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Geothermal Heat Pump Manufacturing Activities 2008

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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, *Geothermal Heat Pump Manufacturing Activities 2008*, provides an overview and tables with historical data spanning 1999-2008. These tables will correspond to similar tables presented in *Renewable Energy Annual 2008* and are numbered accordingly.

Data in this report are based upon manufacturing shipment information reported on Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Prior editions of this report may be found on the EIA website at http://tonto.eia.doe.gov/reports/reportsD.asp?type=Renewable.

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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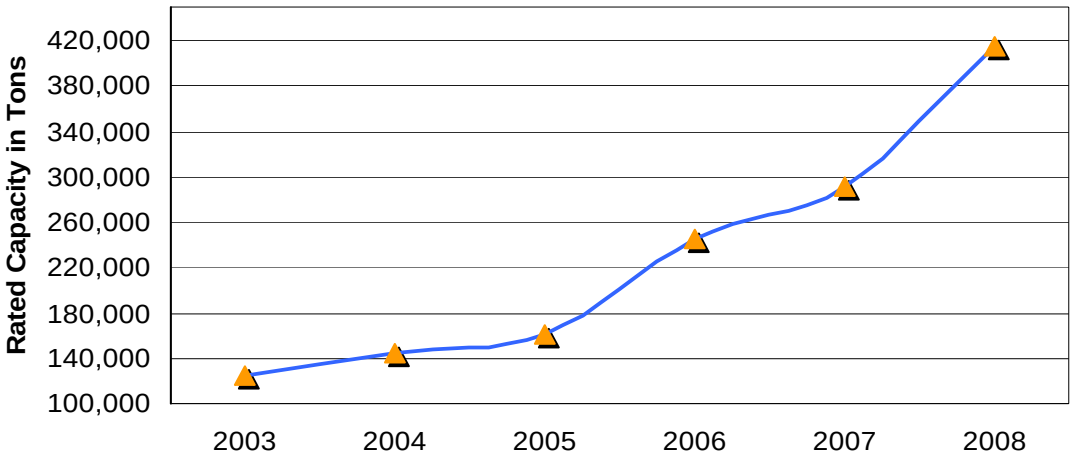
Overview

As consumer concerns continued over the rising cost of energy and tighter budgets, many savvy businesses and residential owners started to look for a more efficient way to heat and cool their buildings and homes through clean alternative energy sources; one of these was geothermal heat pump systems. Fueling this growth, in part, was the Emergency Economic Stabilization Act of 2008, H.R. 1424[1]. The Act, which became law on October 3, 2008, provides long-term tax incentives to encourage the use of renewable energy technologies that includes geothermal heat pumps for homes and commercial applications.

In 2008, total shipments of geothermal heat pumps surged more than 40 percent to 121,243 units (Table 4.1), while capacity shipped rose almost 43 percent to 416,105 tons (Figure 4.1 and Table 4.2). However, this was accompanied by growing pressures in the geothermal heat pump industry, such as manufacturers' backlog orders, a shortage of trained installers, and high investment costs for consumers.

Figure 4.1 Geothermal Heat Pump Shipments, 2003-2008



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

[1] As part of the Emergency Economic Stabilization Act of 2008, new energy credits for installed qualified geothermal heat pump systems include a 10 percent investment tax credit to a business and a 30 percent investment credit, capped at $2,000, to a residential consumer. The criteria are: for a closed-loop system, 14.1 energy efficiency ratio (EER) and a coefficient of performance (COP) of at least 3.3. For an open-loop system, 16.2 EER and 3.6 COP. For a direct expansion system, 15 EER and 3.5 COP. In addition, the geothermal heat pumps must include a desuperheater, which helps heat water, or an integrated water heating system. The Act is available at http://financialservices.house.gov/eesa.html.

Industry Status

In 2008, there were about 23 known domestic manufacturers of geothermal heat pumps, including brand-name manufacturers[2] that shipped geothermal heat pumps manufactured by others under contract.

Almost all manufacturers have their geothermal heat pumps tested and certified by the Air Conditioning, Heating, and Refrigeration Institute (AHRI) for their cooling capacities and their operating efficiencies. In general, geothermal heat pumps are rated based on one of the four standards by the AHRI. These standards are ARI-320 (ARI/ISO 13256-1 Water-Source Heat Pumps), ARI-325 (ARI/ISO 13256-1 Ground Water-Source Heat Pumps), ARI-330 (ARI/ISO 13256-1 Ground-Source Heat Pumps), and ARI-870 (Direct Geoexchange Heat Pumps)[3].

Out of 121,243 geothermal heat pump (GHP) units shipped in 2008, a total of 23,204 were ARI-320 rated, 91,402 were ARI-325 or ARI-330 rated, and 783 were ARI-870 rated. ARI-rated shipments increased to 115,389 units in 2008, while the number of other non-ARI rated units shipped decreased to 5,854 in 2008 (Table 4.1).

Manufacturers reporting GHP shipments in 2008 also reported being involved in one or more of the following geothermal heat pump-related activities (Table 4.15):

- 17 manufacturers were involved in the design of geothermal heat pumps or systems,
- 12 were developing prototype geothermal heat pumps only,
- 5 were developing prototype systems, which include pumps and other components,
- 15 were involved in wholesale distribution,
- 3 were involved in retail distribution,
- 4 were offering installation of their GHP products, and
- 3 were involved in the manufacture of system components.

[2] Brand name manufacturer is defined as a name used to identify a product in the consumer marketplace, which attributes the product to the owner of the name as the manufacturer.

[3] For explanation of ARI standards 320, 325, 330, and 870 see survey form instructions at http://www.eia.doe.gov/cneaf/solar.renewables/page/forms/inst902.pdf.

Of the 23 manufacturers active in 2008, 8 are planning to introduce new ARI-320 rated water-source heat pumps, 9 are planning new ARI-325 rated ground water-source heat pumps, 9 are planning to introduce new ARI-330 rated ground source closed-loop heat pumps, and 3 are expecting to introduce new non-ARI rated heat pumps in 2009 (Table 4.13). These statistics indicate that increasing public demand for alternative energy systems has created business opportunities for the geothermal heating and cooling industry, and the manufacturers have positioned themselves to supply a wide range of geothermal heat pumps designed to meet the needs of virtually every size and type of building.

In 2008, direct employment in the geothermal heat pump manufacturer industry accounted for 1,537 person-years[4] (Table 4.14), an increase of about 26 percent from 2007. Of the 23 manufacturers, 11 had 90 percent or more of their total company-wide revenues in geothermal heat pump-related activities, 1 had 50 to 89 percent, 4 had 10 to 49 percent, and 7 manufacturers had less than 10 percent (Table 4.16).

Geothermal Heat Pump Shipments

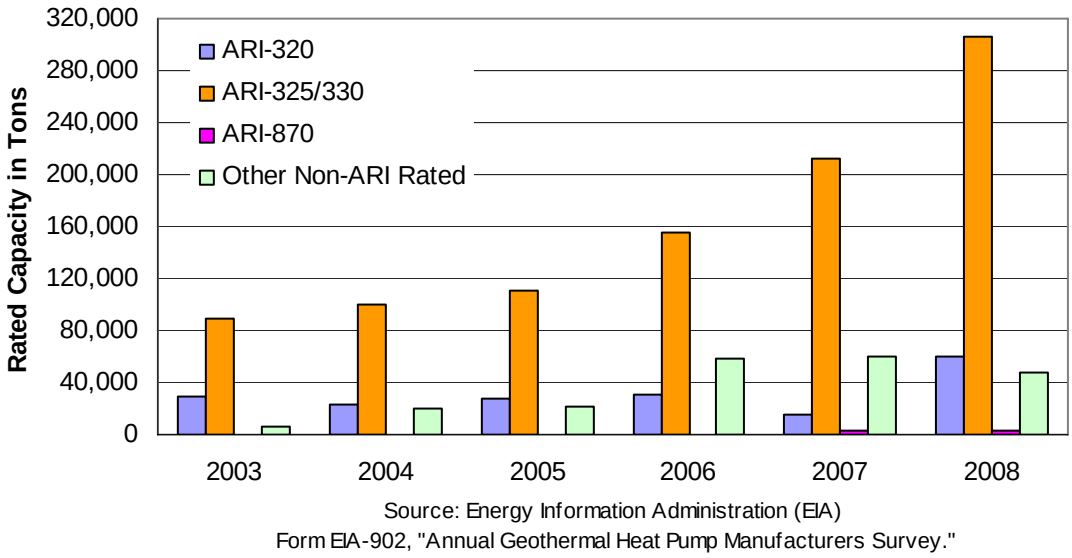
The total rated capacity of geothermal heat pumps shipped in 2008 was 416,105 tons, approximately 43 percent more than the 2007 shipments of 291,300 tons (Table 4.2). The average unit size shipped in 2008 was 3.43 tons, compared to an average unit size of 3.37 tons in 2007 (Table 4.1 and Table 4.2).

Shipments of ground water-source heat pumps and ground-source heat pumps (ARI-325/330 rated) continued to dominate the GHP industry in 2008, accounting for more than 73 percent of the total shipments (Figure 4.2 and Table 4.2). The shipments of ARI-325 and ARI-330 were 306,650 tons, a 44 percent increase from the corresponding 2007 shipments. In 2008, water-source heat pump (ARI-320 rated) shipments rose substantially to 59,360 tons[5] (Figure 4.2 and Table 4.2). Shipments of direct geoexchange heat pumps (ARI-870 Rated) totaled 3,114 tons in 2008 (Figure 4.2 and Table 4.2), about the same volume as in 2007. Despite the double-digit growth in total shipments, non-ARI rated heat pump shipments in 2008 decreased to 46,981 tons, more than 21 percent below 2007 shipments (Figure 4.2 and Table 4.2).

[4] See the EIA glossary.

[5] For the past few years, there has been an unexplained fluctuation for this category. This is in part, largely caused by one manufacturer classifying its equipment differently each year.

Figure 4.2 Geothermal Heat Pump Shipments by Model Type, 2003-2008



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

Total Revenue and Average Price

The total revenue for shipments of geothermal thermal heat pumps was approximately $319 million in 2008 (Table 4.5). Revenue includes charges for cooperative advertising and warranties, but does not include excise taxes and the cost of freight or transportation.

The average price (dollars per ton) for water-source heat pumps (ARI-320 rated) was $743.34 in 2008, and the average price for ground water-source heat pumps and ground-source heat pumps (ARI-325/330 rated) was $787.73 (Table 4.5).

Domestic Shipments

As prices for electricity rise, and prices for such winter heating fuels as natural gas and oil show significant volatility, geothermal heat pumps for heating and cooling are becoming increasingly viable. During 2008, domestic shipments continued to surge rapidly, with rated capacity totaling 346,622 tons, slightly more than a 45 percent increase from 238,870 tons in 2007 (Table 4.6).

During 2008, GHP shipments to domestic wholesale distributors, the largest customer category, totaled 184,869 tons or 53 percent of the domestic market share. Shipments to the second-largest customer category, installers, amounted to 160,084 tons, or 46 percent of the domestic market-share (Table 4.10).

In 2008, domestic shipments to the residential sector accounted for 165,146 tons or more than 47 percent of the domestic market. Of the domestic shipments to the residential sector, 4 percent were ARI-320 rated, 86 percent were ARI-325/330 rated, approximately

2 percent were ARI-870 rated, and 8 percent were non-ARI rated (Table 4.11). The commercial sector was the largest domestic market in the United States in 2008, accounting for 174,044 tons or more than 50 percent of the domestic market share. Twenty-six percent of the purchases for this sector were ARI-320 rated, more than 64 percent were ARI-325/330 rated, less than 0.01 percent were ARI-870 rated, and about 10 percent were non-ARI rated. The industrial sector, with slightly more than 2 percent of domestic shipments, was the smallest domestic sector.

Complete Systems

In general, geothermal heating/cooling systems provide space heating and cooling, as well as water heating. A complete geothermal heating/cooling system is defined as a unit with all the necessary functional components, except for installation materials. The system includes three principal components (listed below) and a device called a "desuperheater" which can be added to provide hot water when the system is providing heat or air conditioning.

- Geothermal earth connection subsystem: Using the earth as the heat source and heat sink, this subsystem consists of a series of pipes which are commonly called a "loop." They carry a fluid used to connect the geothermal system's heat pump to the earth near the building to be conditioned.

- Geothermal heat pump subsystem: An electric heat pump that exchanges heat between the fluid and the air that conditions the building.

- Geothermal heat distribution subsystem: An air-delivery system that delivers the conditioned air to the building.

Of the manufacturers reporting 2008 shipments, the majority of these manufacturers sell only geothermal heat pump subsystems (geothermal heat pump units), and five manufacturers reported selling complete systems. These systems accounted for 19,043 tons, or 4.6 percent of total GHP shipped in 2008 (Table 4.12).

Origin of Shipments

Of the 416,105 tons of total GHP shipments in 2008, 86 tons of GHP shipments were imported from China (Table 4.9). The remaining 416,019 tons of GHP shipments were manufactured in the United States. The top five manufacturing states were: Florida, Indiana, Michigan, Oklahoma, and Texas, with almost 56 percent (232,888 tons) of the total shipped from Indiana and Oklahoma (Table 4.8).

Destination of Shipments

Exports of GHP shipments totaled 69,483 tons in 2008. The export market accounted for more than 16 percent of total shipments and was dominated by sales to Canada, with almost 81 percent (56,212 tons) of total exports (Table 4.7).

In 2008, a total of 346,622 tons of domestic GHP shipments went to all 50 States, Puerto Rico and the District of Columbia (Table 4.6). About 51 percent of domestic GHP shipments (175,190 tons) went to ten States: Florida, Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, New York, Ohio, and Pennsylvania, with approximately 14 percent (49,093 tons) of the total shipments sent to Illinois and Pennsylvania.

Average Performance Rating

The performance rating is useful for comparing GHP units of the same type. However, the ratings used for different types of GHP units are usually not comparable. In 2008, the capacity-weighted average cooling energy efficiency ratio (EER)[6] by model type for ARI-320 was 13.1, ARI-325/330 was 19.5, ARI-870 was 17.5, and other non-ARI rated was 13.5 (Table 4.3). The capacity-weighted average heating coefficient of performance (COP)[7] by model type for ARI-320 was 4.4, ARI-325/330 was 4.0, ARI-870 was 4.2, and other non-ARI rated was 3.6 (Table 4.4).

Geothermal Direct Use of Energy and Heat Pumps

Direct use of geothermal energy and energy consumed by GHP units both increased in 2008. In modern direct use systems, a well is drilled into a geothermal reservoir to provide a steady stream of hot water. This can be used for many applications that require heat such as: heating buildings, raising plants in greenhouses, drying crops, heating water at fish farms and other industrial processes. Direct use of geothermal energy inched upward from 9.4 to 9.7 trillion Btu, while GHP energy consumption increased 15 percent in 2008 to an estimated 37 trillion Btu (Table 4.17)[8].

[6] The energy efficiency ratio (EER) is the ratio of cooling capacity in Btu/hour to energy input in watts under a given set of conditions. The greater the EER the more efficient the unit.

[7] The coefficient of performance (COP) is the ratio of heat provided in Btu/hour to energy input in watts. The greater the COP the more efficient the unit.

[8] Data provided by Dr. John W. Lund, Oregon Institute of Technology, Geo-Heat Center.

Table 4.1 Geothermal Heat Pump Shipments by Model Type, 1999 - 2008

(Number of Units)

Year	Model Type				
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	Total
1999	7,910	31,631	-	2,138	41,679
2000	7,808	26,219	-	1,554	35,581
2001	NA	NA	NA	NA	NA
2002	6,445	26,802	-	3,892	37,139
2003	10,306	25,211	-	922	36,439
2004	9,130	31,855	-	2,821	43,806
2005	9,411	34,861	-	3,558	47,830
2006	10,968	47,440	-	5,274	63,682
2007	8,112	66,863	809	10,612	86,396
2008	23,204	91,402	783	5,854	121,243

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

- = No data reported.

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

Table 4.2 Rated Capacity of Geothermal Heat Pump Shipments by Model Type, 1999 - 2008
(Tons)

Year	Model Type				
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	Total
1999	27,970	153,947	-	9,735	191,651
2000	26,469	130,132	-	7,590	164,191
2001	NA	NA	NA	NA	NA
2002	16,756	96,541	-	12,000	125,297
2003	29,238	89,731	-	5,469	124,438
2004	23,764	100,317	-	20,220	144,301
2005	28,064	110,291	-	22,047	160,402
2006	31,198	155,736	-	58,669	245,603
2007	15,667	212,739	3,412	59,482	291,300
2008	59,360	306,650	3,114	46,981	416,105

NA = Not available. No survey was conducted for 2001.
- = No data reported.
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 4.3 Average Cooling Efficiency for Geothermal Heat Pump Shipments, 2007 and 2008
(Average EER)

Year	Model Type			
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated
2007	12.5	18.1	18.4	13.2
2008	13.1	19.5	17.5	13.5

EER = Energy Efficiency Ratio.

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

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

Table 4.4 Average Heating Efficiency for Geothermal Heat Pump Shipments, 2007 and 2008 (Average COP)

Year	Model Type			
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated
2007	4.1	3.9	4.2	3.7
2008	4.4	4.0	4.2	3.6

COP = Coefficient of Performance.

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

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

Table 4.5 Geothermal Heat Pump Shipments by Model Type, Quantity, Revenue, and Average Price, 2007 and 2008

Model Type	2007			2008		
	Quantity (Rated Capacity in Tons)	Revenue (Thousand Dollars)	Average Price (Dollars per Ton)	Quantity (Rated Capacity in Tons)	Revenue (Thousand Dollars)	Average Price (Dollars per Ton)
ARI-320 GHP Only	15,667	11,525	735.60	59,360	44,125	743.34
ARI-325/330	212,739	166,167	781.08	306,650	241,556	787.73
ARI-870	3,412	3,420	1,002.36	3,114	W	W
Other (Non-ARI Rated)	59,482	37,860	636.50	46,981	W	W
U.S. Total	**291,300**	**218,972**	**751.70**	**416,105**	**319,520**	**767.88**

W = Data withheld to avoid disclosure of proprietary company data.
Notes: Totals may not equal sum of components due to independent rounding.
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 4.6 Geothermal Heat Pump Shipments by Destination, 2007 and 2008
(Rated Capacity in Tons)

Destination	2007	2008
Alabama	1,259	1,963
Alaska	5	107
Arizona	4,926	6,608
Arkansas	3,028	4,057
California	5,499	9,522
Colorado	4,899	4,233
Connecticut	3,101	3,577
Delaware	1,464	1,835
District of Columbia	1,432	1,792
Florida	9,841	12,439
Georgia	3,744	8,013
Hawaii	15	174
Idaho	327	1,180
Illinois	20,296	26,599
Indiana	11,118	18,119
Iowa	8,288	12,801
Kansas	2,094	2,720
Kentucky	9,632	10,931
Louisiana	1,704	603
Maine	103	719
Maryland	9,472	12,048
Massachusetts	4,188	7,719
Michigan	6,031	13,075
Minnesota	7,669	17,124
Mississippi	545	1,711
Missouri	4,123	8,585
Montana	623	1,755
Nebraska	5,456	12,618
Nevada	1,371	4,286
New Hampshire	2,406	3,324
New Jersey	2,807	2,785
New Mexico	1,296	1,806
New York	16,174	19,589
North Carolina	2,527	2,645
North Dakota	2,044	3,483
Ohio	14,304	20,332
Oklahoma	9,210	9,036
Oregon	1,671	2,343
Pennsylvania	15,032	22,494
Puerto Rico	-	21
Rhode Island	93	339
South Carolina	3,403	2,455
South Dakota	744	4,215
Tennessee	8,200	10,144
Texas	8,719	10,207
Utah	2,167	2,689
Vermont	61	543
Virginia	9,073	8,610
Washington	2,980	3,936
West Virginia	289	771
Wisconsin	3,135	7,522
Wyoming	282	420
Shipments to United States/Territories	238,870	346,622
Exported	52,430	69,483
Total Shipments	**291,300**	**416,105**

- = No data reported.

Note: "Export" in Table 4.6 and "Exporter" in Table 4.10 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.

Table 4.6 Geothermal Heat Pump Shipments by Destination, 2007 and 2008 (Rated Capacity in Tons) (Continued)

Destination	2007	2008

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

Table 4.7 Distribution of U.S. Geothermal Heat Pump Exports by Country of Destination, 2007 and 2008
(Rated Capacity in Tons)

Region/Country	2007	2008	Percent of U.S. Exports 2008
Asia			
China	110	6	*
India	15	5	*
Jordan	-	19	0.03
Korea, South	2,180	3,905	5.62
Palestinian Authority	8	183	0.26
Thailand	-	366	0.53
Total	2,313	4,484	6.45
Australia & Oceania			
Australia	5,186	345	0.50
New Zealand	-	101	0.15
Total	5,186	446	0.64
Central America			
Barbados	-	91	0.13
Cayman Islands	-	5	*
Mexico	342	16	0.02
Total	342	112	0.16
Europe			
Czech Republic	181	-	-
Estonia	20	-	-
Hungary	-	12	0.02
Ireland	-	50	0.07
Italy	1,863	30	0.04
Latvia	69	5	*
Lithuania	152	45	0.06
Netherlands	-	8	0.01
Poland	970	303	0.44
Portugal	-	7	0.01
Romania	426	432	0.62
Russia	905	47	0.07
Slovakia	-	273	0.39
Spain	55	39	0.06
Turkey	75	2,816	4.05
United Kingdom	7,769	4,162	5.99
Total	12,485	8,229	11.84
North America			
Canada	32,104	56,212	80.90
Total	32,104	56,212	80.90
U.S. Total	**52,430**	**69,483**	**100.00**

* = Less than 0.01 percent.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.8 Geothermal Heat Pump Shipments by Origin, 2007 and 2008
(Rated Capacity in Tons)

Origin	2007	2008
Arkansas	1,867	3,618
Florida	44,328	61,388
Indiana	99,166	115,428
Michigan	30,179	31,561
Minnesota	8,524	13,010
New York	-	13,961
Ohio	2,401	3,459
Oklahoma	58,792	117,460
Pennsylvania	943	4,849
South Dakota	-	18,709
Tennessee	581	129
Texas	44,519	32,447
Shipments from United States/Territories	291,300	416,019
Imported	-	86
Total Shipments	**291,300**	**416,105**

- = No data reported.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.9 Distribution of U.S. Geothermal Heat Pump Imports by Country of Origin, 2007 and 2008
(Rated Capacity in Tons)

Region/Country	2007	2008	Percent of U.S. Imports 2008
Asia			
China	-	86	100.00
Total	-	86	100.00
U.S. Total	**-**	**86**	**100.00**

- = No data reported.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.10 Geothermal Heat Pump Domestic Shipments by Customer Type and Model Type, 2007 and 2008
(Rated Capacity in Tons)

Customer	2007	2008
Exporter	91	-
Wholesale Distributor	130,275	184,869
Retail Distributor	5,629	1,256
Installer	102,241	160,084
End-User	634	413
U.S. Total	**238,870**	**346,622**

- = No data reported.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.11 Geothermal Heat Pump Domestic Shipments by Sector and Model Type, 2008
(Rated Capacity in Tons)

Destination	Model Type				
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	Total
Residential	6,846	141,495	2,885	13,920	165,146
Commercial[1]	45,319	111,630	17	17,078	174,044
Industrial	5,686	1,746	-	-	7,432
Electric Power	-	-	-	-	-
Transportation	-	-	-	-	-
U.S. Total	**57,851**	**254,871**	**2,902**	**30,998**	**346,622**

[1]Including government.
- = No data reported.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.12 Shipments of Complete Geothermal Heating/Cooling Systems, 2007 and 2008

Shipments Information	2007	2008
Complete Systems		
Shipped	157	3,891
Rated Capacity (Tons)	623	19,043
Percent of Total Shipments	s	5
Number of Companies	2	5
Revenue of Systems (Thousand Dollars)	W	W

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

W = Data withheld to avoid disclosure of proprietary company data.

Note: Complete geothermal heating/cooling system is defined as geothermal heat pump unit with all the necessary functional components, except for installation materials. These include geothermal heat pump, air handler, heat exchanger, and system kits.

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

Table 4.13 Number of Companies Expecting to Introduce New Geothermal Heat Pump Products in 2009

New Product Type	Number of Companies
ARI-320 Water-Source Heat Pumps	8
ARI-325 Ground Water-Source Heat Pumps	9
ARI-330 Ground Source Closed-Loop Heat Pumps	9
ARI-870 Direct Geoexhange Heat Pumps	-
Other (Non-ARI Rated)	3
Non-Geothermal Heat Pump System Components	-

- = No data reported.

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

Table 4.14 Employment in the Geothermal Heat Pump Industry, 2007 - 2008

Year	Person Years
2007	1,219
2008	1,537

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

Table 4.15 Companies Involved in Geothermal Heat Pump Activities by Type, 2007 and 2008

Type of Activity	2007	2008
Geothermal Heat Pump or System Design	12	17
Prototype Geothermal Heat Pump Development	10	12
Prototype Systems Geothermal Development	4	5
Wholesale Distribution	12	15
Retail Distribution	4	3
Installation	3	4
Manufacture of System Components	2	3

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

Table 4.16 Geothermal Heat Pump-Related Sales as a Percentage of Total Company Sales Revenue, 2007 and 2008

Percent of Total Sales Revenue	Number of Companies	
	2007	2008
90-100	8	11
50-89	1	1
10-49	4	4
Less than 10	4	7
U.S. Total	**17**	**23**

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

Table 4.17 Geothermal Energy Consumption by Direct Use of Energy and from Heat Pumps, 1990 - 2008
(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
2007	0.0094	0.0317	0.0411
2008	0.0097	0.0365	0.0462

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 2008).