

PRELIMINARY
INVENTORY OF WESTERN U.S. CITIES
WITH
PROXIMATE HYDROTHERMAL POTENTIAL
Volume I: Report
August, 1980

PREPARED BY



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For the

U.S. DEPARTMENTS OF ENERGY AND HOUSING & URBAN DEVELOPMENT

Under

O.I.T. GEOHEAT CENTER CONTRACT NO. FG06-79ET-27256

Principal Investigators
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NOTE: Volume II of this report contains individual state maps depicting inventoried cities and hydrothermal resources.



I. ABSTRACT

Eight states in the western U.S. are inventoried to identify incorporated cities located within five miles of a thermal well or spring having a temperature of 50°F or greater. Inventoried states include: Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, and Washington.

The inventory identifies a total of 1,277 hydrothermal sites within five miles of 373 cities in the eight states, with a combined population of 6,720,347 persons. The combined heat load for all cities (exclusive of industrial loads) is estimated at $132,558.0 \times 10^9$ Btu/yr.

The inventory appears in two volumes, the first being this report, and the second containing individual state maps of identified cities and hydrothermal sites.



II. OBJECTIVES & METHODOLOGY

A. OBJECTIVES

The objective of this report is to provide a preliminary inventory of cities in eight western states which are proximate to a confirmed hydrothermal resource, and to tentatively identify their population growth and heating load characteristics. The states inventoried include: Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, and Washington.

This inventory is the first known region-wide compilation of incorporated population centers possessing proximate (5 mi. or less) hydrothermal potential for direct-use or heat pump application. As such, it is intended as a preliminary aid for geothermal officials engaged in resource planning and commercialization. Specifically, the identification of municipalities co-located with hydrothermal resources is intended to recognize the significant urban energy value of geothermal resources, and to encourage the formulation and implementation of urban hydrothermal development strategies.

B. METHODOLOGY

This report was prepared under a subcontract from the Oregon Institute of Technology (OIT) Geoheat Center. In specifying the project's work scope OIT requested that cities be inventoried in eight western states based upon two selection criteria:

- 1) That the community or population center in question be an incorporated municipality; and
- 2) That the city in question be located within five miles or less of a thermal well or spring having a confirmed temperature of 50° F or greater.

The report was prepared in accordance with these criteria, except for applying the incorporation prerequisite to sites in Nevada



and Hawaii. In Nevada, many population centers are not municipally incorporated, instead relying on county government for local services; therefore, two unincorporated communities are included in the Nevada sites because of their size and resource potential. In Hawaii, the local government system is even more county-based, with municipal incorporation being very rare; therefore, all identified Hawaiian cities are urban population centers, but they do not exercise any powers of a municipal corporation.

The inventory was compiled using each state's most current and available data describing thermal ground water, population growth, and energy use. The states' thermal ground water mapping was cross-checked against locations of incorporated cities to establish the 5-mile criteria. It should be noted that several well-known communities may not appear in the inventory due to the 5-mile limitation. For purposes of establishing the 5-mile limit distances were measured from city centers, such that some cities may have had outer boundaries within five miles of a resource, but were eliminated because of the greater actual distance to the developed urban center. Many additional cities were found to be within 5 to 15 miles of a confirmed resource; however, the purpose of the 5-mile limit was to identify communities having minimal resource piping requirements, and therefore, increased near-term potential for development. Screening was also performed for the requisite temperature of 50° or greater; the purpose of including resources beneath direct-use temperature requirements was to acknowledge the large potential for ground water heat pump applications.

Identified cities were subsequently described according to: hydro-thermal resource depth and temperature ranges (depth information was available for only five of the eight states); current population



level and annual average growth rate; and by estimated community heating load. These characteristics are intended to tentatively compare resource potential against current and projected population levels, and to indicate the local potential for displacing conventionally-fueled heating loads.

The estimation of community heating loads was performed using a methodology developed at the OIT Geoheat Center (Lund, 1980). This methodology estimates heating load according to two major community land-uses:

1. Residential space heating and water heating; and
2. Commercial space heating and water heating.

The public facility and institutional space and water heating portion of the community load is included within the commercial estimate shown in the inventory tables of Part III. The scope of this inventory precluded estimates of industrial process heat loads in identified cities, so that each community's total estimated heat load is exclusive of any industrial process heat requirements which may be met by hydrothermal energy.

The following sections explain the heat load methodology in detail, as it was applied to the residential and commercial (including public and institutional) sectors.

a) Residential Heating Load

Based upon U.S. Census Bureau data and national homebuilding averages, an average residential structure size of 1,800 square feet and average household size of 2.8 persons were used. Space heating varies according to climate and is therefore a function of the degree days of heating



(DD) and the outside design temperature (T), with a correction factor of C_D . Based upon extensive analysis of heating loads in the Klamath Falls, Oregon area, a peak heating rate of 25 Btu/hr/ft² was used for an average home, based upon an older outside design temperature of 0°F. Using the current residential outside design temperature of 4°F, a corrected peak heating load of 23.5 Btu/hr/ft² is obtained for the Klamath Falls, Oregon area. Using the following ASHRAE relationship, an annual heating load is given as:

$$SHL = \frac{\text{Peak load/hr} \times 24 \times DD \times C_D}{65 - T}$$

(For Klamath Falls: DD = 6,516 F-days/year, current outside design temperature, T = 4°F, C = 0.74, and the peak heating load = 23.5 x 1,800 = 42.3 x 10³ Btu/hr.)

$$SHL = \frac{42.3 \times 10^3 \times 24 \times 6,516 \times 0.74}{65 - 4} = 80.2 \times 10^6 \text{ Btu/yr}$$

An expression can be developed from the Klamath Falls peak load to determine the peak load for any other area, based upon the residential outside design temperature T and the solid line in Figure 1. This relationship is:

PHL = 45,000 - 693 x T (in Btu/hr. for an 1,800 ft² house). Thus, the annual heating load relationship can be expressed as follows:

$$SHL = \frac{(45,000 - 693 \times T) \times 24 \times DD \times C_D}{65 - T}$$

(in Btu/yr)

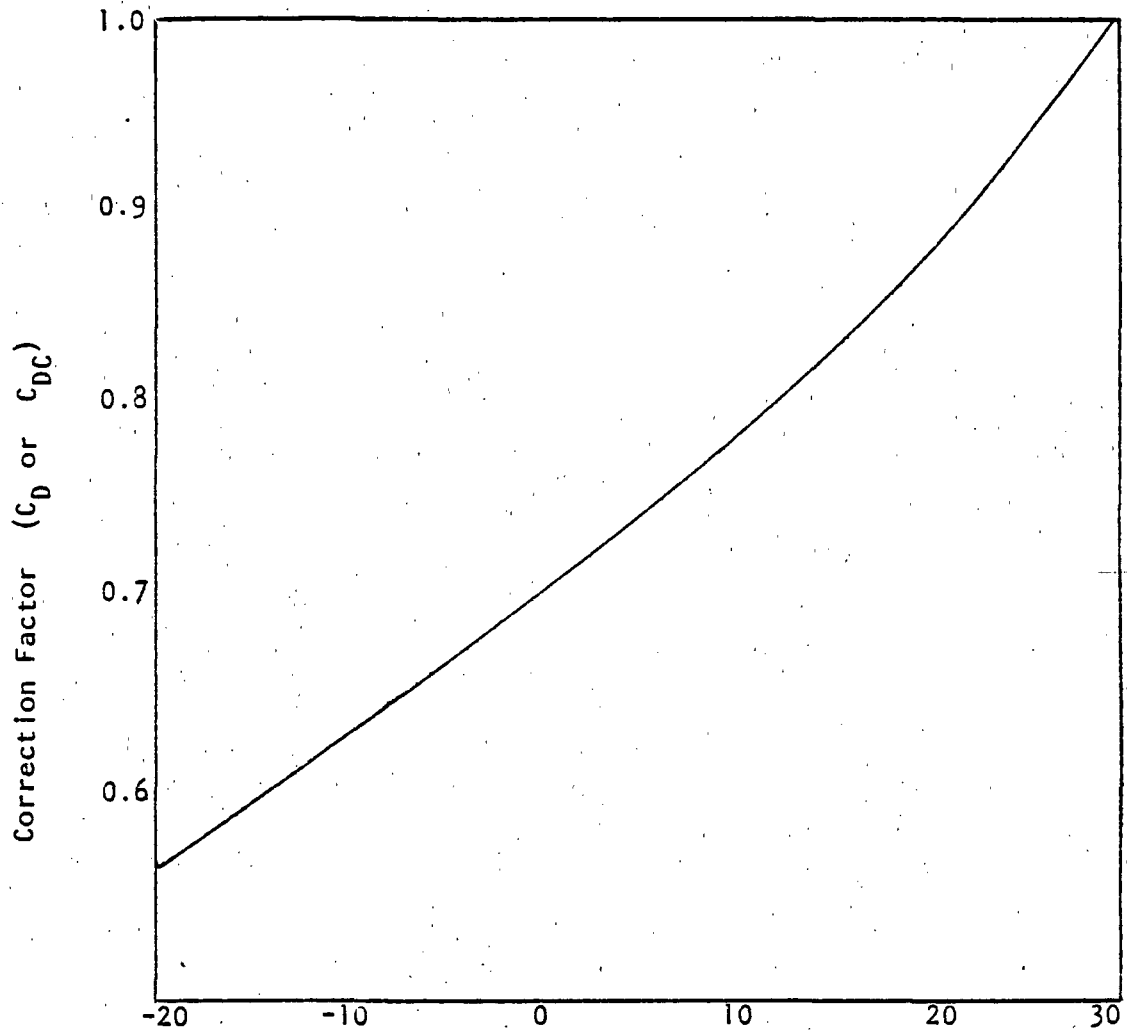


Figure 1.

Outside Design Temperature in °F (T or T_C) adapted from ASHRAE, 1976.



The remaining energy use in an average residence is based upon 1980 utility data collected by the Bonneville Power Administration, which serves five of the eight states inventoried. This energy use includes domestic water heating and other electric appliances. The data for these loads are based upon the following information:

Domestic Water Heating

Single family residence: 4,360 kwhr/yr
Multi-family residence: 3,229 kwhr/yr

All other electrical load (lights, appliances, etc.)

Single-family residence: 7,667 kwhr/yr
Multi-family residence: 6,862 kwhr/yr

Single-family residences account for 74.2 percent of the residences in the five-state region served by the Bonneville Power Administration, and therefore, a weighted average for the foregoing figures are:

Domestic water heating: 4,068 kwhr/yr
All other electric load: 7,459 kwhr/yr

The final factor used in the residential calculation is the penetration or capture rate of electrical energy vs. fossil fuel within a given geographic area. Using the same Bonneville Power Administration data cited above, the following figures represent the electric share of each climate zone:

Climate Zone	Annual Degree Days Heating + Cooling	Electrical	
		Percent Penetration of Water Heating	Percent Penetration of Space Heating
I	6,000	85.4	45.6
II	6,000-7,000	91.0	55.1
III	7,000-8,000	91.0	44.5
IV	8,000	52.6	22.7



Using the above information, the following estimate can be made for a hydrothermal resource site:

1. Electric space heating load:

$$SHL_1 = \frac{(45,000 - 693 \times T) \times 24 \times DD \times C_D}{65 - T} \times \frac{P}{2.8} \times C_h$$

(in Btu/yr)

where:

DD = degree days of heating for the area,

T = outside residential design temperature,

C_D = outside residential design temperature correction factor for the area,

C_h = saturation rate for electrical space heating, and

P = population of area.

2. Fossil fuel space heating load:

$$SHL_2 = SHL_1 \times \frac{1 - C_h}{C_h}$$

3. Electric water heating load:

$$\begin{aligned} WHL_1 &= 4,068 \times \frac{P}{2.8} \times C_w \text{ (in kwh/yr)} \\ &= 4,959 \times 10^6 \times P \times C_w \text{ (in Bt/yr)} \end{aligned}$$

where:

C_w = saturation rate for electrical water heating.

4. Fossil fuel water heat load:

$$WHL_2 = WHL_1 \times \frac{1 - C_w}{C_w}$$

Summary:

Total space heating load:

$$SHL_R = SHL_1 + SHL_2$$

Total water heating load:

$$WHL_R = WHL_1 + WHL_2$$

Total residential heating load:

$$RHL = SHL_R + WHL_R$$

b) Commercial & Public/Institutional Heating Load

Based upon the Klamath Falls, Oregon experience cited above, a value of 33 Btu/ft²/hr peak heating load was assumed using an outside design temperature of 0°F.

A corrected peak heating load of 28.4 Btu/ft²/hr is obtained for Klamath Falls using the current commercial outside design temperature of 9°F. This gives an annual use of ($C_{DC} = 0.78$ for an outside commercial design temperature of 9°F).

$$\begin{aligned} SHL &= \frac{28.4 \text{ Btu} \times 24 \text{ hr} \times 6,516^\circ\text{F} \times \text{day} \times 0.78}{\text{ft} \times \text{hr} \times \text{day} \times 65 - 9 \times \text{yr}} \\ &= 61,861 \text{ Btu/ft}^2/\text{yr} \end{aligned}$$

An expression can be developed from the Klamath Falls peak load to determine the peak commercial load for any other area based upon the commercial outside design temperature, T_c . This relationship is:

$$PHL = 33 - 0.508 T_c \text{ (in Btu/hr/ft}^2\text{)}$$

Thus, the annual heating load relationship is expressed as follows:

$$SHL = \frac{(33.0 - 0.508 T_c) \times 24 \times DD \times C_{DC}}{65 - T}$$

(in Btu/ft²/hr)

Using data from the Bonneville Power Administration again, the 1980 commercial penetration or capture rate for electricity is estimated to be 25% of the space heating and 35% of the water heating.

In the United States the Urban Land Institute estimates that commercial land use requirements are between 0.75 and 1.0 acre per 1,000 persons. The heated space in a typical commercial project is calculated as follows:

1.00 x 0.80 x 0.80 = 0.65 acres/1,000 population < 4,000;
0.75 x 0.80 x 0.80 = 0.50 acres/1,000 population > 4,000;
or 28.31 ft²/person and 21.78 ft²/person respectively.

The commercial water heating load calculations are based upon the following assumptions:

2 gals/employee/day,
2 employees/1,000 ft²,
= 4 gals/1,000 ft²/day.

Compared to the known residential use of:

$$\begin{aligned} & 4,068 \text{ kwhr/yr/residence,} \\ & 30 \times 2.8 = 84 \text{ gals/residence/day.} \end{aligned}$$

Commercial water heating:

$$\begin{aligned} & = \frac{4,068 \text{ kwhr} \times \text{res} \times \text{day} \times \text{gals}}{\text{yr} \times \text{res} \times 84 \text{ gals} \times 1,000 \text{ ft}^2 \times \text{day}} \\ & = 0.1937 \text{ kwhr/ft}^2/\text{yr} \\ & = 661 \text{ Btu/ft}^2/\text{yr} \end{aligned}$$

Thus, the following commercial heating load can be estimated for a hydrothermal site:

1. Electric space heating load (saturation rate of 25 percent):

$$\begin{aligned} \text{SHL}_3 &= 0.25 \times \frac{(33.0 - 0.508 \times T_c)}{65 - T_c} \times 24 \times P \times A \times \text{DD} \times C_{DC} \\ &= \frac{(198 - 3.05 \times T_c)}{65 - T_c} \times P \times A \times \text{DD} \times C_{DC} \text{ (in Btu/yr)} \end{aligned}$$

where:

- P = population of the area,
- A = 28.31 for P < 4,000,
= 21.78 for P > 4,000.
- DD = degree days of heating,
- T_c = commercial outside design temperature, and
- C_{DC} = commercial correction factor for outside design temperature.

2. Fossil fuel space heating load:

$$\text{SHL}_4 = 3.00 \times \text{SHL}_3$$



3. Electric water heating load (saturation rate of 35 percent):

$$\begin{aligned} \text{WHL}_3 &= 0.35 \times 661 \times P \times A \\ &= 231.4 \times P \times A \text{ (in Btu/yr)} \\ &= 0.0678 \times P \times A \text{ (in kwhr/yr)} \end{aligned}$$

4. Fossil fuel water heating load:

$$\text{WHL}_4 = 1.857 \times \text{WHL}_3$$

Commercial Summary:

Total space heating load:

$$\text{SHL}_C = \text{SHL}_3 + \text{SHL}_4$$

Total water heating load:

$$\text{WHL}_C = \text{WHL}_3 + \text{WHL}_4$$

Total commercial heating load:

$$\text{CHL} = \text{SHL}_C + \text{WHL}_C$$

In addition, public facility and institutional loads were estimated and combined with commercial loads shown in Part III. The public/institutional uses includes government buildings, schools, churches, and fraternal organizations. Based upon the Klamath Falls experience, the following per capita estimates were made for a typical community's public needs:

Public buildings	3 ft ² /person
Schools	22 ft ² /person
Churches and fraternal	<u>5 ft²/person</u>
Total -	30 ft ² /person

Using the Klamath Falls' commercial heating rate of 28.4 Btu/ft²/hr peak load:

$$30 \times 33 = 990 \text{ Btu/person/hr}$$



The annual rate for Klamath Falls would be:

$$\frac{852 \times 24 \times 6,516 \times 0.78}{65 - 9} \\ = 1.856 \times 10^6 \text{ Btu/person/yr}$$

The peak heating load expression for the public and institutional load for any other area based upon the commercial outside design temperature, T_c , would be:

$$\text{PHL} = 30 (33 - 0.508 T_c) \\ = 990 - 15.2 T_c \text{ (in Btu/person/hr)}$$

Therefore, the annual public/institutional heating load relationship is expressed as follows:

$$\text{SHL} = \frac{(990 - 15.2 \times T_c) \times 24 \times \text{DD} \times C_{DC}}{65 - T_c} \\ \text{(in Btu/person/yr).}$$

The corresponding water heating rate based on the commercial usage of 661 Btu/ft²/yr would be:

$$661 \times 30 = 0.0198 \times 10^6 \text{ Btu/person/yr}$$

Thus, the public/institutional heating load for a hydrothermal site can be calculated as follows:

1. Electric space heating load (using the commercial saturation rate of 25 percent):

$$\text{SHL}_5 = 0.25 \times \frac{(990 - 15.2 \times T_c)}{65 - T_c} \times 24 \times P \times \text{DD} \times C_{DC}$$

$$= \frac{(5,940 - 91.2 \times T_c)}{65 - T_c} \times P \times DD \times C_{DC} \text{ (in Btu/hr)}$$

$$= \frac{(1.74 - 0.0267 \times T_c)}{65 - T_c} \times P \times DD \times C_{DC} \text{ (in kwhr/hr)}$$

2. Fossil fuel space heating load:

$$SHL_6 = 3.00 \times SHL_5$$

3. Electric water heating load (using the commercial saturation rate of 35 percent):

$$WHL_5 = 0.35 \times 0.0198 \times 10^6 \times P$$

$$= 6.930 \times 10^3 \times P \text{ (in Btu/yr)}$$

$$= 20.30 \times P \text{ (in kwhr/yr)}$$

4. Fossil fuel water heating load:

$$WHL_6 = 1.857 \times WHL_5$$

Public/Institutional Summary:

Total space heating load:

$$SHL_p = SHL_5 + SHL_6$$

Total water heating load:

$$WHL_p = WHL_5 + WHL_6$$

Total public and institutional heating load:

$$PHL = SHL_p + WHL_p$$



C. CONSTRAINTS

Finally, it should be noted that a major constraint for this report was a mandatory period of performance of three weeks, from notice to proceed to report distribution. This time constraint precluded a more exhaustive site search through individual state energy agencies; nor have these agencies had an opportunity to review and comment upon results as reported herein. It has been this time constraint and the inability for individual state-level coordination which necessitates the "preliminary" nature of this report.



III. INVENTORY OF CITIES

ALASKA

City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)			
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total	
Akutan	60	-5.07	1	100-181		2.8	0.3	3.1	
Kotzebue	2,526	6.12	1	162	6,311	128.6	13.2	141.8	
Manley Hot Springs	69	1.88	1	138		2.7	0.3	3.0	
Tenakee Springs*	134	5.51	1	179		5.5	0.5	6.0	
Unalaska	619	10.12	1			28.9	2.9	31.7	
STATE TOTALS: ⁴			3,408		5		168.5	17.0	185.5

¹ 1978 population, Alaska Department of Labor.

² Average annual growth rate, 1970-1978.

³ See reference, Section IV.

⁴ Note: The proposed new state capitol site is near a geothermal resource. If a city the size of Juneau, Alaska existed there at this time, reported state heating load totals would increase by more than 400%.

* HUD UDAG qualified as of June, 1980.

ARIZONA

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
COCHISE CO.								
Willcox	3,300	3.56	14	86-102		80.1	7.2	87.2
Subtotal	3,300		14			80.1	7.2	87.2
GRAHAM CO.								
Pima*	1,690	5.34	11	45-138		33.2	2.8	36.0
Safford	8,025	6.31	13	67-116		157.7	13.2	170.8
Thatcher*	3,370	5.66	14	45-138		66.2	5.5	71.7
Subtotal	13,085		16			257.1	21.4	278.5
GREENLEE CO.								
Clifton	8,735	.91	8	100-33		154.0	12.4	166.4
Subtotal	8,735		8			154.0	12.4	166.4
MARICOPA CO.								
Avondale*	7,130	.95	18	86-122		101.3	7.2	108.5
Buckeye*	2,900	1.45	7	86-104		41.2	3.0	44.2
Chandler	24,000	8.74	2	89-111		36.3	2.7	39.0
El Mirage*	3,800	2.08	77	88-124		54.0	3.9	57.8
Gila Bend*	2,400	4.21	39	86-119		31.7	2.1	33.3
Gilbert	4,250	1.95	2	89-111		64.3	4.7	69.1
Glendale	80,000	15.1	12	86-104		1135.9	81.1	1217.0
Goodyear	2,745	3.54	18	86-122		39.0	2.8	41.8
Litchfield Park	3,195	11.50	56	86-110		45.4	3.2	48.6
Mesa	130,000	12.08	10	86-90		1968.3	144.7	2113.0
Paradise Valley	10,570	5.76	40	86-90		150.1	10.7	160.9
Peoria	13,000	21.41	10	86-110		184.6	13.2	197.8
Scottsdale	85,070	3.18	34	88-93		1287.0	94.6	1381.6

ARIZONA

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
Sun City	45,125	28.80	4	86-110		640.7	45.7	686.5
Surprise*	3,400	5.01	109	86-117		48.3	3.4	51.7
Youngtown	2,000	.75	42	86-117		28.4	2.0	30.4
Subtotal	419,585		200			5586.0	425.0	6281.0
PIMA CO.								
Green Valley	7,725	19.71	1	86-91		114.5	8.6	123.1
Marana*	1,825	7.26	1	86		27.0	2.0	29.1
Subtotal	9,550		2			141.5	10.6	152.2
PINAL CO.								
Apache								
Junction	9,345	28.26	2	90-93		141.5	10.4	151.9
Arizona City	1,145	44.75	7	88-110		16.8	1.2	18.0
Casa Grande	16,445	7.01	3	88-110		241.0	17.5	258.6
Eloy*	6,945	3.64	7	88-110		99.8	5.3	105.1
Mammoth	2,235	1.80	3	88-107		33.1	2.5	35.6
Oracle	2,040	4.79	1	100		30.2	2.3	32.5
San Manuel	4,670	.98	7	88-108		69.2	5.2	74.4
Subtotal	42,825		12			631.8	44.3	676.2
YUMA CO.								
Wellton	1,000	1.01	2	90		10.9	.7	11.6
Subtotal	1,000		2			10.9	.7	11.6
STATE TOTALS	498,080		254			7131.4	521.7	7653.1

¹ 1978 population, Arizona Department of Economic Security.

² Average annual growth rate, 1970 base year.

³ See reference. Section IV.

*HUD UDAG qualified as of June, 1980.

CALIFORNIA

COUNTY City	Current Population ¹	Growth Rate (%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
CONTRA COSTA CO.								
Concord	105,100	2.34	1	75-81		2251.5	192.9	2444.5
Lafayette	20,250	-2.89	1	75-81		459.2	38.7	497.9
Pleasant Hill	26,150	.97	1	75-81		560.2	48.0	608.2
Walnut Creek	54,600	3.70	1	75-81		1169.7	100.2	1269.9
Subtotal	206,100		1			4440.6	379.9	4820.5
IMPERIAL CO.								
Brawley	14,350	.44	2	111-124	1006-1250	170.5	11.0	181.5
Calipatria*	2,570	4.09	3	102-282	812-8350	32.7	2.1	34.8
El Centro	25,600	2.13	2	318-334	5000-5147	312.5	20.5	33.0
Holtville	4,680	3.39	25	84-113	463-1500	57.1	3.8	60.9
Subtotal	47,200		32			572.7	37.4	610.1
KERN CO.								
Ridgecrest	15,750	10.64	2	86-90	410-830	305.1	25.3	330.4
Subtotal	15,750		2			305.1	25.3	330.4
LASSEN CO.								
Susanville	7,150	.82	4	96-120	295-593	234.8	22.5	257.3
Subtotal	7,150		4			234.8	22.5	257.3
LOS ANGELES CO.								
Beverly Hills	33,250	-0.05	1	80		502.3	36.9	539.1
Hermosa Beach	19,150	1.00	1	114		278.4	20.1	298.5
Los Angeles	2,817,800	.25	2	80-104		44547.5	3334.2	47881.8
Palos Verdes Estates	14,850	.24	2	77-104		215.9	15.6	231.5
Redondo Beach	63,600	-.12	1	114		924.7	66.7	991.4
Subtotal	2,948,650		5			46468.8	3473.5	49942.2

CALIFORNIA--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
MARIN CO.								
Mill Valley	13,500	-.04	1	100		305.6	25.7	331.3
Subtotal	13,500		1			305.6	25.7	331.3
MENDOCINO CO.								
Ukiah	12,950	2.83	1	60-75		284.6	24.3	308.9
Subtotal	12,950		1			284.6	24.3	308.9
MODOC CO.								
Alturas	2,980	.65	1	72		132.8	12.9	145.7
Subtotal	2,980		1			132.8	12.9	145.7
NAPA CO.								
Calistoga*	3,530	8.76	10	68-333	149-2000	79.4	6.8	86.2
Napa	48,800	.61	3	76-85		1038.9	87.0	1125.9
St. Helena	4,550	4.34	4	69-90		98.5	8.4	106.8
Yountville	2,950	2.65	3	69-85		62.8	5.3	68.1
Subtotal	59,830		20			1279.6	107.4	1387.0
ORANGE CO.								
Costa Mesa	81,600	1.23	2	69-70		1352.8	103.2	1456.0
Fountain Valley	54,200	.59	4	425	8340	898.6	68.6	967.1
Huntington Beach	172,200	1.71	5	96-425		2854.9	217.8	3072.7
Laguna Beach	16,900	1.19	1	82		311.8	24.7	336.6
Newport Beach	65,300	1.12	1	96		1082.6	82.6	1165.2
San Juan Capistrano	18,400	38.67	1	95		339.5	26.9	366.4
Seal Beach	26,800	.97	1	425	8340	389.6	28.1	417.7

CALIFORNIA--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
ORANGE CO.-(cont'd.)								
Westminster	70,800	.35	2	425		1058.1	77.3	1135.4
Subtotal	506,200		7			8287.9	629.2	8917.1
RIVERSIDE CO.								
Banning	13,250	1.01	1	112		163.6	10.8	174.4
Beaumont	6,725	2.26	2	90-110		145.6	12.1	157.7
Corona	37,400	3.59	1	119	917	594.8	45.5	640.4
Hemet	22,700	8.53	3	70-111		434.0	34.8	468.8
Indian Wells	1,600	15.11	1	182	356	18.6	1.2	19.8
Lake Elsinore*	5,875	6.64	2	118-124		93.4	7.2	100.6
Norco	19,400	3.37	1	119	917	308.5	23.6	332.2
Palm Desert	14,900	19.80	1	182	356	184.0	12.2	196.2
Palm Springs	36,150	3.39	1	100		446.4	29.5	475.9
San Juacinto	7,175	6.36	2	83-116		137.2	11.0	148.2
Subtotal	165,175		11			2526.1	188.0	2714.1
SAN BENITO CO.								
Hollister	9,900	2.92	1	75		208.1	17.4	225.6
Subtotal	9,900		1			208.1	17.4	225.6
SAN BERNARDINO CO.								
Loma Linda	9,425	3.97	6	106-124	138-975	162.0	12.5	174.5
Redlands	40,250	1.07	2	124	138-500	691.7	53.5	745.2
Rialto	34,150	2.04	1	80-106		554.1	41.9	596.0
San Bernardino*	106,500	-.05	2	120-130	194	1728.0	130.8	1858.7
Subtotal	190,325		10			3135.6	238.8	3374.4

CALIFORNIA--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>SAN DIEGO CO.</u>								
Chula Vista*	82,200	2.11	3	80-97		1467.9	115.1	1583.0
El Cajon	72,100	3.79	1	87		1146.9	86.1	1232.9
Escondido	62,500	6.99	1	81		1084.4	84.1	1168.6
Imperial Beach*	21,100	.42	1			376.8	29.5	406.3
La Mesa	50,900	2.99	1	80		809.7	60.7	870.4
San Marcos	15,400	29.53	1			267.2	20.7	287.9
Subtotal	304,200		6			5152.8	396.3	5549.1
<u>SAN LUIS OBISPO CO.</u>								
Arroyo Grande	10,950	4.69	1	98		215.6	17.5	233.1
Grover City	8,400	4.14	1	98		165.4	13.4	178.7
Paso Robles	9,325	3.01	4	55-118		206.8	17.3	224.2
Pismo Beach	5,200	2.86	2	135		102.4	8.3	110.7
Subtotal	33,875		6			690.2	56.5	746.7
<u>SANTA CLARA CO.</u>								
Gilroy	21,550	3.39	1	77		453.2	37.8	491.0
Subtotal	21,550		1			453.2	37.8	491.0
<u>SIERRA CO.</u>								
Loyalton	3,270	24.66	7	111-201	399-1099	120.0	11.7	131.7
Subtotal	3,270		7			120.0	11.7	131.7

CALIFORNIA--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>SONOMA CO.</u>								
Sonoma	5,925	4.41	4	72-118		126.1	10.6	136.7
Subtotal	5,925		4			126.1	10.6	136.7
<u>VENTURA CO.</u>								
Ojai	6,425	1.49	2	62-116		113.9	8.9	122.7
Thousand Oaks	73,800	3.54	1	62-116		1114.1	81.7	1195.9
Subtotal	80,225		3			1227.9	90.7	1318.6
STATE TOTALS:								
	4,634,755		123			75952.7	5785.9	81738.6

¹1980 population, Population Research Unit Report 80 E-1.

²Average annual growth rate, 1970 base year.

³See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

HAWAII

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load ($\times 10^9$ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
HAWAII								
Captain Cook	2,025	6.03	2	67-70	774-780	10.3	0.1	10.4
Hakalau	249	-6.64	1	72	333	1.2	0.0	1.2
Hawi	793	- .05	5	80-84	42-522	3.9	0.0	3.9
Hilo	33,277	1.47	9	45-57	20-425	165.0	1.2	166.2
Honolulu	560	-2.4	1	70	333	2.8	0.0	2.8
Kailua	48,520	2.94	2	67-77	615-853	246.0	2.2	248.2
Kapaau	614	15.90	5	70-73	42-522	3.0	0.0	3.0
Keaau	775	-1.85	4	60-72	101-361	3.8	0.0	3.8
Kealahou	1,039	4.04	7	67-70	430-905	5.2	0.1	5.3
Laupahoehoe	503	1.13	2	64-66	600-700	2.5	0.0	2.5
Makapala	191	- .50	3	71-73	135-522	0.9	0.0	0.9
Mountain View	537	2.82	4	60-72	101-361	3.5	0.1	3.6
Naalehu	1,149	1.33	4	66	34-896	5.7	0.0	5.7
Ookala	401	-1.75	4	64-68	217-700	2.0	0.0	2.0
Paaui	758	.68	2	64-68	217-626	3.8	0.0	3.8
Pahala	1,620	.75	6	63-70	172-937	8.0	0.1	8.1
Pahoa	920	- .04	10	71-199	140-755	6.0	.2	6.2
Papaaloa	267	-1.63	2	64-66	600-700	1.3	0.0	1.3
Papaikou	1,566	-1.71	6	64-70	20-425	7.8	0.1	7.9
Waimea	1,179	-2.49	1	62		5.8	0.0	5.8
Subtotal	96,943		57			488.6	4.1	492.7
MAUI								
Haiku	594	2.8	7	70-77	228-371	2.9	0.0	2.9
Haliimaile	746	1.69	9	70-77	228-1140	3.7	0.0	3.7
Honokakua	237	-4.50	11	70-77	27-893	1.2	0.0	1.2
Kahului	10,662	2.88	13	69-79	28-675	52.9	0.4	53.3
Lahaina	5,137	3.82	13	68-82	20-749	25.5	0.2	25.7
Lower Paia	1,476	3.36	10	70-79	48-371	7.3	0.1	7.4
Makawao	2,702	15.35	6	70-73	228-1140	13.4	0.1	13.5
Paia	192	-6.45	10	70-79	48-371	1.0	0.0	1.0
Pauwela	437	2.31	6	70-73	48-371	2.2	0.0	2.2
Pukalani	3,918	14.05	7	70-75	202-1140	19.4	0.1	19.5

HAWAII--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
MAUI--(cont'd.)								
Paunene	470	-5.85	17	70-75	28-675	2.3	0.0	2.3
Waihee	405	1.71	8	69-73	28-675	2.0	0.0	2.0
Waikapu	693	1.59	13	69-79		3.4	0.0	3.4
Wailuka	10,043	2.59	12	69-79		49.8	0.3	50.1
Subtotal	37,712		43			187.0	1.3	188.3
MOLOKAI								
Kaunakakai	1,996	8.65	3	73-76	17-1080	9.9	0.1	10.0
Kualapuu	503	1.41	4	73-151	17-1095	2.5	0.0	2.5
Mauna Loa	700	-1.97	1	93	540	3.5	0.0	3.5
Subtotal	3,199		6			15.9	0.1	16.0
OAHU								
Aiea	32,616	15.97	6	72-81	170-391	161.7	1.1	162.8
Ewa	2,555	-1.21	5	72-86	194-468	12.7	0.1	12.8
Ewa Beach	14,155	8.23	2	78	312-468	70.2	0.5	70.7
Haleiwa	2,320	-1.17	13	70-77	36-428	11.5	0.1	11.6
Kahuka	930	.14	1	77	250	4.6	0.0	4.6
Laie	4,475	4.89	1	77	250	22.2	0.2	22.4
Maili	4,371	-.06	7	75-145	168-640	21.7	0.1	21.8
Makaha	6,193	3.34	7	77-145	168-640	30.7	0.2	30.9
Makakilo City	7,481	11.38	4	72-78	194-468	37.1	0.3	37.4
Maunawilu	5,217	-.17	2	79-86	41-730	25.9	0.2	26.1
Nanakuli	7,370	1.33	2	75-82	175-451	36.5	0.3	36.8
Pearl City	42,267	9.04	13	71-86	170-575	209.6	1.4	211.0
Wahiawa	16,653	-.54	6	72-77	28-1012	82.6	0.6	83.2
Waianae	7,535	12.82	8	77-145	164-451	37.4	0.2	37.6
Waialua	3,518	-1.31	12	71-74	36-428	82.6	0.6	83.2
Waimanalo	3,555	7.08	4	70-151	41-1095	17.6	0.2	17.8
Waimanalo Beach	4,119	3.53	4	70-151	41-1095	20.4	0.2	20.6
Waipahu	28,445	.46	13	72-86	170-575	141.1	1.0	142.1
Subtotal	193,779		54			1026.1	7.1	1033.2

HAWAII-- (continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
KAUAI								
Anahola	894	4.01	13	66-77	62-700	4.4	0.0	4.4
Eleele	538	-2.90	5	72-77	56-952	2.7	0.0	2.7
Hanalei	466	20.46	5	73-77	159-790	2.3	0.0	2.3
Hanamaulu	2,523	.25	11	72-82	180-568	12.5	0.1	12.6
Hanapepe	1,284	-.75	5	72-77	109-952	6.4	0.0	6.4
Kalaheo	2,404	5.88	7	72-77	109-952	12.0	0.1	12.1
Kapaa	4,278	1.28	12	66-82	62-581	21.2	0.2	21.4
Kaumakani	812	-1.99	6	72-77	43-364	4.0	0.0	4.0
Kekaha	3,198	3.30	10	71-77	45-262	15.9	0.1	16.0
Kilauea	824	2.28	7	72-79	58-760	4.1	0.0	4.1
Koloa	1,103	-1.94	5	72-77	393-952	5.5	0.0	5.5
Lihue	3,881	2.42	6	72-82	180-540	19.2	0.2	19.4
Puhi	953	2.34	7	72-77	180-540	4.7	0.0	4.7
Wailua	1,153	-1.64	11	66-82	62-568	5.7	0.0	5.8
Waimea	1,553	-.10	9	73-77	48-364	7.7	0.1	7.8
Subtotal	25,864		45			128.3	1.0	129.1
STATE TOTALS:	357,497		205			1845.9	13.5	1859.3

¹ 1980 population, Hawaii Department of Planning and Economic Development.

² Average annual growth rate, 1970 base year.

³ See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

IDAHO

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
ADA CO.								
Boise	114,033	3.8	46	68-169		3474.2	335.5	3809.7
Eagle	1,813	16.7	16	68-169		55.2	5.3	60.6
Kuna	1,603	21.3	15	70-81		49.6	4.8	54.5
Meridian	5,713	14.8	1	70		171.6	16.5	188.2
Subtotal	123,162		70			3750.7	362.1	4112.9
ADAMS CO.								
Council	1,091	2.67	2	72		36.9	3.6	40.6
New Meadows*	609	.08	6	109-144		26.2	2.7	28.9
Subtotal	1,700		8			63.1	6.3	69.5
BANNOCK CO.								
Chubbeck	6,608	8.5	7	68-106		214.6	21.0	235.6
Downey	604	.4	1	109		19.6	1.9	21.5
Lava Hot Springs*	617	2.4	2	113		20.0	2.0	22.0
McCammon	865	4.9	1	72		28.1	2.7	30.8
Pocatello	47,152	2.4	7	68-106		1531.4	149.7	1681.1
Subtotal	55,846		11			1813.7	177.4	1991.1
BEAR LAKE CO.								
Georgetown*	529	3.2	1	79		20.0	2.0	22.0
Subtotal	529		1			20.0	2.0	22.0

IDAHO--(continued)

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
BLAINE CO.								
Hailey	1,863	3.84	1	131		71.8	7.1	78.9
Ketchum	2,528	- .38	1	158		116.4	11.7	128.1
Sun Valley	405	15.63	1	158		18.6	1.9	20.5
Subtotal	4,796		2			206.8	20.7	227.5
BOISE CO.								
Crouch	103	5.63	4	113-167		4.4	0.5	4.9
Idaho City*	260	7.32	2	104-108		10.0	1.0	11.0
Subtotal	363		6			14.4	1.5	15.9
BONNEVILLE CO.								
Ammon	4,298	8.61	1	68		149.4	14.5	163.8
Iona	1,119	3.22	1	68		38.9	3.8	42.7
Swan Valley*	211	2.15	1	77		8.3	0.8	9.1
Subtotal	5,628		2			196.6	19.1	215.6
BUTTE CO.								
Arco	1,372	1.29	3	91-104		51.7	5.1	56.7
Butte City	93	-1.32	3	91-104		3.5	0.3	3.8
Subtotal	1,465		3			55.2	5.4	60.6
CAMAS CO.								
Fairfield	440	3.87	1	70		19.7	2.0	21.7
Subtotal	440					19.7	2.0	21.7

IDAHO--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x 10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
CANYON CO.								
Caldwell*	16,572	1.31	3	68-104		497.9	47.9	545.8
Greenleaf	621	11.53	3	70-104		18.7	1.8	20.4
Melba	238	2.60	27	68-115		7.1	0.7	7.8
Nampa*	28,062	3.74	5	68-88		843.0	81.2	924.3
Wilder	823	1.25	4	70-77		24.7	2.4	27.1
Subtotal	46,316		37			1391.4	134.0	1525.5
CARIBOU CO.								
Soda Springs	4,114	2.25	2	82-88		155.3	15.5	170.9
Subtotal	4,114		2			155.3	15.5	170.9
CASSIA CO.								
ATBion	280	2.78	4	70-131		9.1	0.9	10.0
Burley*	8,883	.91	1	72		289.5	27.8	317.2
Malta*	262	4.21	5	68-145		8.5	0.8	9.4
Oakley	927	5.16	1	145		29.0	2.8	31.8
Subtotal	10,352		10			336.2	32.2	368.4
CUSTER CO.								
Challis*	1,025	3.84	2	104-109		40.0	4.0	44.0
Clayton	33	-1.04	1	106		1.3	0.1	1.4
Stanley	64	4.52	2	106-136		2.5	0.2	2.7
Subtotal	1,122		5			43.7	4.4	48.1

IDAHO--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
<u>ELMORE CO.</u>								
Glenns Ferry*	1,597	1.90	7	70-100		47.3	4.5	51.9
Mountain Home	8,111	2.51	5	68-75		259.5	25.1	284.6
Subtotal	9,708		12			306.9	29.6	336.5
<u>FRANKLIN CO.</u>								
Dayton*	272	4.67	4	145-183		9.1	0.9	10.0
Preston	3,680	1.40	6	104-183		123.3	12.1	135.4
Weston*	300	3.80	2	70-72		10.0	1.0	11.0
Subtotal	4,252		8			142.4	14.0	156.4
<u>FREMONT CO.</u>								
Ashton	1,553	3.85	1	79		59.3	5.8	65.1
Newdale*	316	2.29	21	72-124		11.5	1.1	12.6
Saint Anthony	3,352	1.37	2	73		121.8	11.9	133.7
Teton*	623	7.47	14	72-124		22.7	2.2	24.9
Subtotal	5,844		22			215.3	21.0	236.3
<u>GEM CO.</u>								
Emmett*	4,473	1.67	4	68-75		132.1	12.7	144.9
Subtotal	4,473		4			132.1	12.7	144.9
<u>JEFFERSON CO.</u>								
Ririe*	674	2.15	2	72-120		24.5	2.4	26.9
Subtotal	674		2			24.5	2.4	26.9

IDAHO--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>LEMHI CO.</u>								
Leadore	138	3.04	1	75		4.7	0.5	5.2
Subtotal	138		1			4.7	0.5	5.2
<u>MADISON CO.</u>								
Rexburg	11,241	1.90	3	70-79		409.0	39.9	448.9
Subtotal	11,241		3			409.0	39.9	448.9
<u>MINIDOKA CO.</u>								
Ileyburn	2,865	9.38	1	72		95.0	9.2	104.1
Paul*	1,029	1.62	1	72		34.1	3.3	37.4
Rupert*	5,798	3.38	1	72		192.2	18.5	210.7
Subtotal	9,692		1			321.2	31.0	352.2
<u>NEZ PEARCE CO.</u>								
Lewiston	26,067	- .06	1	68		726.6	69.2	795.8
Subtotal	26,067		1			726.6	69.2	795.8
<u>ONEIDA CO.</u>								
Malad City*	2,022	1.18	2	77		65.6	6.4	72.1
Subtotal	2,022		2			65.6	6.4	72.1
<u>OWYHEE CO.</u>								
Grand View*	340	15.83	22	70-185		10.1	1.0	11.1
Homedale*	1,739	2.91	5	68-73		52.2	5.0	57.3
Subtotal	2,079		27			62.4	6.0	68.4

IDAHO--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>PAYETTE CO.</u>								
Fruitland	2,258	5.41	2	68		67.5	6.5	74.0
New Plymouth*	1,366	4.82	1	68		40.9	3.9	44.9
Payette*	5,180	1.82	2	68		155.2	14.9	170.1
Subtotal	8,804		3			263.6	25.4	289.0
<u>POWER CO.</u>								
American Falls	3,883	5.03	8	72-90		123.7	12.0	135.7
Rockland*	205	-.24	3	100		6.5	0.6	7.2
Subtotal	4,088		11			130.2	12.7	142.9
<u>TETON CO.</u>								
Victor	239	-.10	1	68		9.4	0.9	10.3
Subtotal	239		1			9.4	0.9	10.3
<u>TWIN FALLS CO.</u>								
Buhl*	3,208	.98	8	75-91		96.8	9.2	106.0
Filer*	1,274	1.08	1	81		38.5	3.6	42.1
Hansen*	764	10.51	1	68		23.1	2.2	25.2
Hollister	89	7.02	8	93-102		2.8	0.3	3.1
Kimberly*	1,917	2.89	2	68-84		57.9	5.5	63.4
Murtaugh*	179	5.54	4	73-90		5.4	0.5	5.9
Twin Falls	24,129	.79	1	84		728.4	69.1	797.5
Subtotal	31,560		24			952.8	90.4	1043.3
<u>VALLEY CO.</u>								
Cascade	1,003	2.55	2	108-111		43.2	4.4	47.6
Subtotal	1,003		2			43.2	4.4	47.6

IDAHO--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
WASHINGTON CO.								
Midvale*	470	20.9	3	77-126		14.	1.4	15.7
Weiser*	4,865	12.15	6	70-158		148.3	14.3	162.7
Subtotal	5,335		9			162.7	15.7	178.4
STATE TOTALS:	383,052		292			1204.1	1164.9	13204.8

¹ 1978 population, Idaho Department of Health & Welfare.

² Average annual growth rate, 1970 base year.

³ See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

NEVADA

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
CLARK CO.								
Boulder City	10,100	11.67	2	82-145	400	178.4	14.4	192.8
Henderson	21,500	1.28	1	91	1135	419.6	35.0	454.6
Las Vegas	165,000	3.90	2	75-79		3220.6	268.4	3489.0
North Las Vegas	41,390	- .18	2			807.9	67.3	875.2
Subtotal	237,990		5			4626.5	385.1	5011.6
CHURCHILL CO.								
Fallon	5,500	10.73	1	131		162.6	15.3	177.9
Subtotal	5,500		1			162.6	15.3	177.9
ELKO CO.								
Carlin	1,300	- .12	1	174		6.4	4.3	10.8
Elko	10,500	4.72	2	75-190	570	358.2	34.8	393.0
Wells	1,130	.57	2	97-142		39.9	3.9	43.8
Subtotal	12,930		5			404.5	43.0	447.5
HUMBOLT CO.								
Winnemucca	5,000	4.92	3	73-93	55-495	163.0	15.5	179.3
Subtotal	5,000		3			163.0	15.5	179.3
LINCOLN CO.								
Caliente*	900	- .22	2	108-145		30.2	2.8	33.1
Subtotal	900		2			30.2	2.8	33.1

NEVADA--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
<u>LYON CO.</u>								
Yerington	2,600	3.67	1	180	364	79.1	7.5	86.6
Subtotal	2,600		1			79.1	7.5	86.6
<u>MINERAL CO.</u>								
Hawthorne	5,000	5.16	3	186	423-602	136.7	12.7	149.3
Subtotal	5,000		3			136.7	12.7	149.3
<u>NYE CO.</u>								
Gabbs*	780	-1.34	1	156	200-325	21.6	2.0	23.6
Tonopah	2,000	2.07	1	106		62.6	5.9	68.5
Subtotal	2,780		2			84.1	7.9	92.1
<u>CARSON CITY</u>								
Carson City	38,300	8.78	3	75-120	125-200	1160.1	109.7	1269.8
Subtotal	38,300		3			1160.1	109.7	1269.8
<u>STOREY CO.</u>								
Virginia City	580	-.42	1	82		17.6	1.7	19.2
Subtotal	580		1			17.6	1.7	19.2
<u>WASHOE CO.</u>								
Reno	118,000	5.06	17	70-185	86-1006	3756.2	358.2	4114.4
Sparks	50,000	5.21	1	72	650	1591.6	151.8	1743.4
Subtotal	168,000		18			5347.8	510.0	5857.8

NEVADA--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)			
			No. of Sites	Temp. Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total	
<u>WHITE PINE CO.</u>									
Ely	5,680	-1.08	1	84-95		197.1	19.2	216.4	
Subtotal	5,680		1			197.1	19.2	216.4	
STATE TOTALS: 485,260									
						15			
							12410.1	1130.6	13540.7

¹ 1978 population, Nevada State Planning Office.

² Average annual growth rate, 1970 base year.

³ See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

OREGON

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
BAKER CO.								
Baker*	9,575	0.26	2	81		324.8	32.0	356.8
Haines*	365	1.80	1	135		12.4	1.2	13.6
Huntington*	565	1.27	1	75	500	15.6	1.5	17.1
Subtotal	10,505		4			352.8	34.7	387.6
HARNEY CO.								
Burns	3,575	0.95	5	63-82	564-200	125.9	12.5	138.3
Hines	1,600	1.52	4	64-72		56.3	5.6	61.9
Subtotal	5,175		9			182.2	18.1	200.3
JACKSON CO.								
Ashland*	15,650	2.98	2	66-104		494.8	46.8	541.6
Phoenix*	2,000	6.16	1	104		61.6	5.8	67.4
Talent	2,490	8.81	1	104		78.7	7.4	86.2
Subtotal	20,140		2			635.1	60.0	695.1
KLAMATH CO.								
Bonanza*	280	2.42	2	59-199		9.4	0.9	10.3
Klamath Falls	17,750	1.39	5	60-234		597.2	57.5	654.8
Malin*	560	1.69	1	73		18.8	1.8	20.7
Subtotal	18,590		8			625.5	60.2	685.8
LAKE CO.								
Lakeview	2,850	0.60	5	63-201	100-134	102.8	10.0	112.8
Paisley*	300	1.71	1	92		9.9	1.0	10.9
Subtotal	3,150		6			112.7	11.1	123.7

OREGON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>LANE CO.</u>								
Oakridge	4,025	1.96	1	115		117.6	11.1	128.7
Subtotal	4,025		1			117.6	11.1	128.7
<u>MALHEUR CO.</u>								
Adrian*	190	0.0	4	66-116		5.3	.5	5.9
Jordan Valley	420	12.7	1	120		11.8	1.1	13.0
Ontario*	8,500	3.4	1	163		261.8	24.3	276.0
Vale	1,790	2.62	2	97-207	695	53.0	5.1	58.1
Subtotal	10,900		8			322.0	31.0	353.0
<u>MULTNOMAH CO.</u>								
Troutdale	4,575	19.49	1	64		134.9	12.9	147.8
Subtotal	4,575		1			134.9	12.9	147.8
<u>UMATILLA CO.</u>								
Hermiston	8,600	8.42	1	75	500	224.8	21.1	245.9
Milton- Freewater*	5,450	3.64	1	76	572	135.4	12.6	148.0
Stanfield	1,400	6.35	1	76		36.6	3.4	40.0
Subtotal	15,450		3			396.8	37.2	434.0
<u>UNION CO.</u>								
Cove	450	2.66	1	84		14.6	1.4	16.0
Imbler	290	12.07	3	Warm-84	1150-1468	8.7	0.8	9.6
Summerville*	130	7.89	3	Warm-84		3.9	0.4	4.3
Union	2,000	3.40	2	Hot -180		63.8	6.2	70.1
Subtotal	2,870		6			91.0	8.9	99.9

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
WASCO CO.								
The Dalles	10,700	0.3	2	72-82	427-546	357.6	35.0	392.6
Subtotal	10,700		2			357.6	35.0	392.6
STATE TOTAL:	106,080		50			3328.4	320.1	3648.5

¹ 1979 population, Portland State University

² Average annual growth rate, 1970 base year.

³ See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

WASHINGTON

COUNTY City	Current Population ¹	Growth Rate(%) ²	Resource Data ³			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth.Range(Ft.)	Residential	Commercial	Total
ADAMS CO.								
Hatton	79	3.52	9	68-109		2.3	0.2	2.5
Lind	650	.50	4	62-66		20.0	2.0	22.0
Othello	4,670	1.33	5	69-84		140.3	13.4	153.7
Ritzville	1,940	.38	8	55-68		2.7	6.0	68.7
Washtucha*	300	-.56	1	78		9.7	0.9	10.6
Subtotal	7,639		26			235.0	22.5	257.5
ASOTIN CO.								
Clarkston	7,310	1.76	5	73-79		240.8	23.6	264.4
Subtotal	7,310		5			240.8	23.6	264.4
BENTON CO.								
Benton City	1,900	8.62	1	63		50.9	4.8	55.7
Kennewick	29,810	10.66	2	70-73		798.6	74.6	873.2
Prosser	3,788	3.14	1	77		112.9	10.8	123.7
Richland	33,550	3.07	2	70-118		898.8	84.0	982.8
West Richland	2,641	14.56	1	118		70.7	6.6	77.4
Subtotal	71,689		7			1932.0	180.8	2112.8
CHELAN CO.								
Leavenworth*	1,550	1.92	1	52		48.6	4.6	53.2
Wenatchee	18,700	1.17	1	96		586.4	55.4	641.7
Subtotal	20,250		2			635.0	60.0	695.0
CLARK CO.								
Battle Ground	2,697	9.73	3	52-62		87.7	8.4	96.1
Camas	5,900	.21	13	50-58		173.6	16.3	189.8
La Center	445	5.37	4	54-63		13.1	1.2	14.3
Ridgefield*	1,050	.51	1	58		30.9	2.9	33.8

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load ($\times 10^9$ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
<u>CLARK CO.-(cont'd.)</u>								
Washougal	3,900	1.68	6	51-56		114.9	10.8	125.6
Subtotal	13,992		27			420.1	39.6	459.6
<u>COWLITZ CO.</u>								
Castlerock	2,025	2.55	1	50		63.8	6.1	69.8
Woodland	2,215	5.31	2	55-63		2.8	0.3	3.1
Subtotal	4,240		3			66.6	6.3	72.9
<u>DOUGLAS CO.</u>								
East Wenatchee	1,650	8.97	1	96		51.7	4.9	56.6
Subtotal	1,650		1			51.7	4.9	56.6
<u>FERRY CO.</u>								
Republic	1,065	2.62	3	49-53		35.4	3.5	38.9
Subtotal	1,065		3			35.4	3.5	38.9
<u>FRANKLIN CO.</u>								
Connell	2,074	8.74	5	70-85		55.5	6.2	60.7
Pasco	16,370	1.96	1	70		438.5	41.0	479.5
Subtotal	18,440		6			494.1	46.2	540.3
<u>GARFIELD CO.</u>								
Pomeroy	1,920	.59	1	73		56.3	5.4	61.7
Subtotal	1,920		1			56.3	5.4	61.7

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
GRANT CO.								
Coulee City	537	.42	8	57-84		17.0	1.6	18.6
Ephrata	5,500	.52	4	60-86		159.3	15.2	174.4
Hartline	170	-1.12	1	57		6.0	0.6	6.6
Marlin	95	9.19	1	74		3.0	0.3	3.3
Moses Lake	11,300	1.07	14	58-82		327.2	31.1	358.4
Quincy	3,580	1.18	1	70		113.2	10.8	124.1
Soap Lake	1,460	4.14	1	81		42.3	4.0	46.3
Warden	1,620	3.24	5	58-73		48.7	4.6	53.3
Subtotal	24,262		35			716.6	68.3	784.9
KING CO.								
Black Diamond*	1,100	-.57	1	62		34.0	3.2	37.2
Enumclaw	5,135	1.02	1	62		155.5	14.7	170.2
Pacific*	1,950	.72	1	58		59.1	5.6	64.6
Subtotal	8,185		3			248.5	23.5	272.1
KITSAP CO.								
Port Orchard	4,620	2.04	1	66		152.7	14.7	167.3
Subtotal	4,620		1			152.7	14.7	167.3
KITTITAS CO.								
Cle Elum*	1,735	.06	1	61		61.1	5.9	67.0
Ellensburg*	13,000	-.47	2	69-83		403.7	37.9	441.6
Roslyn*	950	-.87	1	61		33.5	3.2	36.7
S. Cle Elum	426	1.54	1	61		15.0	1.4	16.5
Subtotal	16,111		5			513.4	48.5	561.8

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
<u>KLICKITAT CO.</u>								
Goldendale	3,420	4.19	18	58-66		106.6	10.3	116.9
Subtotal	3,420		18			106.6	10.3	116.9
<u>LEWIS CO.</u>								
Centralia	11,190	1.26	1	53		337.5	32.4	369.9
Chehalis	6,000	.53	3	53-63		181.0	17.4	198.4
Morton*	1,410	2.70	3	50-53		43.8	4.1	47.9
Mossyrock*	466	1.55	11	52-57		14.5	1.4	15.8
Napavine	605	6.72	11	50-86		18.8	1.8	20.6
Toledo*	666	.20	1	45		20.7	2.0	22.6
Vader*	411	.69	1	45		12.9	1.2	14.2
Winlock*	1,011	1.51	3	77-86		31.4	3.0	34.4
Subtotal	21,759		35			660.6	63.2	723.9
<u>LINCOLN CO.</u>								
Davenport	1,600	1.93	2	54-75		39.7	3.7	43.4
Odessa	1,100	.27	2	65-72		34.4	3.3	37.7
Reardon	515	3.60	1	63		12.7	1.2	15.0
Wilbur*	1,100	.37	2	51-66		38.5	3.8	42.3
Subtotal	4,325		7			125.4	12.0	137.4
<u>OKANAGAN CO.</u>								
Oroville*	1,590	.25	5	57-62		59.2	5.7	65.0
Subtotal	1,590		5			59.2	5.7	65.0

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (10^9 BTU/yr.)		
			No. of Sites	Temp. Range (F.)	Depth Range (Ft.)	Residential	Commercial	Total
PIERCE CO.								
Eatonville*	1,050	2.58	1	60		30.9	2.9	33.8
Fife	2,070	4.66	1	58		62.7	5.9	68.6
Milton	3,000	1.71	1	58		97.0	9.2	106.2
Tacoma*	157,800	.24	1	58		4779.4	450.8	5230.3
Subtotal	163,920		4			4970.0	468.9	5438.9
SKAGIT CO.								
Anacortes	8,870	1.69	1	64		259.5	24.6	284.1
Subtotal	8,870		1			259.5	24.6	284.1
SKAMANIA CO.								
North								
Bonneville	412	-1.13	9	52-55		12.1	1.1	13.2
Stevenson	956	.49	9	52-55		28.1	2.6	30.7
Subtotal	956		9			40.2	3.8	44.0
SPOKANE CO.								
Airway Height	1,360	9.20	1	54		43.8	4.2	48.1
Cheney	7,110	1.31	4	52-84		228.9	22.6	251.6
Medical Lake	3,580	.15	1	54		115.2	11.4	126.6
Subtotal	12,050		5			388.0	38.3	426.3
STEVENS CO.								
Colville	4,830	3.23	2	53-57		160.6	15.9	176.5
Subtotal	4,830		2			160.6	15.9	176.5

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
THURSTON CO.								
Bucoda	516	2.51	1	60		15.6	1.5	17.1
Subtotal	516		1			15.6	1.5	17.1
WALLA WALLA CO.								
College Place	5,530	2.51	39	63-104		140.4	13.1	153.5
Walla Walla	24,750	.53	36	63-104		628.2	60.0	687.2
Subtotal	30,280		44			768.6	72.1	840.6
WHITMAN CO.								
Albion	630	-.92	2	58-60		19.0	1.9	20.8
Colfax	2,800	.57	2	63-70		84.4	8.2	92.6
Lamont*	90	.25	2	68		2.8	0.3	3.1
Oakesdale	440	.17	1	58		13.3	1.2	14.6
Pullman	23,050	1.38	9	54-64		713.7	69.2	782.9
Saint John*	550	-.48	1	58		16.6	1.6	18.2
Subtotal	27,560		16			849.8	82.5	932.3
YAKIMA CO.								
Grandview	4,720	3.44	5	64-80		140.7	13.6	154.2
Granger	1,670	.73	3	61-78		49.8	4.8	54.6
Harrah*	360	2.00	2	64-66		9.6	0.9	10.5
Mabton*	1,160	2.81	4	64-73		34.6	3.3	37.9
Moxee City*	800	3.70	12	57-111		24.0	2.3	26.3
Naches	680	.23	5	63-65		20.4	2.0	22.3
Selah	4,090	2.61	4	73-82		122.6	11.7	134.4
Sunnyside	7,920	1.92	4	64-72		236.0	22.8	258.8
Tieton*	518	.98	3	63-64		15.5	1.5	17.0
Toppenish*	6,034	.56	4	67-75		179.8	17.3	197.2
Union Gap	2,740	3.81	11	68-112		82.1	7.9	90.0

WASHINGTON--(continued)

COUNTY City	Current Population	Growth Rate(%)	Resource Data			Estimated Community Heating Load (x10 ⁹ BTU/yr.)		
			No.of Sites	Temp.Range(F.)	Depth Range(Ft.)	Residential	Commercial	Total
YAKIMA CO.-(cont'd.)								
Wapato*	3,170	1.29	6	66-80		84.9	8.0	92.8
Yakima*	52,700	1.73	11	66-80		1570.6	151.7	1722.3
Zillah*	1,460	3.14	14	64-84		39.1	3.7	42.8
Subtotal	88,022		58			2609.8	251.5	2861.3
STATE TOTALS:	569,475		330			16812.0	1598.1	18410.1

¹1979 population, Washington State Office of Financial Management.

²Average annual growth rate, 1970 base year.

³See reference, Section IV.

* HUD UDAG qualified as of June, 1980.

SUMMARY

State	Number of Cities	Current Population	Number of Hydrothermal Sites	Estimated Community Heating Load ($\times 10^9$ Btu/yr.)		
				Residential	Commercial	Total
Alaska	5	3,408	5	168.5	17.0	185.5
Arizona	31	498,080	254	7,131.4	521.7	7,653.1
California	60	4,634,755	123	75,952.7	5,785.9	81,738.6
Hawaii	70	357,497	205	1,845.9	13.5	1,859.3
Idaho	72	383,052	292	12,040.1	1,164.9	13,204.8
Nevada	19	168,000	18	5,347.8	510.0	5,857.8
Oregon	27	106,080	50	3,328.4	320.1	3,648.5
Washington	89	569,475	330	16,812.0	1,598.1	18,410.1
TOTAL	373	6,720,347	1,277	122,626.8	9,931.2	132,558.0



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IV. REFERENCES

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
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