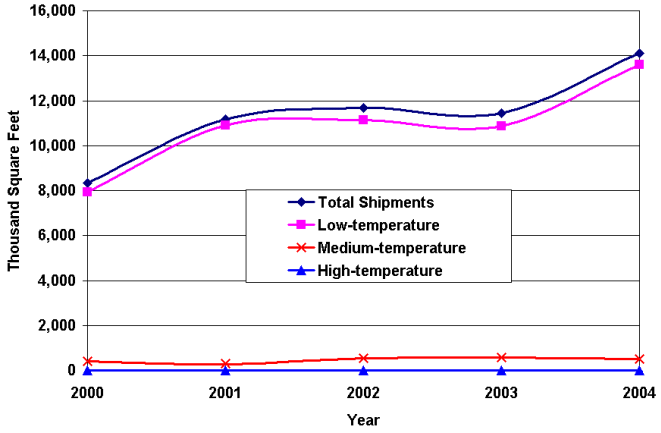
Solar Thermal and Photovoltaic Collector Manufacturing Activities 2004 Highlights

Solar Thermal Collectors

Solar collector shipments surged 23 percent in 2004 to 14.1 million square feet, despite a decline in the number of companies shipping solar thermal collectors (Figure H1). Domestic shipments rose to 13.3 million square feet, a 22 percent increase over 2003 (Table 29). Exports gained 57 percent, while imports increased 25 percent (Table 30). The number of companies shipping solar collectors dropped from 26 to 24 between 2003 and 2004.

Low-temperature collectors continued to dominate the market in 2004, with a 96 percent share (Table 31 and Figure H1). Nearly three-fourths of all collectors were produced in the United States, including U.S. territories, with New Jersey, California, Florida, Puerto Rico, and Hawaii accounting for around 75 percent of collectors shipped (Table 32). Thirty-seven percent were manufactured in New Jersey, followed by California with 32 percent. About 26 percent of collectors shipped were imported, mostly from Israel (Figure H2).

Figure H1. Solar Thermal Collector Shipments, 2000-2004

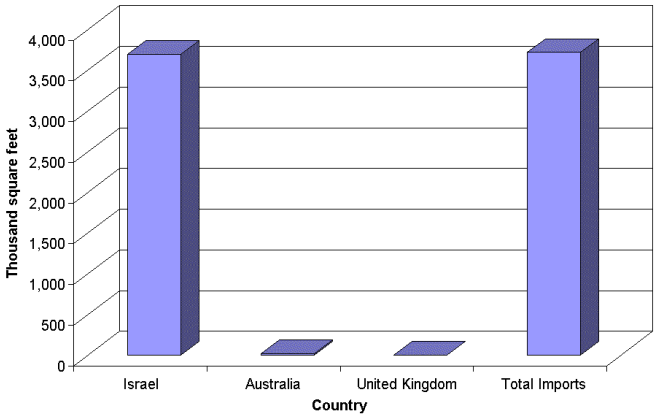


Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

During 2004, 13.3 million square feet of domestic solar thermal shipments were sent to 45 states and 2 U.S. territories or possessions (Table 34). Nearly 80 percent of solar collectors were shipped to the following states: Florida, California, Arizona, New Jersey, and Illinois (Table 32), with Florida and California accounting for almost two-thirds of the total.

After two years of decline, the solar collector export market rebounded to near 2001 record levels. Approximately 6 percent of total shipments (0.8 million square feet) were exported, principally to Canada, Brazil, and Mexico (Table 35). Collectors were shipped to various kinds of businesses in similar proportions for both 2003 and 2004, with wholesale distribution growing fastest at 31 percent (Table 36).

Figure H2. Solar Thermal Collector Imports, 2004

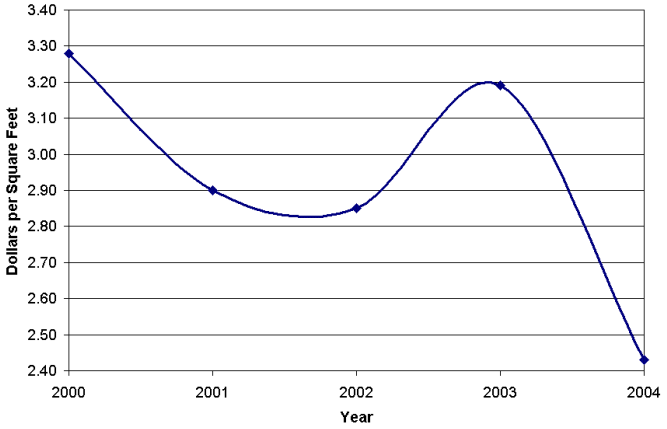


Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Advanced technology and production economies of scale have led to significant cost reductions. While the volume of total shipments increased, the value of total shipments actually declined to $34.3 million [6 percent from 2003] (Table 37). As a result, the average price for total shipments dropped a substantial 24 percent, from $3.19 per square foot in 2003 to $2.43 per square foot in 2004 (Figure H3). On the other hand, the value of low-temperature collectors, 96 percent of total shipments, increased from $22.7 million in 2003 to $24.5 million in 2004, an increase of 9 percent (Table 37). However, the average price of low-temperature collectors decreased from $2.08 in 2003 to $1.80 in 2004. In contrast, the value of medium-temperature collectors decreased from $13.8 million to $9.8 million, a 29 percent decrease. The average value of medium-temperature collectors fell somewhat less, 21 percent, to $19.30 per square foot.

There were no high-temperature collector shipments such as parabolic dish or trough collectors reported in 2004. However, recent activities have focused on high-temperature technology, which will be one of the favored options to meet the growing demand for electricity throughout the United States. On August 9, 2005, Southern California Edison and Stirling Energy Systems, Inc. announced an agreement for development of a 500-megawatt (MW) solar project using innovative Stirling dish technology. When completed, the proposed power station would be the world's largest solar-only facility, capable of producing more electricity than all other U.S. solar projects combined.

Figure H3. Solar Thermal Collector Average Price, 2000-2004



Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Patterns of shipments by market sector, end use, and type were similar in 2003 and 2004 (Table 38). The residential sector continued to be the prime market for solar collectors, totaling 12.9 million square feet, or 91 percent of total shipments (Table 38). The largest end use for solar collectors shipped in 2004 was for heating swimming pools, consuming 13.6 million square feet (97 percent) of total shipments.

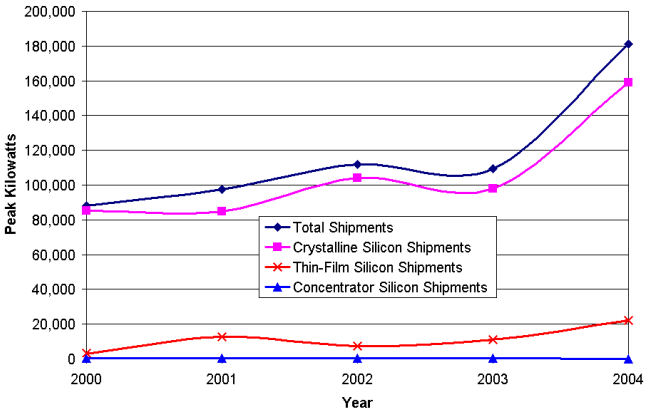
The value of shipments of complete systems increased to $18.3 million in 2004 from $13.6 million in 2003 (Table 39). The number of complete systems rose dramatically from 7,266 systems in 2003 to 29,769 systems in 2004 (Table 39). This increase was due to the change of reporting methodology by one of the manufacturers. Hence, the average size of a complete collector increased from 119 square feet to 187 square feet.

In 2004, the industry remained highly concentrated, with the 5 largest companies accounting for 94 percent of total shipments (Table 41). This concentration has stayed between 90 and 96 percent over the past 5 years. New product introduction continues to be anticipated by only a few companies (Table 40). Although employment increased more than 10 percent in 2004, it was still only 82 percent of peak employment during the past decade, which occurred in 1995 (Table 42). A total of 19 companies were involved in the design of collectors or systems, 10 were involved in prototype collector development, and 8 were active in prototype system development (Table 43). Companies which produce solar products continue to do so as the predominant portion of their business (Table 44).

Photovoltaic Cells and Modules

2004 was a big year for photovoltaic (PV) cells and modules, returning to the pattern of strong growth seen between 2000 and 2002. Domestic shipments jumped from 48,664 peak kilowatts to a record 78,346 peak kilowatts, a 61 percent increase (Table 45). Total shipments of PV cells and modules reached a record high of 181,116 peak kilowatts, a 66 percent increase from 109,357 peak kilowatts in 2003. Module shipments increased 79 percent to 143,274 peak kilowatts in 2004, while cell shipments increased to 37,842 peak kilowatts from 29,295 peak kilowatts (Table 46 and Figure H4). From 2003 to 2004, imports surged from 9,731 to 47,703 peak kilowatts, as did exports, rising from 60,693 to 102,770 peak kilowatts (Table 47 and Figure H5).

Figure H4. Photovoltaic Shipments, 2000-2004



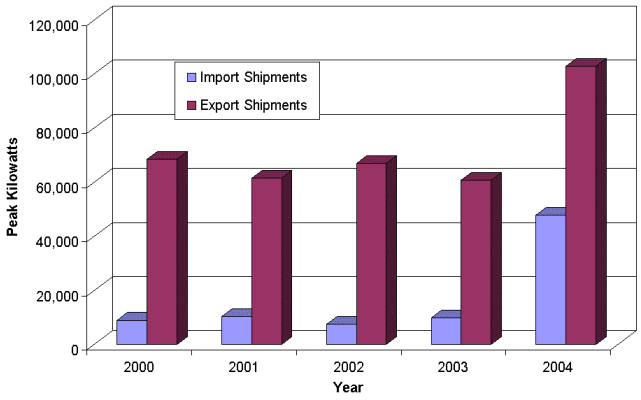
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

The renewed vigor of the PV market was due to advanced development of innovative technologies, expansion of existing manufacturing facilities, and the opening of the Sharp PV manufacturing facility in Memphis, TN. All in all, there were 19 companies involved in manufacturing photovoltaic products, or one less than in 2003. Three of the largest PV manufacturers, including BP Solar International LLC, Sharp Manufacturing Company of America, and Shell Solar Industries LP, were the main contributors to the increase. These companies were also primarily responsible for noticeable changes in PV shipments to business categories, average price of cells/modules, market sector and end-use distributions, imports and exports, and the employment in the PV manufacturing industry.

Trends in sales to different groups of recipients varied. Sales to wholesale distributors, the largest recipient category, rose 62 percent to 106,400 peak kilowatts in 2004. Sales to the second-largest category, installers, nearly tripled to 34,779 peak kilowatts in 2004. In contrast, the end-users and exporter categories decreased by 88 and 69 percent, respectively (Table 48).

Crystalline silicon cells and modules shipments continued to dominate all PV technologies, increasing to 159,138 peak kilowatts in 2004 (Table 49 and Figure H4). However, its market share declined slightly to 88 percent from 90 percent of total shipments in 2003. Within this category, single-crystal shipments in 2004 jumped to 94,899 peak kilowatts, a 60 percent increase. Cast and ribbon silicon shipments rose even more sharply during 2004—67 percent— to 64,239 peak kilowatts.

Figure H5. Photovoltaic Import and Export Shipments, 2000-2004

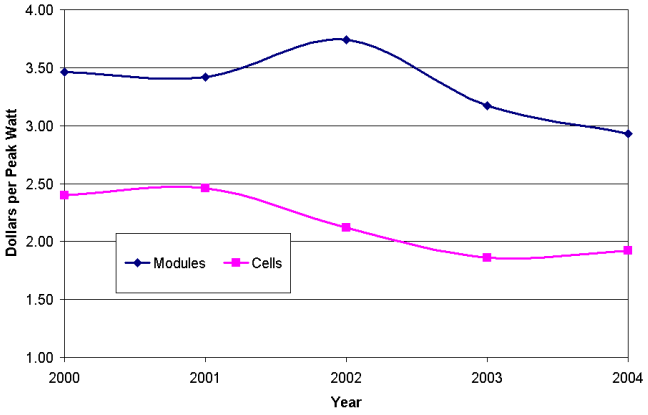


Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Thin-film shipments doubled to 21,978 peak kilowatts in 2004 over 2003. The increase was mainly due to the activities of two companies. The market share of thin-film shipments has steadily increased, from 6 percent in 2002 to 10 percent in 2003 to 12 percent of total shipments in 2004 (Table 49).

The total value of photovoltaic cell and module shipments grew around 60 percent to $493 million in 2004 (Table 50). The average price for modules (dollars per peak watt) decreased 8 percent, from $3.17 in 2003 to $2.93 in 2004. Principally due to the effect of one manufacturer, the average price of the cells increased 3 percent or 6 cents, from $1.86 in 2003 to $1.92 in 2004 (Figure H6).

Figure H6. Photovoltaic Cell and Module Average Prices, 2000-2004



Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

A major change in shipments to end-use markets occurred during 2004. Grid-interactive electricity generation became the dominant end-use of PV cells and modules shipped, with a market share of 71 percent (129,265 peak kilowatts) in 2004 (Table 51). This compares to just 39 percent (42,485 peak kilowatts) in 2003. Further, with remote applications included, electricity generation accounted for 82 percent of the 2004 market share. In contrast, shipments for communications decreased from 14,185 to 11,348 peak kilowatts, and transportation declined sharply from 14,143 to 1,380 peak kilowatts in 2004. Shipments to the consumer goods sector continued to hold a small market share while increasing from 2,995 peak kilowatts in 2003 to 6,444 peak kilowatts in 2004.

Despite the huge increase in domestic shipments, PV exports still increased their market share by 1 percent between 2003 and 2004. PV cell and module export shipments rose 69 percent to 102,770 peak kilowatts in 2004 (Table 52). Germany maintained its position as the predominant importer of U.S. PV cells and modules, taking 41 percent of U.S. export shipments (42,128 peak kilowatts) in 2004 (Table 53). This represented a 31-percent increase from 32,088 peak kilowatts in 2003. The Netherlands replaced Hong Kong as the second-largest recipient of U.S. PV exports, with a 28-percent export market share in 2004 (28,744 peak kilowatts). Hong Kong, the third-largest importer of U.S. PV cells and modules, accounted for approximately 12 percent of U.S. exports with 11,793 peak kilowatts. U.S. imports were dominated by shipments from Japan and Hong Kong.

Complete PV systems shipments tripled from 5,525 systems in 2003 to 16,990 systems in 2004 (Table 54). The increase was mainly due to the introduction of a lightweight, portable, and rugged system by one of the largest vertically-integrated producers in the U.S. solar energy industry. However, the total peak kilowatts and value of shipped systems actually decreased, from 9,545 peak kilowatts in 2003 to 8,110 peak kilowatts in 2004 and from $50 million in 2003 to $39 million in 2004. As a result, the value per system decreased more than 74 percent in 2004, and the value per peak kilowatt dropped from $5.28 in 2003 to $4.86 in 2004.

The strong growth of the PV manufacturing industry in 2004 restored the pre-2003 upward trend in employment, rising more than 12 percent, from 2,590 person-years in 2003 to 2,916 person-years in 2004 (Table 55). The U.S. photovoltaic industry has made significant technical advances in crystalline silicon and thin film technology. Further, at least 8 companies reported that for 2005 they plan to introduce crystalline silicon products, and at least 3 companies plan to introduce thin-film products. However, no new flat plate or concentrator products have been planned (Table 56). In 2004, overall company involvement in PV-related activities included 12 in cell manufacturing and 18 in module or system design; 13 in prototype module development and 9 in prototype systems development; 16 in wholesale distribution; 10 in retail distribution; and 6 in installation (Table 57).

Tables

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Table 29. Annual Solar Thermal Collector Domestic Shipments, 1995-2004

Year	Solar Thermal Collectors[a] (Thousand Square Feet)
1995	7,136
1996	7,162
1997	7,759
1998	7,396
1999	8,046
2000	7,857
2001	10,349
2002	11,004
2003	10,926
2004 [p]	13,301
Total	90,938

[a] **Total shipments minus export shipments.**
P = Preliminary
Notes: Totals may not equal sum of components due to independent rounding. Total shipments include those made in or shipped to U.S. Territories.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 30. Annual Shipments of Solar Thermal Collectors, 1995-2004

Year	Number of Companies	Collector Shipments [a] (Thousand Square Feet)		
		Total [b]	Imports	Export
1995	36	7,666	2,037	530
1996	28	7,616	1,930	454
1997	29	8,138	2,102	379
1998	28	7,756	2,206	360
1999	29	8,583	2,352	537
2000	26	8,354	2,201	496
2001	26	11,189	3,502	840
2002	27	11,663	3,068	659
2003 [p]	26	11,444	2,986	518
2004 [p]	24	14,114	3,723	813

[a] Includes imputation of shipment data to account for nonrespondents.
[b] Includes shipments of solar thermal collectors to the government, including some military, but excluding space applications.
P = Preliminary.
Note: Total shipments as reported by respondents include all domestic and export shipments and may include imported collectors that subsequently were shipped to domestic or foreign customers.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 31. Annual Shipments of Solar Thermal Collectors by Type , 1995-2004
(Thousand Square Feet)

	Low-Temperature		Medium-Temperature		
Year	Total Shipments [a, b]	Average per Manufacturer	Total Shipments [a]	Average per Manufacturer	High-Temperature Total Shipments [a, c]
1995	6,813	487	840	32	13
1996	6,821	487	785	41	10
1997	7,524	579	606	29	7
1998	7,292	607	443	23	21
1999	8,152	627	427	21	4
2000	7,948	723	400	25	5
2001	10,919	1,092	268	16	2
2002	11,126	856	535	31	2
2003 [p]	10,877	906	560	33	7
2004	13,608	1,512	506	30	0

[a] **Includes imputation of shipment data to account for nonrespondents.**
[b] **Includes shipments of solar thermal collectors to the government, including some military, but excluding space applications.**
[c] **For high-temperature collectors, average annual shipments per manufacturer are not disclosed.**
P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 32. Shipments of Solar Thermal Collectors Ranked by Origin and Destination, 2004

Origin/Destination	2004 Shipments[P]	
	Thousand Square Feet	Percent of U.S. Total
Origin		
Top Five States	10,375	74
New Jersey	5,200	37
California	4,480	32
Florida	544	4
Puerto Rico	93	1
Hawaii	58	*
Other Domestic	16	*
Imported	3,723	26
U.S. Total	14,114	100
Destination		
Top Five States	10,960	78
Florida	4,955	35
California	4,306	31
Arizona	702	5
New Jersey	600	4
Illinois	396	3
Other Domestic	2,342	17
Exported	813	6
U.S. Total	14,114	100

*** = Less than 0.5 percent.**
P = Preliminary.
Notes: Totals may not equal sum of components due to independent rounding. U.S. total includes territories.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 33. Shipments of Solar Thermal Collectors Ranked by Origin and Destination, 2003

Origin/Destination	2003 Shipments	
	Thousand Square Feet	Percent of U.S.Total
Origin		
Top Five States	8,351	73
California	3,990	35
New Jersey	3,536	31
Florida	623	5
Puerto Rico	113	1
Tennessee	89	1
Other Domestic	106	1
Imported	2,986	26
U.S. Total	11,444	100
Destination		
Top Five States	9,641	84
Florida	4,290	37
California	3,514	31
New Jersey	804	7
Arizona	731	6
Hawaii	302	3
Other Domestic	1,285	11
Exported	518	5
U.S. Total	11,444	100

Notes: Totals may not equal sum of components due to independent rounding. U.S. total includes territories.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 34. Shipments of Solar Thermal Collectors by Destination, 2004
(Square Feet)

Destination	Shipments[P]
Alaska	40
Arizona	702,498
Arkansas	22,425
California	4,305,861
Colorado	13,539
Connecticut	172,495
Delaware	59
Florida	4,955,350
Georgia	22,191
Hawaii	278,289
Idaho	684
Illinois	396,245
Indiana	84,324
Iowa	54
Kansas	873
Kentucky	81,599
Louisiana	34,717
Maine	40,677
Maryland	90,686
Massachusetts	124,870
Michigan	146,397
Minnesota	12,813
Mississippi	48
Missouri	1,945
Montana	320
Nevada	41,673
New Hampshire	40,629
New Jersey	599,565
New Mexico	31,632
New York	325,619
North Carolina	62,117
Ohio	56,546
Oklahoma	1,462
Oregon	79,236
Pennsylvania	251,104
Puerto Rico	102,460
Rhode Island	49
Tennessee	1,057
Texas	49,762
Utah	3,120
Vermont	9,406
Virgin Islands of the U.S.	253
Virginia	93,239
Washington	6,239
West Virginia	44,000
Wisconsin	12,926
Wyoming	278
Shipments to United States/Teritories	13,301,371
Exports	813,001
Total Shipments	14,114,372

P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 35. Distribution of U.S. Solar Thermal Collector Exports by Country, 2004

Country	U.S. Export Shipments (Square Feet)[P]	Percent of U.S. Exports
Africa		
Morocco	17,712	2.18
Total	17,712	2.18
Asia		
Japan	120	0.01
Taiwan	2,935	0.36
Total	3,055	0.38
Europe		
Czech Republic	14,520	1.79
France	8,299	1.02
Italy	13,366	1.64
Romania	1,400	0.17
Spain	254	0.03
Sweden	48,000	5.90
Total	85,839	10.56
North & Central America		
Antigua and Barbuda	1,424	0.18
Bahamas	674	0.08
Barbados	37	*
Bermuda	415	0.05
Canada	279,290	34.35
Cayman Islands	368	0.05
Costa Rica	1,600	0.20
Guatemala	2,379	0.29
Mexico	122,080	15.02
Netherlands Antilles	128	0.02
Turks and Caicos Islands	232	0.03
Total	408,627	50.26
Oceania & Australia		
Australia	29,880	3.68
Total	29,880	3.68
South America		
Bolivia	17,980	2.21
Brazil	233,920	28.77
Chile	2,225	0.27
Ecuador	1,213	0.15
Peru	12,550	1.54
Total	267,888	32.95
Total	813,001	100.00

P = Preliminary.
*** = Less than 0.01 percent.**
Notes: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 36. Distribution of Solar Thermal Collector Shipments, 2003 and 2004

Recipient	Shipments (Thousand Square Feet)	
	2003	2004[p]
Wholesale Distribution	6,316	8,248
Retail Distributors	4,283	5,092
Exporters	262	253
Installers	413	398
End Users and Other[a]	170	124
Total	11,444	14,114

[a] **Other includes minimal shipments not explained on form EIA-63A.**
P = Preliminary.
Notes: Totals may not equal sum of components due to independent rounding. Total includes U.S. territories.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 37. Solar Thermal Collector Shipments by Type, Quantity, Value, and Average Price, 2003 and 2004

Type	2003			2004 [p]		
	Quantity (Thousand Square Feet)	Value (Thousand Dollars)	Average Price (Dollars per Square Foot)	Quantity (Thousand Square Feet)	Value (Thousand Dollars)	Average Price (Dollars per Square Foot)
Low-Temperature						
Liquid and Air	10,877	22,674	2.08	13,608	24,545	1.80
Medium/High Temperature	567	13,784	24.31	506	9,769	19.30
Medium						
Air	6	W	W	4	W	W
Liquid						
ICS/Thermosiphon	111	5,803	52.09	118	2,772	23.57
Flate Plate	440	7,378	16.78	383	6,802	17.75
Evacuated Tube	2	W	W	2	W	W
Concentrator	*	W	W	0	0	0
High						
Parabolic Dish and Trough	7	W	W	0	0	0
Total	11,444	36,458	3.19	14,114	34,311	2.43

ICS = Integral collector storage.
W = Data withheld to avoid disclosure of proprietary company data
P = Preliminary
Notes: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 38. Shipments of Solar Thermal Collectors by Market Sector, End Use, and Type, 2003 and 2004
(Thousand Square Feet)

Type	Low-Temperature	Medium-Temperature					High-Temperature		
	Liquid/Air	Air	Liquid						
	Metallic and Nonmetallic		ICS/Thermo-siphon	Flat-Plate (Pumped)	Evacuated Tube	Concentrator	Parabolic Dish/Trough	2004 Total [p]	2003 Total
Market Sector									
Residential	12,386	4	115	358	1	0	0	12,864	10,506
Commercial	1,178	0	0	0	0	0	0	1,178	864
Industrial	44	0	3	23	*	0	0	70	71
Utility	0	0	0	0	0	0	0	0	0
Other [a]	0	0	*	3	0	0	0	3	2
Total	13,608	4	118	383	2	0	0	14,114	11,444
End use									
Pool Heating	13,600	0	0	33	0	0	0	13,634	10,800
Hot Water	0	0	118	332	2	0	0	452	511
Space Heating	8	4	0	2	0	0	0	13	76
Space Cooling	0	0	0	0	0	0	0	0	*
Combined Space and Water Heating	0	0	0	16	0	0	0	16	23
Process Heating	0	0	0	0	0	0	0	0	34
Electricty Generation	0	0	0	0	0	0	0	0	0
Other [b]	0	0	0	0	0	0	0	0	0
Total	13,608	4	118	383	2	0	0	14,114	11,444

[a] Other market sector includes shipments of solar thermal collectors to sectors such as government, including the military but excluding space applications.
[b] Other end use includes shipments of solar thermal collectors for other uses such as cooking, water pumping, water purification, desalinization, distillation, etc.
***=Less than 500 square feet.**
ICS= Integral Collector Storage.
P = Preliminary.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 39. Shipments of Complete Solar Thermal Collector Systems, 2003 and 2004

Shipment Information	2003	2004[P]
Complete Collector Systems		
Shipped	7,266	29,769
Thousand Square Feet	864	5,560
Percent of Total Shipments	8	39
Number of Companies	19	18
Value of Systems (Thousand Dollars)	13,586	18,293

P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 40. Number of Companies Expecting to Introduce New Solar Thermal Collector Products in 2005

New Product Type	Number of Companies
Low-Temperature Collectors	5
Medium-Temperature Collectors	6
High-Temperature Collectors	0
Noncollector Components	4

Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 41. Percent of Solar Thermal Collectors Shipments by 10 Largest Companies, 1995-2004

Year	Company Rank	Shipments (Thousand Square Feet)	Percent of Total Shipments
1995	1-5	6,525	85
	6-10	806	11
1996	1-5	6,452	85
	6-10	910	12
1997	1-5	7,183	88
	6-10	731	9
1998	1-5	6,938	89
	6-10	613	8
1999	1-5	7,813	91
	6-10	563	7
2000	1-5	7,521	90
	6-10	567	7
2001	1-5	10,732	96
	6-10	325	3
2002	1-5	10,755	92
	6-10	670	6
2003	1-5	10,485	92
	6-10	700	6
2004[p]	1-5	13,291	94
	6-10	664	5

P = Preliminary.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 42. Employment in the Solar Thermal Collector Industry, 1995-2004

Year	Person Years
1995	386
1996	239
1997	184
1998	207
1999	289
2000	284
2001	256
2002	356
2003	287
2004[p]	317

P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 43. Companies Involved in Solar Thermal Collector Activities by Type, 2003 and 2004

Type of Activity	2003	2004 [p]
Collector or System Design	20	19
Prototype Collector Development	12	10
Prototype System Development	11	8
Wholesale Distribution	21	22
Retail Distribution	12	11
Installation	10	8
Noncollector System Component Manufacture	9	11

P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 44. Solar-Related Sales as a Percentage of Total Company Sales, 2003 and 2004

Percent of Total Sales	Number of Companies	
	2003	2004 [p]
90-100	18	15
50-89	5	6
10-49	1	0
Less than 10	2	3
Total	26	24

P = Preliminary.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 45. Annual Photovolataic Domestic Shipments, 1995-2004

Year	Photovoltaic Cells and Modules[a] (Peak Kilowatts)
1995	11,188
1996	13,016
1997	12,561
1998	15,069
1999	21,225
2000	19,838
2001	36,310
2002	45,313
2003	48,664
2004 [p]	78,346
Total	301,530

[a] Total shipments minus export shipments.
P = Preliminary.
Notes: Totals may not equal sum of components due to independent rounding. Total shipments include those made in or shipped to U.S. Territories.
Sources: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 46. Annual Shipments of Photovolataic Cells and Modules, 2002-2004
(Peak Kilowatts)

Item	2002	2003	2004 [p]
Cells	47,677	29,295	37,842
Modules	64,413	80,062	143,274
Total	112,090	109,357	181,116

P = Preliminary.
Sources: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 47. Annual Shipments of Photovolataic Cells and Modules, 1995-2004

Year	Number of Companies	Photovoltaic Cell and Modules Shipments [a] (Peak Kilowatts)		
		Total	Imports	Exports
1995	24	31,059	1,337	19,871
1996	25	35,464	1,864	22,448
1997	21	46,354	1,853	33,793
1998	21	50,562	1,931	35,493
1999	19	76,787	4,784	55,562
2000	21	88,221	8,821	68,382
2001	19	97,666	10,204	61,356
2002	19	112,090	7,297	66,778
2003 [p]	20	109,357	9,731	60,693
2004 [p]	19	181,116	47,703	102,770

[a] Does not include shipments of cells and modules for space/satellite applications.
P = Preliminary.
Note: Total shipments as reported by respondents include all domestic and export shipments and may include imported cells and modules that subsequently were shipped to domestic or foreign customers.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 48. Distribution of Photovoltaic Cells and Modules, 2002-2004

Recipient	Shipments (Peak Kilowatts)		
	2002	2003	2004[p]
Wholesale Distributers	62,651	65,477	106,400
Retail Distributers	8,270	6,624	5,140
Exporters	449	7,600	2,354
Installers	11,538	11,733	34,779
End-Users	4,012	8,286	1,029
Module Manufacturers	23,784	8,738	11,868
Other [a]	1,386	899	19,546
Total	112,090	109,357	181,116

[a] Other includes categories not identified by reporting companies.
P = Preliminary.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 49. Photovolataic Cell and Module Shipments by Type, 2002-2004

Type	Shipments (Peak kilowatts)			Percent of Total		
	2002	2003	2004[p]	2002	2003	2004[p]
Crystalline Silicon						
Single-Crystal	74,717	59,379	94,899	67	54	52
Cast and Ribbon	29,406	38,561	64,239	26	35	35
Subtotal	104,123	97,940	159,138	93	90	88
Thin-Film	7,396	10,966	21,978	7	10	12
Concentrator	571	452	0	1	*	0
Other [a]	0	0	0	0	0	0
Total	112,090	109,357	181,116	100	100	100

[a] Includes categories not identified by reporting companies.
*** = Less than 0.5 percent.**
P = Preliminary.
Note: Data do not include shipments of cells and modules for space/satellite applications. Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 50. Photovoltaic Cell and Module Shipment Values by Type, 2003 and 2004

Type	2003			2004[p]		
	Value (Thousand Dollars)	Average Price (Dollars per Peak Watt)		Value (Thousand Dollars)	Average Price (Dollars per Peak Watt)	
		Modules	Cells		Modules	Cells
Crystalline Sillicon						
Single-Crystal	158,480	3.38	1.88	253,558	3.09	1.94
Cast and Ribbon	113,511	2.97	1.23	188,371	3.00	1.76
Subtotal	271,991	3.16	1.87	441,930	3.04	1.92
Thin-Film Silicon	W	W	W	W	W	W
Concentrator Silicon	W	W	W	W	W	W
Other [a]	0	---	---	0	---	---
Total	308,192	3.17	1.86	492,718	2.93	1.92

[a] Includes categories not identified by reporting companies.
W = Data withheld to avoid disclosure of proprietary company data.
---= Does not apply.
P = Preliminary.
Notes: Data do not include shipments of cells and modules for space/satellite applications. Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 51. Shipments of Photovoltaic Cells and Modules by Market Sector, End Use, and Type, 2003 and 2004 (Peak Kilowatts)

Sector and End Use	Crystalline Silicon [a]	Thin-Film Silicon	Concentrator Silicon	Other	2004 Total [p]	2003 Total
Market						
Industrial	29,935	558	0	0	30,493	27,951
Residential	53,538	391	0	0	53,900	23,389
Commercial	53,755	13,996	0	0	67,751	32,604
Transportation	1,376	4	0	0	1,380	11,089
Utility	3,233	6,758	0	0	9,991	8,474
Government [b]	3,140	117	0	0	3,257	5,538
Other [c]	14,162	154	0	0	14,316	313
Total	159,138	21,978	0	0	181,116	109,357
End Use						
Electricty Generation						
Grid Interactive	114,400	14,865	0	0	129,265	42,485
Remote	17,838	534	0	0	18,371	15,025
Communication	11,235	113	0	0	11,348	14,185
Consumer Goods	6,442	1	0	0	6,444	2,995
Transportation	1,376	4	0	0	1,380	14,143
Water Pumping	1,028	295	0	0	1,322	6,073
Cells/Modules to OEM [d]	441	6,011	0	0	6,452	11,334
Health	341	0	0	0	341	2,924
Other [e]	6,037	156	0	0	6,193	194
Total	159,138	21,978	0	0	181,116	109,357

[a] Includes single-crystal and cast and ribbon types.
[b] Includes Federal, State, local governments, excluding military.
[c] Other includes shipments that are manufactured for private contractors for research.
[d] Original equipment manufacturer.
[e] Other includes shipments of photovoltaic cells and modules for other uses, such as cooking food, desalinization, distillation, etc.
P = Preliminary.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 52. Export Shipments of Photovoltaic Cells and Modules by Type, 2003 and 2004
(Peak Kilowatts)

Item	Type							
	Crystalline		Thin-Film Silicon		Concentrator Silicon		Total	
	2003	2004[p]	2003	2004[p]	2003	2004[p]	2003	2004[p]
Cells	30,337	36,492	0	0	127	0	30,464	36,492
Modules	25,190	52,938	5,039	13,341	0	0	30,229	66,278
Totals	55,527	89,430	5,039	13,341	127	0	60,693	102,770

P = Preliminary.
Notes: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 53. Destination of U.S. Photovolataic Cell and Module Export Shipments by Country, 2004

Country	Peak Kilowatts	Percent of U.S. Exports[p]
Africa		
Angola	0.3	*
Egypt	90.0	0.1
Ethiopia	18.8	*
Kenya	133.0	0.1
Mali	1.1	*
Nigeria	3.0	*
South Africa	488.2	0.5
Total	734.4	0.7
Asia		
Bangladesh	52.8	0.1
Cambodia	216.0	0.2
China	1,047.4	1.0
Hong Kong	11,793.1	11.5
India	128.9	0.1
Japan	1,974.7	1.9
Jordan	56.6	0.1
Kuwait	12.8	*
Malaysia	1.0	*
Nepal	67.0	0.1
North Korea	138.0	0.1
Oman	57.6	0.1
Philippines	144.8	0.1
Saudi Arabia	0.3	*
Singapore	1,317.1	1.3
South Korea	258.6	0.3
SriLanka	83.0	0.1
Taiwan	109.3	0.1
Thailand	11.3	*
United Arab Emirates	200.0	0.2
Vietnam	1.3	*
Total	17,671.0	17.2
Europe		
Austria	42.0	*
Belgium	2.1	*
Cyprus	19.0	*
Denmark	59.8	0.1
Federal Republic of Germany	42,128.0	41.0
Finland	23.0	*
France	213.1	0.2
Greece	34.0	*
Italy	189.4	0.2
Luxembourg	380.0	0.4
Netherlands	28,744.3	28.0
Norway	10.1	*
Slovakia	50.0	*
Spain	3,661.6	3.6
Sweden	110.1	0.1
Switzerland	345.0	0.3
Turkey	93.6	0.1
United Kingdom	224.1	0.2
Uzbekistan	2.0	*
Total	76,331.2	74.3
North & Central America		
Antigua and Barbuda	0.3	*
Belize	0.5	*
Bermuda	0.3	*
Canada	2,451.7	2.4
Costa Rica	44.3	*
Dominica	2.0	*
Dominican Republic	43.7	*
El Salvador	1.0	*
Guadeloupe	217.7	0.2
Guatemala	6.8	*

Table 53. Destination of U.S. Photovolataic Cell and Module Export Shipments by Country, 2004 (Continued)

Country	Peak Kilowatts	Percent of U.S. Exports[p]
Haiti	39.5	*
Honduras	27.0	*
Mexico	1,629.1	1.6
Netherlands Antilles	27.5	*
Nicaragua	10.0	*
Panama	11.6	*
Trinidad and Tobago	0.3	*
Total	4,513.3	4.4
Oceania & Australia		
Australia	1,706.4	1.7
French Polynesia	19.7	*
New Zealand	29.0	*
Total	1,755.1	1.7
South America		
Argentina	691.0	0.7
Bolivia	52.7	0.1
Brazil	225.2	0.2
Chile	58.7	0.1
Colombia	322.4	0.3
Ecuador	22.7	*
Guyana	6.2	*
Peru	371.9	0.4
Uruguay	6.9	*
Venezuela	7.5	*
Total	1,765.2	1.7
Total U.S. Export	102,770.2	100.0

P = Preliminary.
*** = Value less than 0.05 percent.**
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 54. Shipments of Complete Photovoltaic Systems, 2002-2004

Shipment Information	2002	2003	2004[P]
Complete Photovoltaic Module System Shipped	7,008	5,525	16,990
Peak Kilowatts	8,160	9,545	8,110
Percentage of Total Module Shipments	13	12	6
Value of Systems (Thousand Dollars)	44,984	50,412	39,459

P = Preliminary.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 55. Employment in the Photovoltaic Manufacturing Industry, 1995-2004

Year	Number of Companies	Number of Person-Years
1995	24	1,578
1996	25	1,280
1997	21	1,736
1998	21	1,988
1999	19	2,013
2000	21	1,913
2001	19	2,666
2002	19	2,696
2003[p]	20	2,590
2004	19	2,916

P = Preliminary.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 56. Companies Expecting to Introduce New Photovoltaic Products in 2005

New Product Type	Number of Companies
Crystalline Silicon	
Single-Crystal Silicon Modules	8
Cast Silicon Modules	6
Ribbon Silicon Modules	2
Thin-Film	
Amorphous Silicon Modules	3
Other (Thin Film)	3
Other (Flat Plate)	0
Concentrators	0
Nonmodule System Components	1

Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 57. Number of Companies Involved in Photovoltaic-Related Activities, 2003 and 2004

Type of Activity	Number of Companies	
	2003	2004 [P]
Cell Manufacturing	12	12
Module or Systems Design	17	18
Prototype Module Development	13	13
Prototype Systems Development	11	9
Wholesale Distribution	13	16
Retail Distribution	7	10
Installation	8	6
Noncollector System Component Manufacturing	5	3

P = Preliminary.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."