

Survey of Geothermal Heat Pump Shipments 2006

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Preface

The Energy Information Administration (EIA) reports detailed historical data on geothermal heat pump manufacturing activities annually in its report, the *Renewable Energy Annual*. This report, *Survey of Geothermal Heat Pump Shipments 2006*, provides an overview and tables with historical data spanning 2000-2006. These tables correspond to similar tables presented in *Renewable Energy Annual 2006* and are numbered accordingly.

Data in this report is based upon manufacturers shipment information reported on Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." General information about the survey may be found here: <http://www.eia.doe.gov/oss/forms.html#eia-902> .

Definitions for terms used in this report can be found in EIA's Energy Glossary:

<http://www.eia.doe.gov/glossary/index.html>.

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Survey of Geothermal Heat Pump Shipments, 2006

This report provides information on geothermal heat pump shipments, based on the Energy Information Administration Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." The survey shows that manufacturers shipped 63,682 geothermal heat pumps (GHP) in 2006, a 33 percent increase over the 2005 total of 47,830. Of those shipped in 2006, 10,968 were ARI-320 rated, and 47, 440 were ARI-325 or ARI-330. ARI-rated shipments increased to 58,408 units in 2006, while the number of other non-ARI-rated units shipped increased to 5,274 in 2006 (Table 3.1).

The total rated capacity of geothermal heat pumps shipped in 2006 was 245,603 tons, compared to 160,402 tons in 2005 (Table 3.2). Geothermal (water and ground-source) heat pumps offer a substantial increase in energy efficiency relative to air-source heat pumps. In 2006, the capacity-weighted average cooling energy efficiency ratio (EER) for geothermal heat shipments was 31 percent greater than the current minimum standard of 13 for air-source heat pumps (based on data in Table 3.2 and Table 3.3).¹ The heating efficiency of ground-source and water-source heat pumps is indicated by their coefficient of performance (COP).² In 2006, the capacity-weighted average of COP for geothermal heat shipments was 3.8 (based on data in Table 3.2 and Table 3.4).

The proportion of geothermal heat pumps shipped to each Census Region in 2006 was as follows: the South (29 percent), the Midwest (34 percent), the Northeast (12 percent), and the West (12 percent) (Table 3.5). The proportion of geothermal heat pumps exported was 12 percent. Sixty-one percent of geothermal heat pumps were shipped to wholesale distributors, while 38 percent went to installers. The remaining 1 percent was sold to exporters, retail distributors, or end-users (Table 3.6). The total rated capacity of domestically shipped heat pumps in 2006 was 215,166 tons. Of that total 113,355 tons were shipped to the residential sector and 101,768 tons to commercial sector. (Table 3.7).

Direct use geothermal energy (e.g., low-temperature water from conventional geothermal sources for crop drying) and energy consumed by GHP both increased in 2006. GHP energy consumption increased 15 percent in 2006 to an estimated 28 trillion Btu, while direct use inched upward from 8.8 to 9.1 trillion Btu (Table 3.8).

¹ The energy efficiency ratio (EER) is the ratio of cooling capacity in Btu/hour to the power input in watts under a given set of conditions.

² The coefficient of performance (COP) is the ratio of heat provided in Btu/hour to power input in watts.

**Table 3.1. Geothermal Heat Pump Shipments by Model Type, 2000-2006
(Number of Units)**

Model	2000	2001	2002	2003	2004	2005	2006
ARI-320	7,808	NA	6,445	10,306	9,130	9,411	10,968
ARI-325/330	26,219	NA	26,802	25,211	31,855	34,861	47,440
Other Non-ARI Rated	1,554	NA	3,892	922	2,821	3,558	5,274
Totals	35,581	NA	37,139	36,439	43,806	47,830	63,682

NA=Not Available. No survey was conducted for 2001.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.2. Capacity of Geothermal Heat Pump Shipments by Model Type, 2000-2006
(Total Rated Capacity Tons)**

Model	2000	2001	2002	2003	2004	2005	2006
ARI-320	26,469	NA	16,756	29,238	23,764	28,064	31,198
ARI-325/330	130,132	NA	96,541	89,731	100,317	110,291	155,736
Other Non-ARI Rated	7,590	NA	12,000	5,469	20,220	22,047	58,669
Totals	164,191	NA	125,297	124,438	144,301	160,402	245,603

NA=Not Available. No survey was conducted for 2001.

Note: One ton of capacity is equal to 12,000 Btus per hour.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.3. Average Cooling Efficiency for Geothermal Heat Pump Shipments, 2006
(Average EER)**

Model Type	2006
ARI-320	12.9
ARI-325/330	19.3
Other (Non-ARI Rated)	13.1

EER=Energy Efficiency Ratio

Note: One ton of capacity is equal to 12,000 Btus per hour. Efficiency is expressed as btus of output per wathours of input. The higher the EER the more efficient the unit is.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.4. Average Heating Efficiency for Geothermal Heat Pump Shipments, 2006
(Average COP)**

Model Type	2006
ARI-320	4.4
ARI-325/330	3.9
Other (Non-ARI Rated)	3.4

COP=Coefficient of Performance

Note: One ton of capacity is equal to 12,000 Btus per hour. Efficiency is expressed as Btus of output per watthours of input. The higher the COP the more efficient the unit is.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.5. Geothermal Heat Pump Shipments by Export, Census Region and Model Type, 2006
(Total Rated Capacity Tons)**

Destination	Model Type			Total
	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	
Exported	882	14,226	15,329	30,437
Midwest	1,449	70,549	12,686	84,684
Northeast	4,306	17,046	8,754	30,106
South	19,893	44,739	6,677	71,309
West	4,665	9,163	15,223	29,051
US Territories	3	13	0	16
Total	31,198	155,736	58,669	245,603

NA=Not Available

Note: The Midwest Census Region consists of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The Northeast Census Region consists of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The South Census Region consists of Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The West Census Region consists of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. "Export" in Table 3.5 and "Exporter" in Table 3.6 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.6. Geothermal Heat Pump Domestic Shipments by Customer Type and Model Type, 2006
(Total Rated Capacity Tons)**

Customer	Model Type			Total
	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	
Exporter	6	153	47	206
Wholesale Distributor	10,895	86,402	33,045	130,342
Retail Distributor	0	83	1,483	1,566
Installer	19,415	54,872	8,434	82,721
End-User	0	0	331	331
Total	30,316	141,510	43,340	215,166

NA=Not Available

Note: "Export" in Table 3.5 and "Exporter" in Table 3.6 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.7. Geothermal Heat Pump Domestic Shipments by Sector and Model Type, 2006
(Total Rated Capacity Tons)**

Destination	Model Type			Total
	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	
Residential	3,205	103,366	6,784	113,355
Commercial ^a	27,111	38,101	36,556	101,768
Industrial	-	43	-	43
Total	30,316	141,510	43,340	215,166

^a Including government.

Note: Dash indicates the sector has no shipments reported for that model type.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

**Table 3.8. Geothermal Direct Use of Energy and Heat Pumps, 1990-2006
(Quadrillion Btu)**

Year	Direct Use	Heat Pumps	Total
1990	0.0048	0.0054	0.0102
1991	0.0050	0.0060	0.0110
1992	0.0051	0.0067	0.0118
1993	0.0053	0.0072	0.0125
1994	0.0056	0.0076	0.0132
1995	0.0058	0.0083	0.0141
1996	0.0059	0.0093	0.0152
1997	0.0061	0.0101	0.0162
1998	0.0063	0.0115	0.0178
1999	0.0079	0.0114	0.0193
2000	0.0084	0.0122	0.0206
2001	0.0090	0.0135	0.0225
2002	0.0090	0.0147	0.0237
2003	0.0086	0.0188	0.0274
2004	0.0086	0.0212	0.0298
2005	0.0088	0.0240	0.0328
2006	0.0091	0.0276	0.0367

Note: Direct use includes applications such as: district heating, aquaculture pond and raceway heating, greenhouse heating and agricultural drying.

Source: John Lund, Oregon Institute of Technology, Geo-Heat Center (Klamath Falls, Oregon, March 2007).