soda Lake, NV	1988	146	99	84	
Steam Boat Spring, NV	1985	350	30	27	
Stillwater, NV	1984	450	103	89	
Sulphur Hot Springs, NV	1988	74	95	79	
Valles Caldera, NM	1983	2700	26	25	
Alvord, OR	1989	49	81	69	
Crumps Geiser, OR	1987	61	115	99	
Borax Lake, OR	1987	91	69	60	
Mickey Hot Springs, OR	1987	160	63	55	
Neal Hot Springs, OR	1987	36	144	122	
Newberry Caldera, OR	1988	740	71	58	
Trout Creek, OR	1990	24	232	190	
Vale Hot Springs, OR	1988	870	78	67	
Cove-Fort, UT	1987	330	89	78	
Roosevelt Hot Springs, UT	1984	970	26	24	
Gamma Hot Springs, WA	1989	27	72	61	

bus bar cost of electricity drop by an average of about 15 percent. In absolute terms, the effect of successful R&D can amount to as much as 42 mills/Kwh.

Exhibit 6 shows the estimated hydrothermal electric power capacity which can be generated at or below a given levelized bus bar cost. It is assumed that the cost of power associated with hydrothermal plants which come on-line after the first plant at a given site will be no higher than the estimated levelized bus bar cost for the first plant. The cost of hydrothermal power curves developed in the past were also based on this assumption.

In comparison with the estimates generated in 1979 and 1980, the figures shown in Exhibit 5 are slightly higher, primarily due to a downward revision of the resource temperature at many sites, and higher estimated well costs for most of the sites. Among the financial parameters responsible for elevating the cost of power estimates, the required rate of return on hydrothermal electric power plant investments is most important. Recognizing that venture capital as well as borrowed funds are going to be relatively expensive in the future, the figures for interest rate on debt fraction as well as the rate of return on the equity fraction were revised upward relative to the corresponding figures used in prior analysis. The escalation factors for plant capital costs, plant O&M costs, and energy costs were also raised in comparison with the old figures.

The most significant change in the engineering parameter values is the downward revision of the estimated life span of production and injection wells. This change coupled with the modifications of some

EXHIBIT 6

HYDROTHERMAL ELECTRIC POWER COST CURVE

of the financial parameters resulted in the higher bus bar cost estimates.

In Exhibit 6, the cost of power indicates that approximately 10,000 MWe of hydrothermal electric power can be generated with a bus bar cost below 40 mills/Kwh. When the benefits of a successful R&D program are considered, about 13,000 MWe of hydrothermal electricity can be expected to be generated with bus bar cost less than 40 mills per kwh.

It is important to point out that the cost of power curve presented in Exhibit 6 does not include approximately 1,600 MWe of hydrothermal (steam) power plant capacity at The Geysers. The cost of electricity of this site is likely to be well below 40 mills/Kwh. Over 900 MWe of installed capacity is already on line at this site and the remaining capacity is expected to be installed prior to 1986.

For comparing the cost of hydrothermal electricity with the bus bar cost of electricity at nuclear and fossil fueled power plants, the estimated bus bar costs of power for these plants are marked in Exhibit 6. It should be noted that site-specific variations may cause the actual electricity costs to be different from the figures marked in the exhibit. Nevertheless, the accuracy of estimates displayed in Exhibit 6 is adequate for a rough economic comparison between the hydrothermal electric power and electricity generated at fossil fuel and nuclear power plants.

Since it is a common practice in the utility industry to compute the required revenue in nominal (current) dollars, the vertical axis on the right side of Exhibit 6 is scaled in terms of current dollar levelized cost units. The factor for conversion of bus bar costs

from constant dollars to nominal dollars is a function of the rate of inflation and the discounting factor. In the case of the data utilized for generating the figures presented in Exhibits 5 and 6, the conversion factor is approximately 1.75.

The horizontal scale and the top of Exhibit 6 show the magnitude of the capacity of hydrothermal electricity which can be generated at or below a given bus bar cost if all the known and inferred hydrothermal resources were available for exploitation. USGS circular 790 was the source of information for developing the upper horizontal scale. It was assumed that the statistical distribution of the characteristics of the inferred (undiscovered) resources will be similar to the distribution of the characteristics of the known resources with the result that the distribution of the cost of power estimates for the known and inferred resource base is identical to the distribution for the known resources only. This assumption is reasonable in view of the uncertainty associated with the values of many of the characteristics of the known reservoirs.

SOURCES OF INFORMATION

GELCOM: A Geothermal Levelized Busbar Cost Model, J.N. Gupta and J.G. Leigh, The MITRE Corporation, M78-17, January 1978. (Modified by Engineering and Economics Research, Inc., H.S. Dhillon, J.N. Gupta, K.J.T. Farrell, A. Kumar, July 1982.)

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APPENDIX A

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM *	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Bailey Bay Hot Springs, Alaska	26	1	164	1500	B	Medium Hard	Low	27	11
Geyser Bight, Alaska	136	3	208	1500	F	Medium Hard	Low	17	7
Hot Springs Cove, Alaska	27	1	162	1999	B	Medium Hard	Low	29	11
Power Ranches, Inc., Wells Arizona	23	1	165	2469	B	Medium Hard	Low	27	11
Border, California	31	1	160	2299	B	Soft	High	30	12
Brawley, California	640	13	253	1981	F	Soft	High	10	4
Clear Lake Volcanic Field Area, California	900	18	190	1999	F	Medium Hard	Low	774	86
Coso, California	650	13	220	1486	F	Medium Hard	Low	14	6

* B: BINARY S: STEAM
 F: FLASH S/F: STEAM/FLASH

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM * TYPE	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
East Mesa, California	360	8	182	1800	F	Soft	Low	23	10
The Geysers, California	33	1	237	1500	S/F	Medium	Low	25	10
Heber, California	500	10	175	1500	F	Soft	Low	25	11
Lassen, California	133	3	240	1000	F	Medium	Low	11	5
Mono-Long Valley, California	2100	42	227	1500	B	Medium Hard	Low	9	5
Morgan Springs, California	116	3	217	1500	F	Medium	Low	15	6
Randsburg Area, California	84	2	175	1000	B	Medium Hard	Low	23	9
Salton Sea, California	3400	68	323	500	F	Soft	High	4	3

* B: BINARY S: STEAM
F: FLASH S/F: STEAM/FLASH

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 10 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM *	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Surprise Valley, California	1490	10	152	1500	B	Medium Hard	Low	38	15
Sulfur Bank Mine (Hot Bolata), California	75	2	194	1500	F	Medium Hard	Low	20	8
Wendel-Amadee, California	500	10	126	1000	B	Medium	Low	92	36
Westmoreland, California	1710	35	217	1100	F	Medium Hard	High	15	6
Paradise Hot Spring, Colorado	24	1	154	1999	B	Soft	High	36	14
Kamaili Homesteads, Hawaii	210	5	273	1500	F	Hard	Low	8	4
Puna (Kapoho Reservoir), Hawaii	500	10	275	2200	F	Hard	Low	8	4
Big Creek Hot Springs, Idaho	26	1	162	1999	B	Medium Hard	Low	29	11

* B: BINARY S: STEAM
F: FLASH S/F: STEAM/FLASH

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM * TYPE	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Crane Creek-Cove Creek, Idaho	340	7	171	1500	B	Medium Hard	Low	23	9
Raft River, Idaho	100	2	149	1300	B	Medium	Low	42	16
Baltazor Hot Springs, Nevada	46	1	158	1999	B	Medium Hard	Low	42	5
Boewawe, Nevada	127	3	229	1100	F	Hard	Low	13	6
Brady Hot Springs, Nevada	157	4	155	1000	B	Hard	Low	35	14
Desert Peak Area, Nevada	750	15	221	1999	F	Medium Hard	Low	14	6
Fernley Area, Nevada	33	1	182	1500	F	Medium Hard	Low	23	10
Great Boiling Springs (Gerlach), Nevada	32	1	178	1999	B	Medium	Low	20	8

* B: BINARY S: STEAM
 F: FLASH S/F: STEAM/FLASH

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM * TYPE	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Hot Sulphur Springs (Tuscarora), Nevada	27	1	165	1999	B	Soft	Low	27	11
Humboldt House, Nevada	47	1	217	1999	F	Soft	Low	15	6
Kyle Hot Springs, Nevada	97	2	159	1999	B	Medium	Low	31	12
Leach, Nevada	77	2	162	1500	B	Medium Hard	Low	29	11
Lee Hot Springs, Nevada	28	1	166	1999	B	Hard	Low	26	10
Pinto Hot Springs, Nevada	32	1	178	1999	B	Hard	Low	20	8
San Emedio Desert Area, Nevada	28	1	166	1999	B	Medium Hard	Low	25	10
Soda Lake Area, Nevada	146	3	157	1500	B	Medium Hard	Low	33	13

* B: BINARY S: STEAM
F: FLASH S/F: STEAM/FLASH

SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM * TYPE	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Steamboat Springs, Nevada	350	7	200	300	F	Medium Hard	Low	18	8
Stillwater Area, Nevada	450	9	157	1000	B	Hard	Low	33	13
Sulfur Hot Springs (Hot Sulfur Springs) Nevada	74	2	178	1999	B	Medium Hard	Low	20	8
Valles Caldera, New Mexico	2700	54	134	1000	F	Hard	Low	8	4
Alvord, Oregon	49	1	181	1999	F	Hard	Low	23	10
Crumps Geyser, Oregon	61	2	167	1500	B	Hard	Low	25	10
Hot (Borax) Lake Area, Oregon	91	2	191	1500	F	Medium Hard	Low	20	9
Mickey Hot Springs, Oregon	160	4	205	1999	F	Medium Hard	Low	17	7

* B: BINARY S: STEAM
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SITE-SPECIFIC HYDROTHERMAL RESOURCE DATA

NAME OF SITE	RESOURCE SIZE (MWe 30 yrs.)	NUMBER OF POWER PLANTS	RESOURCE TEMPERATURE °C (BEST ESTIMATE)	RESOURCE DEPTH (METERS)	SYSTEM TYPE *	ROCK TYPE	BRINE SALINITY	NUMBER OF PRODUCTION WELLS	NUMBER OF INJECTION WELLS
Neal Hot Springs, Oregon	36	1	188	1999	F	Hard	Low	21	9
Newberry Caldera, Oregon	740	15	230	1999	F	Hard	Low	13	6
Trout Creek Area, Oregon	24	1	154	1999	B	Hard	Low	36	14
Vale Hot Springs, Oregon	870	18	157	1500	B	Soft	Low	33	13
Cove Fort - Sulphurdale, Utah	330	7	167	1500	B	Medium Hard	Low	25	10
Roosevelt Hot Springs, Utah	970	20	265	1300	F	Medium Hard	Low	8	4
Gamma Hot Springs, Washington	27	1	165	1500	B	Medium	Low	27	11

* B: BINARY S: STEAM
F: FLASH S/F: STEAM/FLASH

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