FRANZ MAUTHNER | WERNER WEISS

SOLAR HEAT WORLDWIDE

Markets and Contribution to the Energy Supply 2011

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2013
EDITION

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Cover: Ritter XL Solar, solar thermal plant with 1,350 sqm on the energy bunker in Hamburg (Germany), a project of the International Building Exhibition IBA Hamburg

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1 Background

This report was prepared within the framework of the Solar Heating and Cooling Programme (SHC) of the International Energy Agency (IEA). The goal of the report is to document the solar thermal capacity installed in the important markets worldwide, and to ascertain the contribution of solar thermal systems to the supply of energy and the CO_2 emissions avoided as a result of operating these systems. The collectors documented are unglazed collectors, glazed flat-plate collectors (FPC) and evacuated tube collectors (ETC) with water as the energy carrier as well as glazed and unglazed air collectors.

The data were collected from a questionnaire survey of the national delegates of the SHC Programme's Executive Committee and other national experts active in the field of solar thermal energy. As some of the 56 countries included in this report have very detailed statistics and others have only estimates from experts, the data was checked for its plausibility on the basis of various publications.

Starting with the collector area, respectively the capacity installed, the contributions of solar thermal systems towards the supply of energy and the reduction of CO_2 were ascertained.

The 56 countries included in this report represent 4.3 billion people, which is round 61% of the world's population. The installed capacity in these countries is estimated to represent 95% of the solar thermal market worldwide.

Figure 1: Countries represented in this report

2 Summary

Total installed capacity in operation worldwide by the end of 2011

By the end of 2011, an installed capacity of 234.6 GW_{th} corresponding to a total of 335.1 million square meters[1] of collector area was in operation in the 56 countries recorded in this report. These 56 countries represent 4.3 billion people, which is 61% of the world's population. The installed capacity in these countries represents more than 95% of the solar thermal market worldwide.

The vast majority of the total capacity in operation was installed in China (152.2 GW_{th}) and Europe (39.3 GW_{th}), which together accounted for 81.6% of the total installed. The remaining installed capacity was shared between the United States and Canada (16.7 GW_{th}), Asia excluding China (9.6 GW_{th}), Latin America (6.3 GW_{th}), Australia and New Zealand (4.9 GW_{th}), the MENA[2] countries Israel, Jordan, Lebanon, Morocco and Tunisia (4.7 GW_{th}) as well as between some Sub-Sahara African countries (0.9 GW_{th}), namely Mozambique, Namibia, South Africa and Zimbabwe.

The breakdown of the cumulated capacity in operation in 2011 by collector type is 27.9% glazed flat-plate collectors, 62.3% evacuated tube collectors, 9.2% unglazed water collectors and 0.7% glazed and unglazed air collectors.

The leading countries in cumulated unglazed and glazed water collector capacity in operation in 2011 per 1,000 inhabitants were Cyprus (542 kW_{th}/1,000 inhabitants), Austria (406 kW_{th}/1,000 inhabitants), Israel (400 kW_{th}/1,000 inhabitants), Barbados (322 kW_{th}/1,000 inhabitants), Greece (268 kW_{th}/1,000 inhabitants), Australia (212 kW_{th}/1,000 inhabitants), Germany (131 kW_{th}/1,000 inhabitants), Turkey (129 kW_{th}/1,000 inhabitants), China (114 kW_{th}/1,000 inhabitants) and Jordan (114 kW_{th}/1,000 inhabitants).

Newly installed capacity worldwide in 2011

In the year 2011, a total capacity of 48.1 GW_{th}, corresponding to 68.7 million square meters of solar collectors, was installed worldwide. This means an increase in new collector installations of 14.3% compared to the year 2010.

The main markets were in China (40.32 GW_{th}) and Europe (3.93 GW_{th}), which together accounted for 92.1% of the overall new collector installations in 2011. The rest of the market was shared between Asia excluding China (0.94 GW_{th}), Latin America represented by Brazil, Chile and Mexico (0.92 GW_{th}), the United States and Canada (0.76 GW_{th}), Australia (0.70 GW_{th}), the MENA region represented by Israel, Jordan, Lebanon and Tunisia (0.40 GW_{th}) and the Sub-Sahara African countries Mozambique, South Africa and Zimbabwe (0.09 GW_{th}).

The breakdown of the newly installed capacity in 2011 by collector type is 14.7% glazed flat-plate collectors, 81.9% evacuated tube collectors, 3.2% unglazed water collectors and 0.2% glazed and unglazed air collectors.

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1 To compare the installed capacity of solar thermal collectors with other energy sources, solar thermal experts agreed upon a methodology to convert installed collector area into solar thermal capacity at a joint meeting of the IEA SHC Programme and major solar thermal trade associations held September 2004 in Gleisdorf, Austria. The represented associations from Austria, Canada, Germany, the Netherlands, Sweden and United States as well as the European Solar Thermal Industry Federation (ESTIF) and the IEA SHC Programme agreed to use a factor of 0.7 kW_{th}/m^2 to derive the nominal capacity from the area of installed collectors.

2 Middle East and North Africa

The leading countries in newly installed unglazed and glazed water collector capacity in 2011 per 1,000 inhabitants were Israel (35 kW_{th}/1,000 inhabitants); Australia (31 kW_{th}/1,000 inhabitants); China (30 kW_{th}/1,000 inhabitants); Austria (20 kW_{th}/1,000 inhabitants); Cyprus (18 kW_{th}/1,000 inhabitants); Turkey (16 kW_{th}/1,000 inhabitants); Greece (15 kW_{th}/1,000 inhabitants); Switzerland (13 kW_{th}/1,000 inhabitants); Germany (11 kW_{th}/1,000 inhabitants) and Lebanon (10 kW_{th}/1,000 inhabitants).

Contribution to the energy supply and CO_2 reduction

The annual collector yield of all water-based solar thermal systems in operation by the end of 2011 in the 56 recorded countries was 195.5 TWh/a (or 704.0 PJ/a). This corresponds to an energy savings equivalent to 20.9 million tons of oil per year and 64.1 million tons of CO_2.

Distribution of systems by system type and application

The thermal use of the energy from the sun varies greatly in different regions across the globe. It can be roughly distinguished by the type of solar thermal collector used, the type of system operation (pumped solar thermal system or thermosiphon systems) applied and the main application of the energy (hot water preparation, space heating, industrial processes, cooling).

Referring to the total unglazed and glazed water collector area, evacuated tube collectors dominated with a share of 63% of the cumulated capacity in operation and a share of 82% of the newly installed capacity. In China, vacuum tube collectors played an important role, and since this was by far the largest market supported by high growth rates, the worldwide figures tend towards a higher share of this type of solar thermal collector.

Unglazed water collectors accounted for 9% of the cumulated water collectors installed worldwide and the share tended to decrease. In 2011 the share of unglazed water collectors was just slightly higher than 3% of the newly installed capacity.

Worldwide, more than three quarters of all solar thermal systems installed are thermosiphon systems and the rest are pumped solar heating systems. Similar to the distribution by type of solar thermal collector in total numbers the Chinese market influenced the overall figures most, and in 2011 89% of the newly installed systems were estimated to be thermosiphon systems while pumped systems accounted for 11%.

In general, thermosiphon systems are more common in warm climates such as in Africa, South and East Asia (excluding China), South America, southern Europe and the MENA region. In these regions thermosiphon systems are more often equipped with flat plate collectors, while in China the typical thermosiphon system for domestic hot water preparation is equipped with evacuated tubes.

The calculated number of water-based solar thermal systems in operation was round 67 million by the end of 2011. Of these, 85% were used for domestic hot water preparation in single family houses and 10% were used by larger domestic hot water consumers, such as multifamily houses, hotels, hospitals, schools, etc. Around 4% of the worldwide installed capacity supplied heat for both domestic hot water and space heating (solar combi-systems). The remaining systems amounted for about 1% or almost 3 million square meters of solar thermal collectors, and delivered heat to district heating networks, industrial processes or thermally driven solar air-conditioning or cooling applications.

In a worldwide context, the share of large solar domestic hot water applications is increasing (10% of total installed capacity vs. 17% of new installed capacity in 2011) while the share of the dominating domestic hot water applications

for single family houses decreased slightly (85% of total installed capacity vs. 78% of newly installed capacity in 2011).

A diversification of the market by types of applications can hardly be detected in a worldwide context, but in several well-established markets in Europe the market penetration of solar combi-systems, solar supported district heating networks, industrial applications and solar cooling systems is increasing. From the top 10 European markets in terms of newly installed glazed water capacity in the year 2011 Germany, Spain, Italy and Austria have the most sophisticated markets for different solar thermal applications. They include systems for hot water preparation, systems for space heating of single- and multifamily houses and hotels, large-scale systems for district heating as well as a growing number of systems for air conditioning, cooling and industrial applications. In other markets, specialization in the field of certain applications became obvious, for example in Denmark almost two thirds of the newly installed capacities in the year 2011 were large-scale solar thermal systems with an average system size of 7,500 m² attached to district heating networks.

2.1 Preview 2012

The estimated total capacity of solar thermal collectors in operation worldwide by the end of 2012 is 268.1 GW_{th}, or 383.0 million square meters of collector area. This corresponds to an annual collector yield of 225.0 TWh, which is equivalent to savings of 24.0 million tons of oil and 73.7 million tons of CO_2 respectively.

The preview for 2012 is based on available market data from Austria, Brazil, China, Germany and India, which represented about 89% of the new installed capacity in the year 2011. The other countries were estimated according to their trend over the past two years. Compared with other forms of renewable energy, solar heating's contribution in meeting global energy demand is, besides the traditional renewable energies like biomass and hydropower, second only to wind power (**Figure 2**).

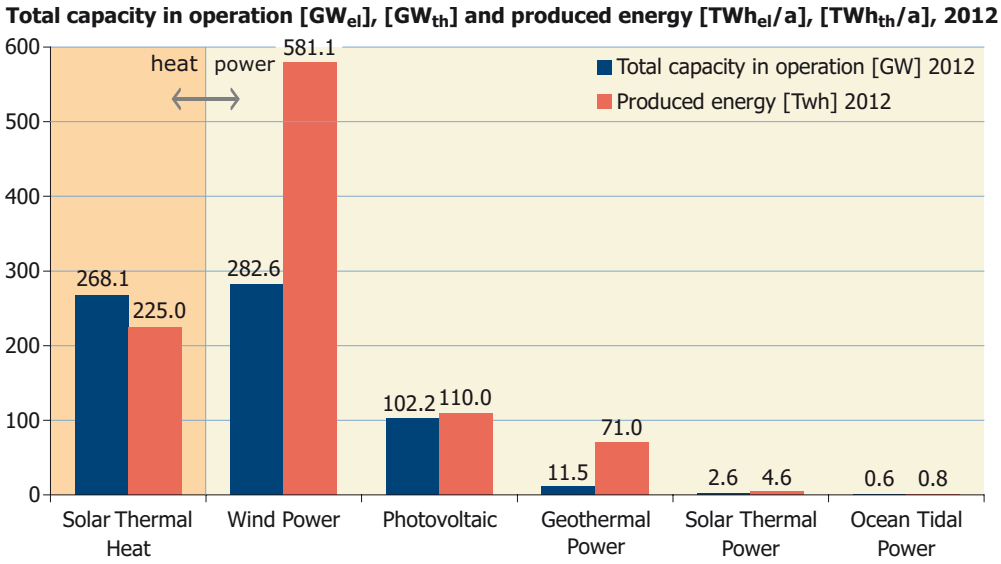


Figure 2: Total capacity in operation [GW_{el}], [GW_{th}] 2012 and annual energy generated [TWh_{el}/a], [TWh_{th}/a]
(Sources: GWEC, EPIA, IEA-SHC, Ocean Energy Systems, REN21, U.S. Geothermal Energy Association)

Employment

Based on data collected from the detailed country reports, the number of jobs in the fields of production, installation and maintenance of solar thermal systems is estimated to be 420,000 worldwide in 2012.

3 Total capacity in operation by end of 2011

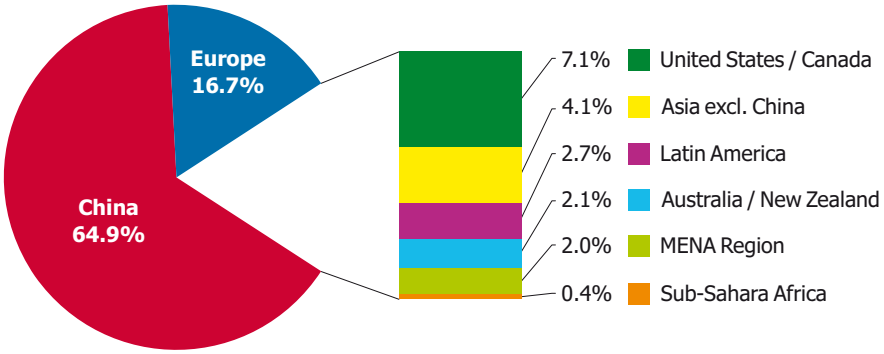
This report aims to give the actual collector area in operation and not the cumulated collector area that has ever been installed in a country. To determine the collector area (and respective capacity) in operation, either official country reports on the lifetime were used or, if such reports were not available, a 25-year lifetime for a system was calculated. The collector area in operation was then calculated using a linear equation. For China, the methodology of the Chinese Solar Thermal Industry Federation (CSTIF) was used. According to the CSTIF approach the operation lifetime is considered to be below 10 years.

The analysis further aims to distinguish between different types of solar thermal collectors, such as unglazed water collectors, glazed water collectors including flat plate collectors (FPC) and evacuated tube collectors (ETC) as well as unglazed and glazed air collectors.

3.1 General market overview of the total installed capacity in operation

By the end of 2011, an installed capacity of 234.6 GW_{th} corresponding to a total of 335.1 million square meters of collector area was in operation in the 56 countries recorded in this report. These 56 countries represent 4.3 billion people, which is 61% of the world's population. The installed capacity in these countries represents more than 95% of the solar thermal market worldwide.

The vast majority of the total capacity in operation was installed in China (152.2 GW_{th}) and Europe (39.3 GW_{th}), which together accounted for 81.6% of total installed. The remaining installed capacity was shared between the United States and Canada (16.7 GW_{th}), Asia excluding China (9.6 GW_{th}), Latin America (6.3 GW_{th}), Australia and New Zealand (4.9 GW_{th}), the MENA countries Israel, Jordan, Lebanon, Morocco and Tunisia (4.7 GW_{th}) as well as between some Sub-Sahara African countries (0.9 GW_{th}), namely Mozambique, Namibia, South Africa and Zimbabwe.



Asia excluding China:	India, Japan, Korea South, Taiwan, Thailand
Latin America:	Brazil, Chile, Mexico, Uruguay
Europe:	EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Sahara Africa:	Mozambique, Namibia, South Africa, Zimbabwe

Figure 3: Share of the total installed capacity in operation (glazed and unglazed water and air collectors) by economic region at the end of 2011

Country	Water Collectors			Air Collectors		TOTAL [MW_{th}]
	unglazed	FPC	ETC	unglazed	glazed	
Albania		63.1	0.5			63.5
Australia	2,730.0	1,849.4	32.2	184.8	4.6	4,801.0
Austria	410.3	2,870.8	52.4		0.8	3,334.3
Barbados*		92.2				92.2
Belgium	31.5	202.9	23.4			257.8
Brazil	1,252.5	3,746.3				4,998.8
Bulgaria		39.3	1.0			40.3
Canada	503.6	38.7	19.5	234.1	8.2	804.2
Chile		27.4				27.4
China		10,351.2	141,828.8			152,180.0
Cyprus	1.4	591.8	14.6			607.8
Czech Republic	292.6	209.8	52.4			554.9
Denmark	13.8	402.3	6.2	2.2	12.1	436.6
Estonia		2.4	0.9			3.3
Finland	7.9	20.1	2.9			30.9
France (mainland)****	71.0	1,396.6	22.4			1,490.0
Germany	428.1	9,107.6	1,174.0		22.6	10,732.2
Greece		2,885.4				2,885.4
Hungary	8.1	89.8	24.3	1.0	0.8	124.0
India		2,995.4	351.2		11.0	3,357.5
Ireland	0.3	78.3	38.5			117.1
Israel	21.4	2,963.9	0.3	0.4		2,986.0
Italy	29.4	1,796.6	268.5			2,094.5
Japan		3,216.0	58.6		332.6	3,607.3
Jordan	4.2	573.2	161.7			739.1
Korea, South		1,108.3				1,108.3
Latvia		2.6				2.6
Lebanon		127.7	181.4			309.1
Lithuania		2.9				2.9
Luxembourg		22.8	2.3			25.1
Macedonia*		17.5	0.5		0.003	18.0
Malta		23.2	7.9			31.1
Mexico	505.4	543.9	161.6		5.4	1,216.3
Morocco**		238.9				238.9
Mozambique***			0.1			0.1
Namibia**		14.5	0.9			15.4
Netherlands	287.2	292.9	9.8			589.9
New Zealand*	4.9	100.1	6.8			111.8
Norway	1.4	10.1	0.7		0.7	13.0
Poland		466.4	144.8			611.2
Portugal	1.4	603.4	10.5			615.2
Romania		62.9	10.7			73.6
Slovakia		88.5	11.0			99.6
Slovenia		112.9	9.8			122.7
South Africa	572.5	251.2	45.7			869.3
Spain	91.4	1,715.1	108.3			1,914.9
Sweden	91.0	179.2	42.0			312.2
Switzerland	148.6	605.1	42.8	613.2		1,409.7
Taiwan	0.1	1,449.5	60.6			1,510.1
Thailand*		64.0				64.0
Tunisia		348.6	29.6			378.2
Turkey		9,229.8	933.8			10,163.6
United Kingdom		358.1	101.8	9.8		469.7
United States	13,986.5	1,723.5	73.7	52.5	52.6	15,888.9
Uruguay		8.8				8.8
Zimbabwe		12.6	0.2			12.7
TOTAL	21,496.4	65,397.2	146,132.3	1,098.0	451.4	234,575.3

* Total capacity in operation refers to the year 2009
** Total capacity in operation refers to the year 2010
*** Newly included countries compared to the 2012 edition of this report
**** The figures for France relate to Metropolitan France (mainland) only. Overseas Departments were not taken into account in this year's statistics.
Note: If no data is given: no reliable database for this collector type is available

Table 1: Total capacity in operation by the end of 2011 [MW_{th}]

Country	Water Collectors			Air Collectors		TOTAL [m²]
	unglazed	FPC	ETC	unglazed	glazed	
Albania		90,075	646			90,721
Australia	3,900,000	2,642,000	46,000	264,000	6,600	6,858,600
Austria	586,191	4,101,100	74,926		1,078	4,763,295
Barbados*		131,690				131,690
Belgium	45,000	289,888	33,395			368,283
Brazil	1,789,227	5,351,866				7,141,093
Bulgaria		56,086	1,450			57,536
Canada	719,364	55,316	27,921	334,426	11,781	1,148,808
Chile		39,079				39,079
China		14,787,370	202,612,630			217,400,000
Cyprus	2,038	845,449	20,790			868,277
Czech Republic	418,000	299,743	74,925			792,668
Denmark	19,695	574,702	8,903	3,133	17,280	623,713
Estonia		3,408	1,312			4,720
Finland	11,308	28,731	4,142			44,181
France (mainland)****	101,471	1,995,094	32,044			2,128,609
Germany	611,530	13,010,880	1,677,120		32,256	15,331,786
Greece		4,122,000				4,122,000
Hungary	11,520	128,352	34,656	1,440	1,152	177,120
India		4,279,088	501,712		15,667	4,796,467
Ireland	404	111,878	55,026			167,308
Israel	30,617	4,234,076	422	550		4,265,665
Italy	42,015	2,566,570	383,510			2,992,095
Japan		4,594,313	83,753		475,199	5,153,265
Jordan	5,940	818,889	230,969			1,055,798
Korea, South		1,583,349				1,583,349
Latvia		3,740				3,740
Lebanon		182,400	259,200			441,600
Lithuania		4,200				4,200
Luxembourg		32,570	3,280			35,850
Macedonia*		25,020	724		4	25,748
Malta		33,122	11,311			44,433
Mexico	722,008	777,055	230,813		7,664	1,737,540
Morocco**		341,260				341,260
Mozambique***			130			130
Namibia**		20,699	1,307			22,006
Netherlands	410,239	418,478	14,000			842,717
New Zealand*	7,025	142,975	9,644			159,645
Norway	2,090	16,885	1,958	0	1,019	21,952
Poland		666,240	206,880			873,120
Portugal	1,946	861,963	15,000			878,909
Romania		89,898	15,302			105,200
Slovakia		126,474	15,776			142,250
Slovenia		161,334	13,966			175,300
South Africa	817,803	358,868	65,253			1,241,924
Spain	130,600	2,450,200	154,750			2,735,550
Sweden	130,000	256,000	60,000			446,000
Switzerland	212,260	864,440	61,160	876,000		2,013,860
Taiwan	85	2,070,686	86,522			2,157,294
Thailand*		91,392				91,392
Tunisia		498,048	42,240			540,288
Turkey		13,185,391	1,333,970			14,519,361
United Kingdom		511,536	145,462	14,000		670,998
United States	19,980,762	2,462,184	105,232	75,000	75,185	22,698,363
Uruguay		12,571				12,571
Zimbabwe		17,959	237			18,196
TOTAL	30,709,138	93,424,579	208,760,370	1,568,549	644,885	335,107,521

* Total capacity in operation refers to the year 2009
** Total capacity in operation refers to the year 2010
*** Newly included countries compared to the 2012 edition of this report
**** The figures for France relate to Metropolitan France (mainland) only. Overseas Departments were not taken into account in this year's statistics.
Note: If no data is given: no reliable database for this collector type is available

Table 2: Total installed collector area in operation by the end of 2011 [m²]

As shown in **Table 1** and **Table 2**, the total capacity is divided into flat plate collectors (FPC): 65.4 GW_{th} (93.4 million square meters), evacuated tube collectors (ETC): 146.1 GW_{th} (208.8 million square meters), unglazed water collectors: 21.5 GW_{th} (30.7 million square meters), and glazed and unglazed air collectors: 1.5 GW_{th} (2.2 million square

meters). The distribution of the worldwide capacity in operation by these different types of solar collectors is illustrated in **Figure 4**.

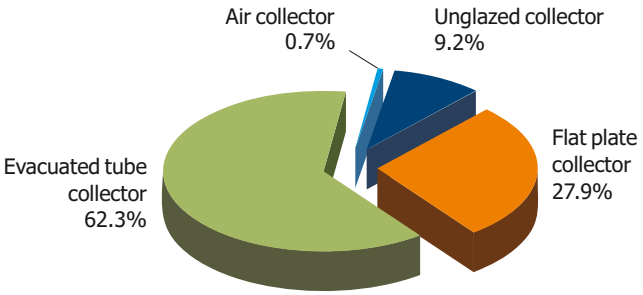


Figure 4: Distribution of the total installed capacity in operation by collector type in 2011

Figure 5 depicts the distribution of unglazed and glazed water collectors for the 10 leading countries in total numbers by the end of 2011.

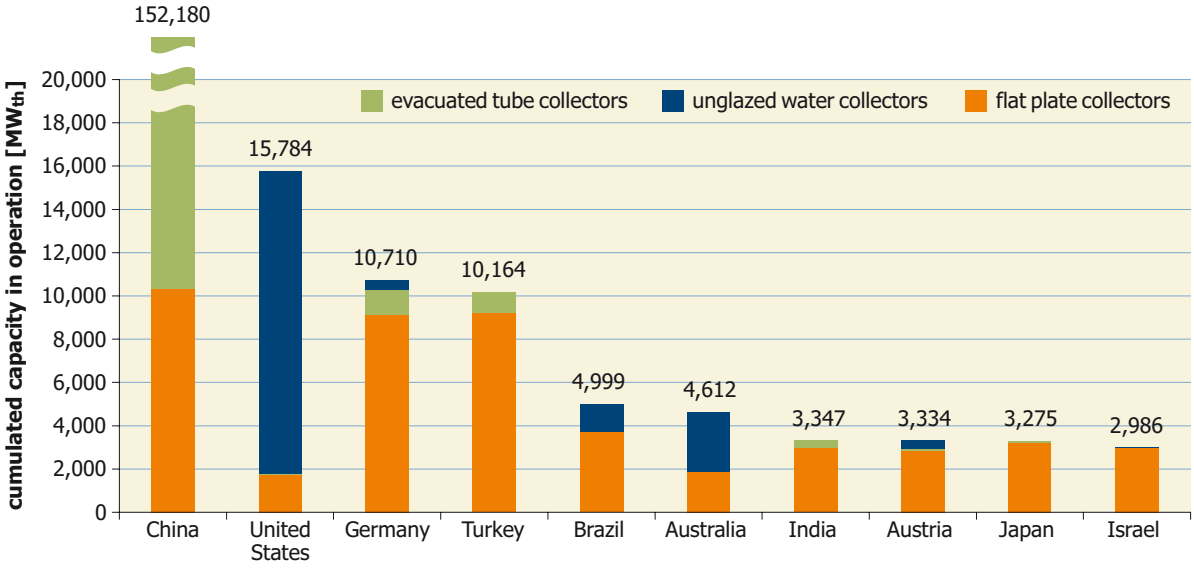


Figure 5: Total installed capacity of unglazed and glazed water collectors in operation in the 10 leading countries by the end of 2011

China, as the world leader in total capacity, is focusing very much on evacuated tube collectors, whereas the United States is holding second position due to its high installation of unglazed water collectors. Only in Australia, and to some extend in Brazil, do unglazed water collectors also play an important role. The rest of the "Top 10 countries" are clearly focusing on flat plate collector technology.

The leading countries in cumulated unglazed and glazed water collector capacity in operation in 2011 per 1,000 inhabitants were Cyprus (542 kW_{th}/1,000 inhabitants), Austria (406 kW_{th}/1,000 inhabitants), Israel (400 kW_{th}/1,000 inhabitants), Barbados (322 kW_{th}/1,000 inhabitants), Greece (268 kW_{th}/1,000 inhabitants), Australia (212 kW_{th}/1,000 inhabitants), Germany (131 kW_{th}/1,000 inhabitants), Turkey (129 kW_{th}/1,000 inhabitants), China (114 kW_{th}/1,000 inhabitants) and Jordan (114 kW_{th}/1,000 inhabitants).

3.2 Total capacity of glazed water collectors in operation

With more than 152 GW_{th}, China is the leader by far in terms of total installed capacity of glazed water collectors. Germany and Turkey are next with around 10 GW_{th} of installed capacity. Several countries, namely Brazil, India, Japan, Israel, Austria, Greece, Italy, Australia, Spain, the United States, Taiwan, France (mainland) and South Korea, had more than 1 GW_{th} of water collectors installed by end of 2011 (see **Figure 6**).

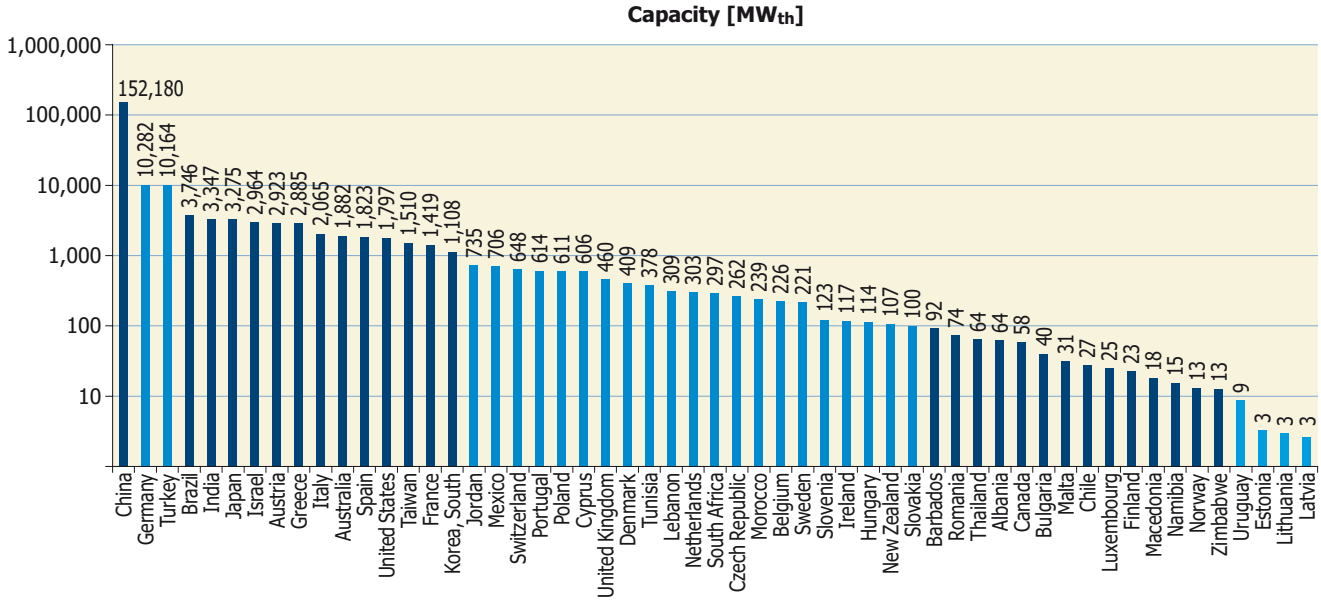


Figure 6: Total capacity of glazed flat plate and evacuated tube collectors in operation by the end of 2011 (note: logarithmic scale of y-axis)

In terms of total installed capacity of glazed water collectors in operation per 1,000 inhabitants, there was a continued dominance by 5 countries: Cyprus ahead of Israel, Austria, Barbados and Greece. China is catching up within the Top 10; passing Jordan and Australia in 2011 (see **Figure 7**).

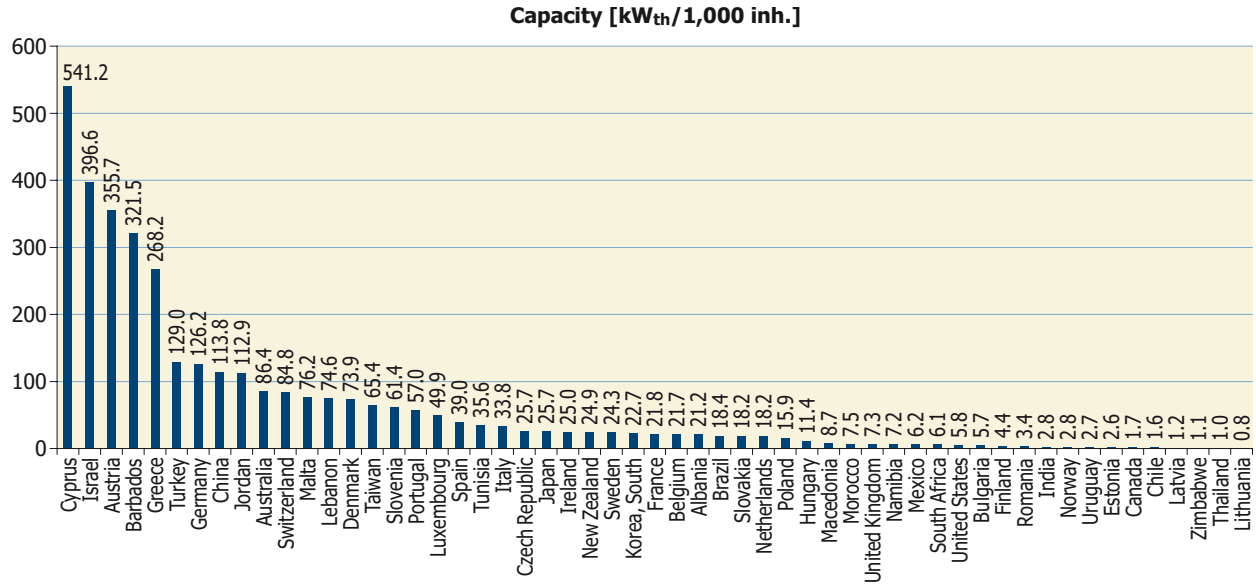


Figure 7: Total capacity of glazed flat plate and evacuated tube collectors in operation in kW_{th} per 1,000 inhabitants by the end of 2011

3.3 Total capacity of glazed water collectors in operation by economic region

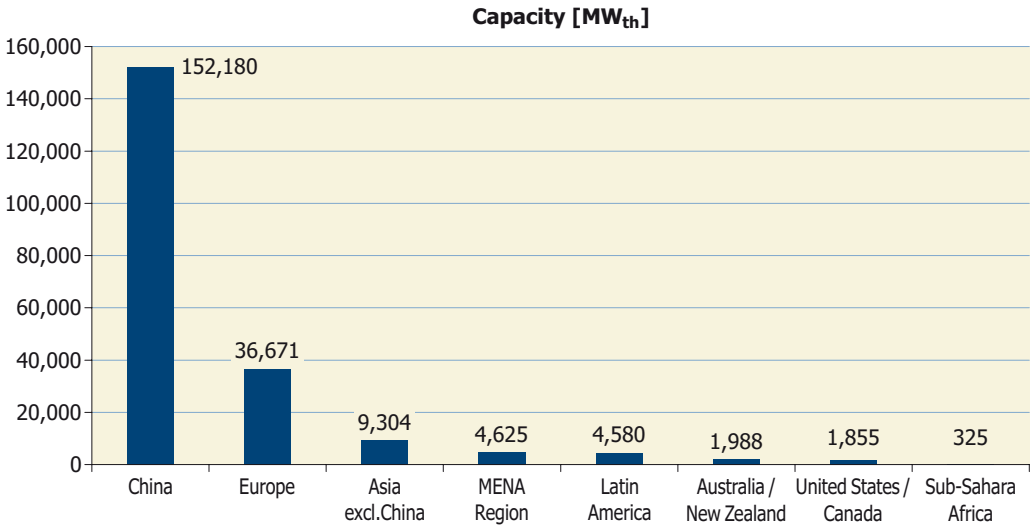
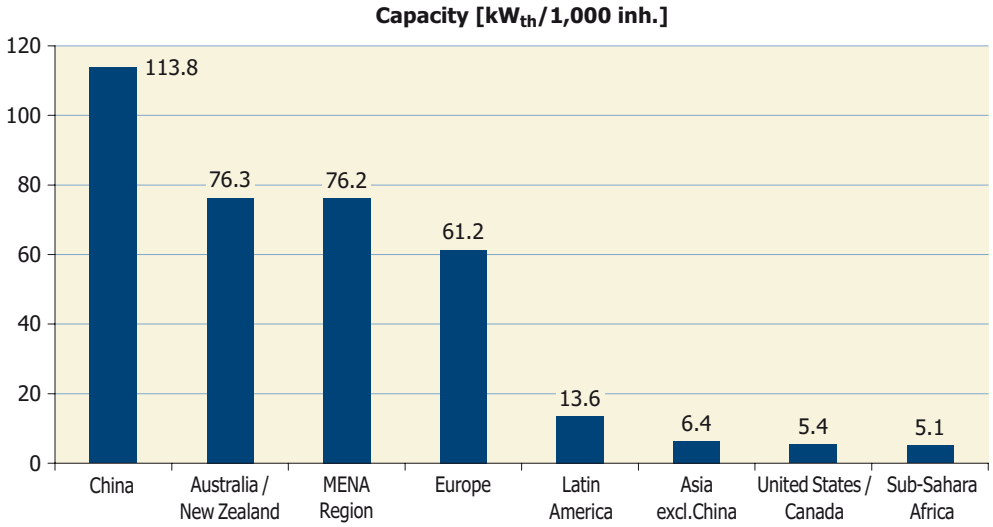


Figure 8: Total capacity of glazed flat plate and evacuated tube collectors in operation by economic region at the end of 2011



Asia excluding China:	India, Japan, Korea South, Taiwan, Thailand
Latin America:	Brazil, Chile, Mexico, Uruguay
Europe:	EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Sahara Africa:	Mozambique, Namibia, South Africa, Zimbabwe

Figure 9: Total capacity of glazed flat plate and evacuated tube collectors in operation by economic region and in kW_{th} per 1,000 inhabitants by the end of 2011

3.4 Total capacity of unglazed water collectors in operation

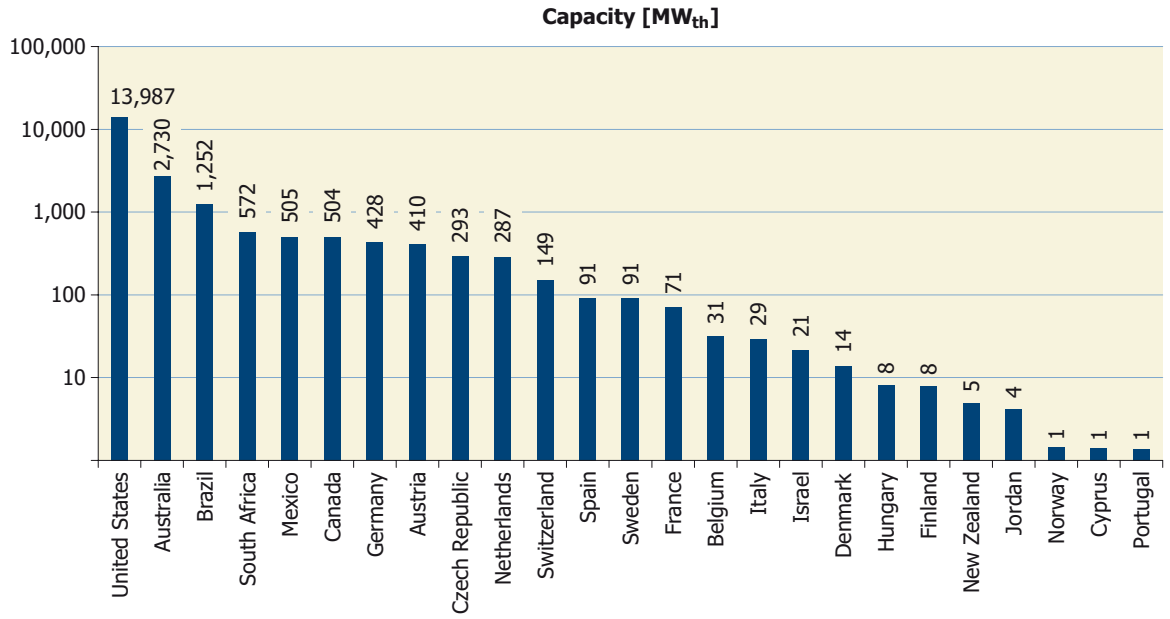


Figure 10: Total capacity of unglazed water collectors in operation by the end of 2011 (note: logarithmic scale of y-axis)

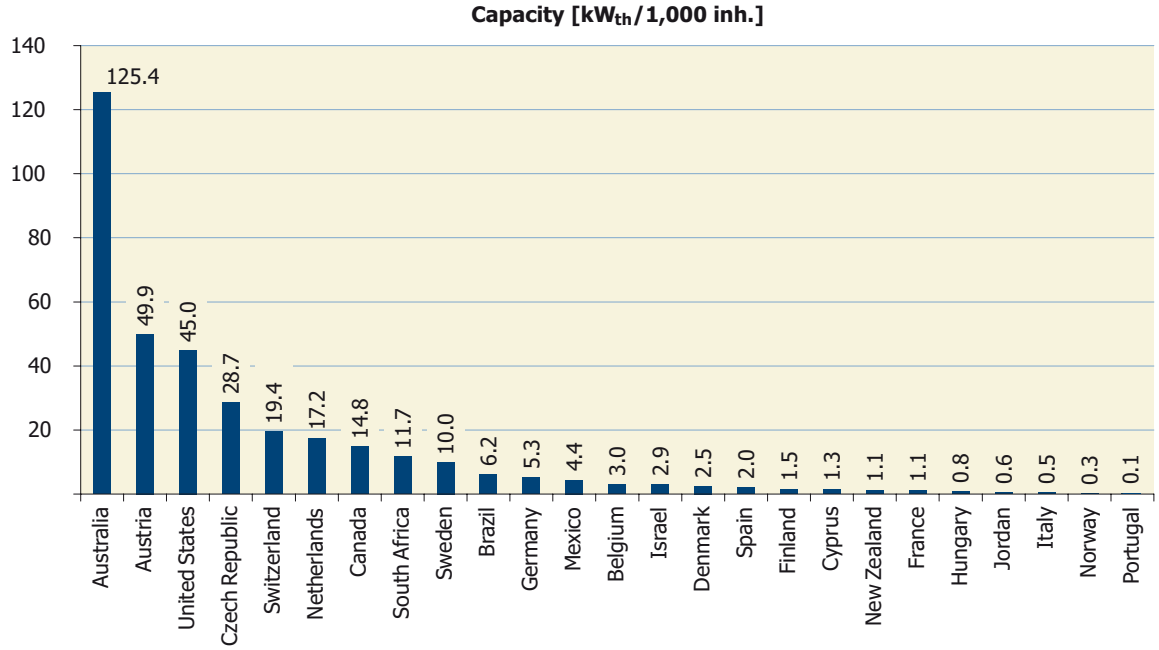


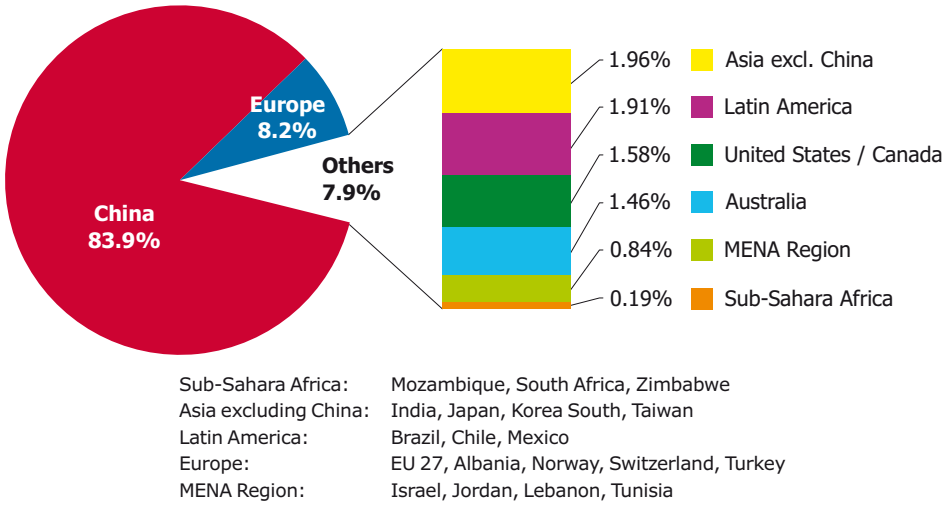
Figure 11: Total capacity of unglazed water collectors in operation in kW_{th} per 1,000 inhabitants by the end of 2011

4 Newly installed capacity in 2011 and market development

4.1 General market overview of newly installed capacity

In the year 2011 a total capacity of 48.1 GW_{th}, corresponding to 68.7 million square meters of solar collectors, was installed worldwide. This means an increase in new collector installations of 14.3% compared to the year 2010[3]. In comparison, the market growth in the period 2009/2010 amounted to 13.9%.

The main markets were in China (40.32 GW_{th}) and Europe (3.93 GW_{th}), which together accounted for 92.1% of the overall new collector installations in 2011. The rest of the market was shared between Asia excluding China (0.94 GW_{th}), Latin America represented by Brazil, Chile and Mexico (0.92 GW_{th}), the United States and Canada (0.76 GW_{th}), Australia (0.70 GW_{th}), the MENA region represented by Israel, Jordan, Lebanon and Tunisia (0.40 GW_{th}) and the Sub-Sahara African countries Mozambique, South Africa and Zimbabwe (0.09 GW_{th}).



Sub-Sahara Africa:	Mozambique, South Africa, Zimbabwe
Asia excluding China:	India, Japan, Korea South, Taiwan
Latin America:	Brazil, Chile, Mexico
Europe:	EU 27, Albania, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Tunisia

Figure 12: Share of the newly installed capacity (glazed and unglazed water and air collectors) by economic regions in 2011

The main driver of the positive global market growth remains China with a reported growth rate of 17.6% in the period 2010/2011. Compared to the former period the growth rate slightly increased by 0.9%.

The other Asian countries considered in this report also recorded a positive market growth of 7.5%, but the high growth rate from 2009/2010 of 36.3% was not reached. The situation in Latin America is similar—high growth rate in 2009/2010 of 20.0% followed by a moderate growth rate of 5.3% in 2010/2011. The same is true for the MENA region where the growth rate amounted to 3.0% in 2010/2011 and 23.4% in 2009/2010 (see **Figure 13**).

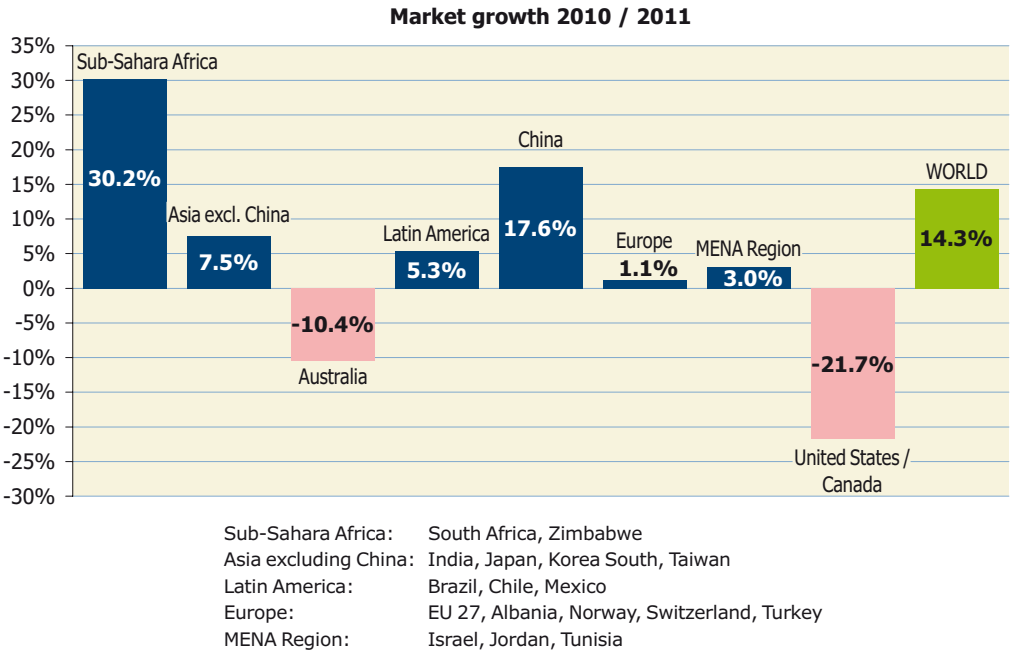
South Africa, the largest and most mature market in Sub-Sahara Africa, reported a growth rate of 30.2%.

In the European market signs of a positive trend reversal can be observed after the significant downfall the previous two years, the large German market in particular has recovered with a growth rate of 10.4% in the period 2010/2011. In summary, the total European market has increased by 1.1%. It must be mentioned here that the strong market in Turkey contributed significantly to this positive figure.

3 Not considered: unglazed and glazed air collectors in Australia, Barbados, Lebanon, Macedonia, Morocco; unglazed water collectors in Mozambique, Namibia, New Zealand, Norway, Thailand and Uruguay

By contrast, in the United States and Canada, which experienced a market growth of 16.1% in 2009/2010, saw a significant decrease of -21.7% in 2010/2011.

In Australia, the market for water collectors declined for a second year in a row, -5.4% in the period 2009/2010 and –10.4% in the period 2010/2011.



Sub-Sahara Africa:	South Africa, Zimbabwe
Asia excluding China:	India, Japan, Korea South, Taiwan
Latin America:	Brazil, Chile, Mexico
Europe:	EU 27, Albania, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Tunisia

Figure 13: Market development of the newly installed capacity between 2010 and 2011 by economic region

Country	Water Collectors			Air Collectors		TOTAL [MW_{th}]
	unglazed	FPC	ETC	unglazed	glazed	
Albania		9.0	0.1			9.1
Australia	420.0	240.8	15.6	25.2	0.6	702.2
Austria	4.0	155.1	6.1		0.2	165.4
Belgium		24.9	7.0			31.9
Brazil	358.5	362.3				720.7
Bulgaria		7.0	0.6			7.6
Canada	52.1	5.5	6.7	19.9	5.0	89.2
Chile		7.6				7.6
China		2,016.0	38,304.0			40,320.0
Cyprus	0.1	18.8	1.2			20.0
Czech Republic	45.5	34.4	11.7			91.6
Denmark		43.3	0.4			43.7
Estonia		0.6	0.6			1.3
Finland		2.1	0.7			2.8
France (mainland)**		169.5	6.2	0.4	0.1	176.2
Germany		806.4	82.6	0.3		889.3
Greece		161.0				161.0
Hungary	1.1	9.8	4.2	0.2	0.2	15.4
India		424.2	282.8			707.0
Ireland		8.8	5.8			14.5
Israel	1.8	259.7				261.4
Italy		237.5	35.5			273.0
Japan		108.7	1.3		7.5	117.5
Jordan		38.2	9.6			47.8
Korea, South		38.3				38.3
Latvia		0.7	0.6			1.3
Lebanon*		28.0	14.0			42.0
Lithuania		0.4	0.8			1.3
Luxembourg		2.5	0.7			3.2
Malta		1.6	0.3			2.0
Mexico	63.0	66.5	59.5	0.2		189.2
Mozambique*			0.1			0.1
Netherlands	19.2	22.0	3.5			44.7
Norway	0.1	2.0	0.7			2.8
Poland		131.2	46.4			177.6
Portugal	0.2	88.4	0.5	0.1		89.2
Romania		6.0	4.9			10.9
Slovakia		13.5	2.6			16.1
Slovenia		6.3	2.1			8.4
South Africa	33.7	30.0	27.5			91.2
Spain	6.0	174.8	12.1	1.1		193.9
Sweden	15.8	11.0	3.6			30.4
Switzerland	6.3	90.4	6.1	6.3		109.1
Taiwan		70.3	7.7			78.0
Tunisia		45.0	5.6			50.6
Turkey		910.8	353.2	1.1		1,265.1
United Kingdom		51.1	13.2	3.9		68.2
United States	523.5	125.9	8.0	10.9	4.2	672.5
Zimbabwe		0.2	0.2			0.4
TOTAL	1,550.9	7,067.8	39,356.2	69.5	17.9	48,062.3

* Newly included countries compared to the 2011 edition of this report

** The figures for France relate to Metropolitan France (mainland) only.
Estimations for the Overseas Departments (DOM) were not taken into account in this year's statistics.

Note: If no data is given: no reliable database for this collector type is available

Table 3: Newly installed capacity in 2011 [MW_{th}/a]

As shown in **Table 3** and **Table 4**, the newly installed capacity in the year 2011 is divided into flat plate collectors (FPC): 7.1 GW_{th} (10.1 million square meters), evacuated tube collectors (ETC): 39.4 GW_{th} (56.2 million square meters), unglazed water collectors 1.6 GW_{th} (2.2 million square meters) and glazed and unglazed air collectors: 0.09 GW_{th} (0.12 million square meters).

Country	Water Collectors			Air Collectors		TOTAL [m²]
	unglazed	FPC	ETC	unglazed	glazed	
Albania		12,890	98			12,988
Australia	600,000	343,980	22,230	36,000	900	1,003,110
Austria	5,700	221,500	8,690		350	236,240
Belgium		35,500	10,000			45,500
Brazil	512,099	517,517				1,029,616
Bulgaria		10,000	800			10,800
Canada	74,490	7,880	9,500	28,377	7,165	127,412
Chile		10,920				10,920
China		2,880,000	54,720,000			57,600,000
Cyprus	142	26,794	1,643			28,579
Czech Republic	65,000	49,150	16,650			130,800
Denmark		61,897	504			62,401
Estonia		900	900			1,800
Finland		3,000	1,000			4,000
France (mainland)**		242,200	8,800	553	117	251,670
Germany		1,152,000	118,000	428		1,270,428
Greece		230,000				230,000
Hungary	1,500	14,000	6,000	300	250	22,050
India		606,000	404,000			1,010,000
Ireland		12,538	8,232			20,770
Israel	2,500	370,984				373,484
Italy		339,300	50,700			390,000
Japan		155,264	1,802		10,773	167,839
Jordan		54,531	13,705			68,236
Korea, South		54,732				54,732
Latvia		1,000	800			1,800
Lebanon*		40,000	20,000			60,000
Lithuania		600	1,200			1,800
Luxembourg		3,500	1,000			4,500
Malta		2,335	480			2,815
Mexico	90,000	95,000	85,000	300		270,300
Mozambique*			130			130
Netherlands	27,396	31,445	5,000			63,841
Norway	160	2,863	946			3,969
Poland		187,400	66,300			253,700
Portugal	235	126,227	736	204		127,402
Romania		8,500	7,000			15,500
Slovakia		19,320	3,680			23,000
Slovenia		9,000	3,000			12,000
South Africa	48,200	42,811	39,300			130,311
Spain	8,600	249,700	17,250	1,500		277,050
Sweden	22,601	15,654	5,153			43,408
Switzerland	9,040	129,142	8,721	9,000		155,903
Taiwan		100,386	11,061			111,447
Tunisia		64,300	8,000			72,300
Turkey		1,301,075	504,600	1,570		1,807,245
United Kingdom		72,953	18,826	5,597		97,376
United States	747,900	179,900	11,400	15,500	6,000	960,700
Zimbabwe		230	320			550
TOTAL	2,215,563	10,096,818	56,223,156	99,329	25,555	68,660,421

* Newly included countries compared to the 2011 edition of this report

** The figures for France relate to Metropolitan France (mainland) only.
Estimations for the Overseas Departments (DOM) were not taken into account in this year's statistics.

Note: If no data is given: no reliable database for this collector type is available

Table 4: Newly Installed collector area in 2011 [m²/a]

In the global context, evacuated tube collectors are by far the most important solar thermal collector technology (see **Figure 14**). This is due to the predominance of the Chinese market where an estimated 95% of all newly installed solar thermal systems are equipped with vacuum tubes.

By contrast in Europe the situation is almost the opposite; more than 80% of all solar thermal systems installed in 2011 were equipped with flat plate collectors (see **Figure 15**).

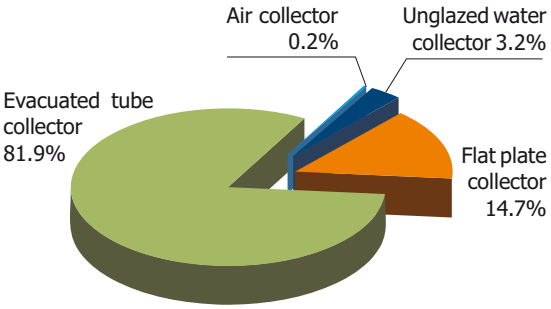


Figure 14: Distribution of the newly installed capacity by collector type in 2011 - WORLD

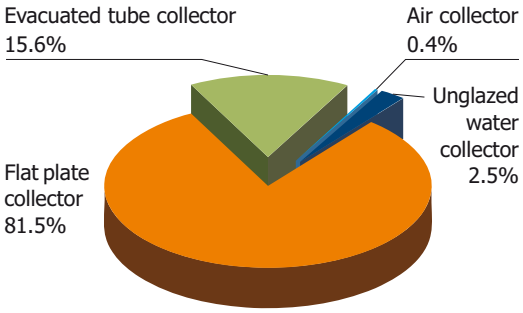


Figure 15: Distribution of the newly installed capacity by collector type in 2011 - EUROPE

Figure 16 depicts the newly installed capacity of glazed and unglazed water collectors for the 10 leading markets in 2011 in total numbers. Compared to the newly installed capacity in 2010, China remained the market leader in absolute terms followed by Turkey.

The United States and Australia faced a significant market decline in 2011 and hence fell behind Germany, Brazil and India within the top 10 ranking.

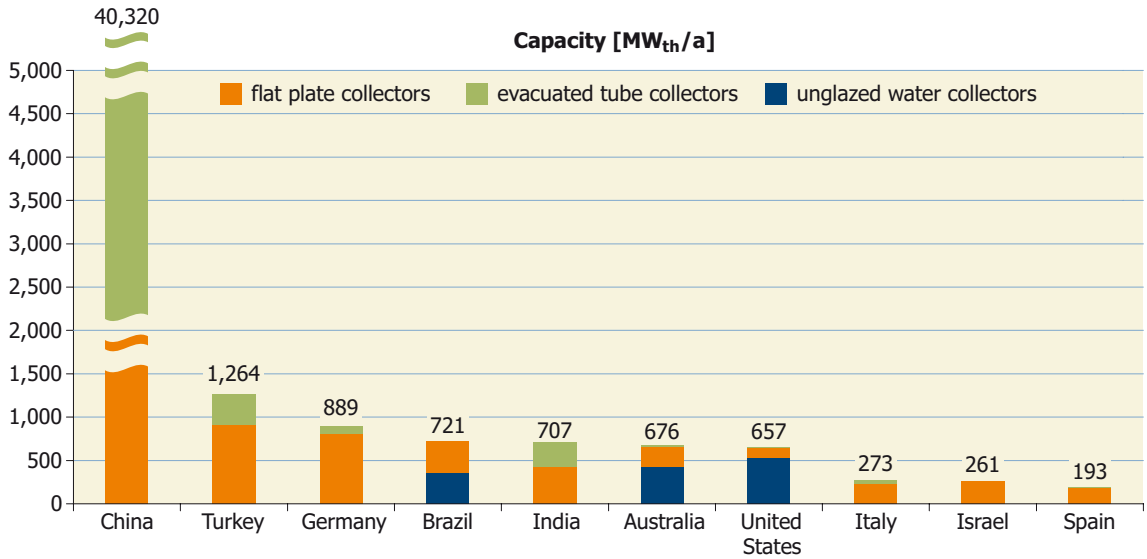


Figure 16: Total capacity of newly installed glazed and unglazed water collectors in the 10 leading countries in 2011

The leading countries in newly installed glazed and unglazed water collector capacity in 2011 per 1,000 inhabitants were Israel (35 kW_{th}/1,000 inhabitants); Australia (31 kW_{th}/1,000 inhabitants); China (30 kW_{th}/1,000 inhabitants); Austria (20 kW_{th}/1,000 inhabitants); Cyprus (18 kW_{th}/1,000 inhabitants); Turkey (16 kW_{th}/1,000 inhabitants); Greece (15 kW_{th}/1,000 inhabitants); Switzerland (13 kW_{th}/1,000 inhabitants); Germany (11 kW_{th}/1,000 inhabitants) and Lebanon (10 kW_{th}/1,000 inhabitants).

4.2 Newly installed capacity of glazed water collectors

For glazed water collectors (FPC and ETC) the solar thermal market in 2011 grew by 15.4% with China once again as the strong driver for this successful development. Within the top 10 glazed water heater markets nothing changed for the leading countries China, Turkey, Germany and India compared to the year 2011 (see **Figure 17**).

In terms of newly installed glazed water collector capacity per 1,000 inhabitants, Israel is leading ahead of China, Austria, Cyprus, Turkey, Greece, Switzerland and Australia, which was the same in the year 2010 (see **Figure 18**).

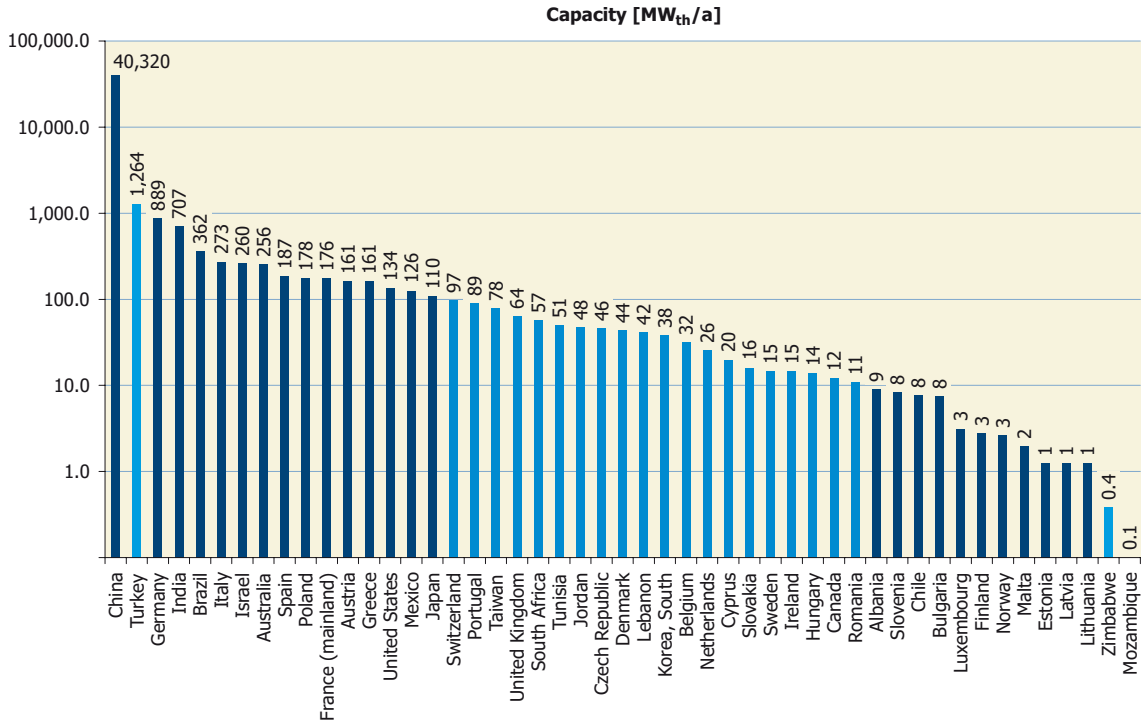


Figure 17: Newly installed capacity of glazed water collectors in 2011 (note: logarithmic scale of y-axis)

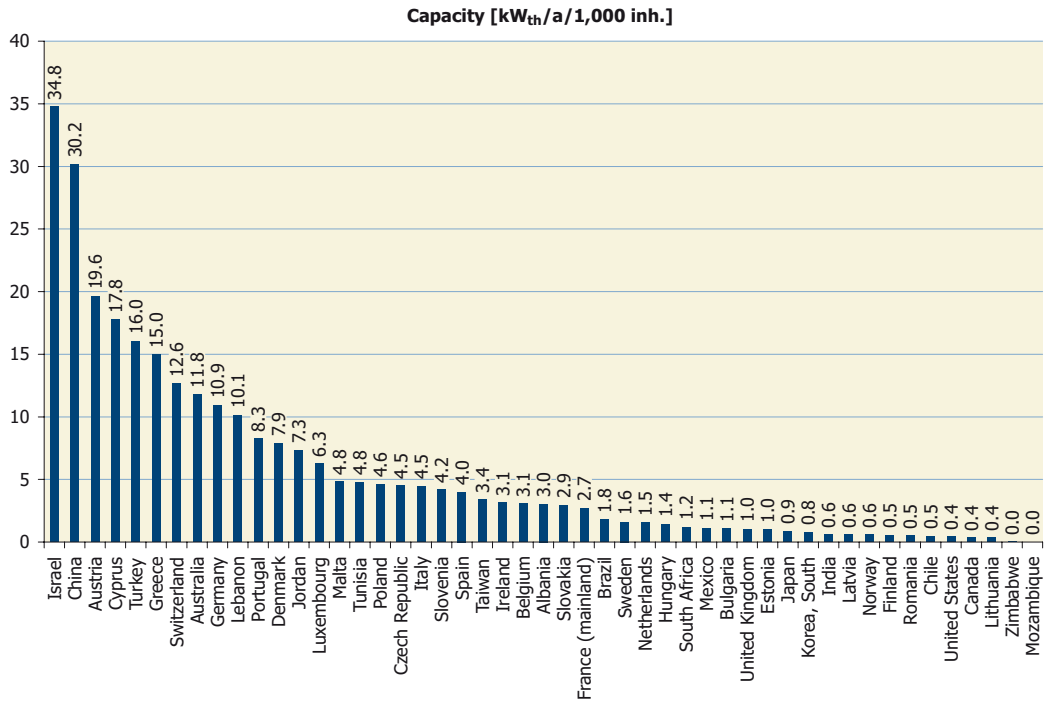
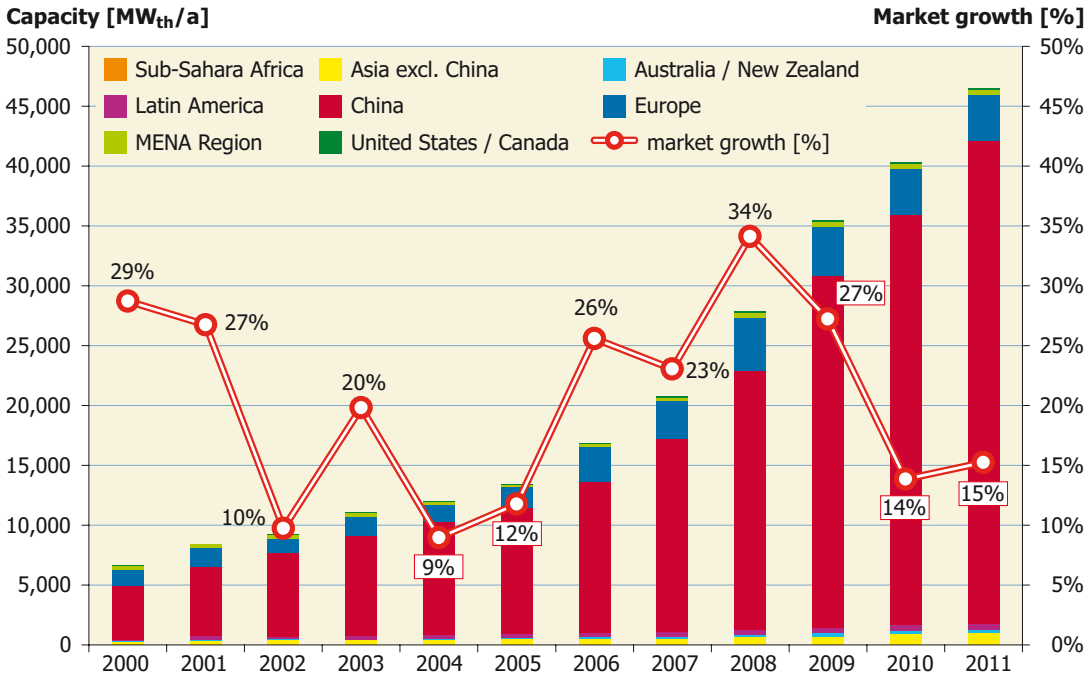


Figure 18: Newly installed capacity of glazed water collectors in 2011 in kW_{th} per 1,000 inhabitants

4.3 Market development of glazed water collectors between 2000 and 2011

The worldwide market development of glazed water collectors is characterized by a steady growth over the past 11 years. Between 2000 and 2011 the average growth rate worldwide was round 20%.

Between 2000 and 2011 the annual installed glazed water collector area worldwide increased 7-fold, and compared to the year 2010 the worldwide market grew by 15.4%. The growth rate remained at a stable level compared to the period 2009/2010 after a downfall in the two preceding years (see **Figure 19**).



Sub-Sahara Africa: Mozambique, Namibia*, South Africa, Zimbabwe
Asia excluding China: India, Japan, Korea South, Taiwan, Thailand**
Latin America: (Barbados**), Brazil, Chile, Mexico, Uruguay**
Europe: EU 27, Albania, Macedonia**, Norway, Switzerland, Turkey
MENA Region: Israel, Jordan, Lebanon, Morocco*, Tunisia

* 2011 estimated / ** 2010 and 2011 estimated

Figure 19: Annual installed capacity of flat plate and evacuated tube collectors from 2000 to 2011

In China the market is characterized by a steady growth whereas in Europe, the second largest economic region, the market is characterized by large fluctuations. After a market decline between 2008 and 2010, the market stabilized in 2011 (see **Figure 20**).

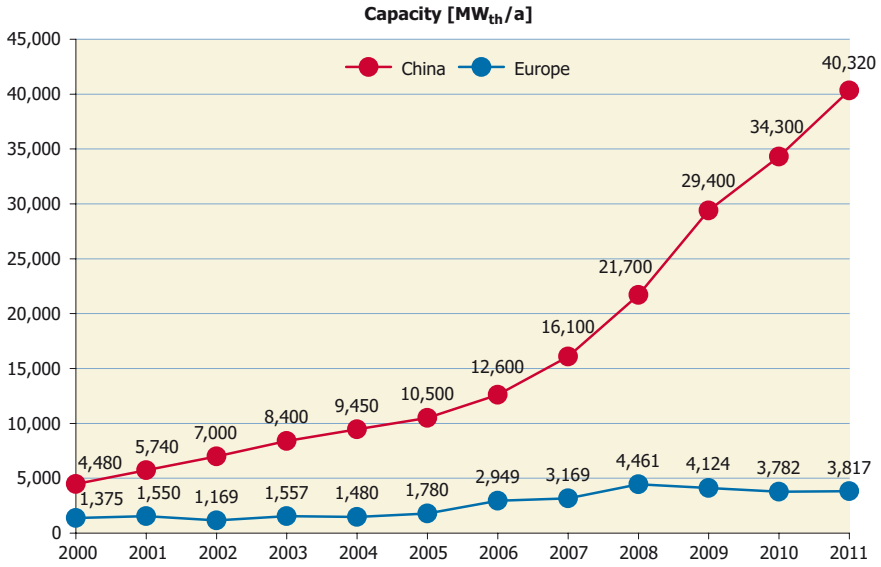


Figure 20: Annual installed capacity of flat plate and evacuated tube collectors from 2000 to 2011 in China and Europe

Besides China another strong Asian market is India, which is following a steady upwards trend (+13.6% in 2010/2011). Other Asian markets, however, are only slightly growing (Japan, +3.6%) or decreasing (South Korea, Taiwan). In Latin America the main drivers are Brazil and Mexico. In the period 2010/2011 a market growth of 9.4% for glazed water collectors was reported in Brazil while the market in Mexico stagnated.

In the MENA region, the mature Israeli market is by far leading in terms of newly installed capacities and shows positive growth rates. The emerging markets in Sub-Sahara African countries also show a solid upward trend, in quantitative terms this is mainly due to the market in South Africa.

In Australia as well as in the USA and Canada, the market for glazed water collectors decreased in the period 2010/2011 (**Figure 21**).

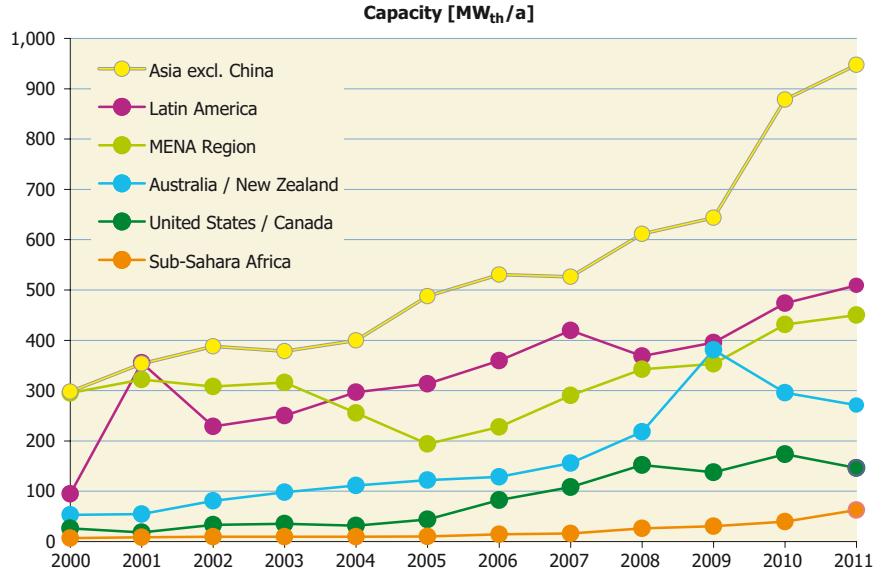


Figure 21: Annual installed capacity of flat plate and evacuated tube collectors from 2000 to 2011

Figure 22 shows the market development between 2000 and 2011 for the annually installed capacity of glazed water collectors per 1,000 inhabitants.

It can be highlighted that in 2011 China was the only economic region with a high market penetration in terms of installations per capita. The annual installed capacity rose from 12.3 kW_{th} per 1,000 inhabitants in 2007 to 30.2 kW_{th} per 1,000 inhabitants in 2011. Worldwide, only Israel installed more solar thermal collectors per capita in 2011.

Other economic regions with a medium market penetration (4 - 12 kW_{th} per 1,000 inhabitants) are slightly increasing in the MENA region, stagnating in Europe and decreasing in Australia / New Zealand. The gap between these markets and China's market is becoming increasingly larger.

Emerging economic regions like Sub-Sahara Africa, Asia (excluding China) and South America showed low market penetration (<4 kW_{th} per 1,000 inhabitants) in 2011, but a positive growth trend can be observed.

By contrast the glazed water collector markets in the United States and Canada showed a market decline with a low level of market penetration.

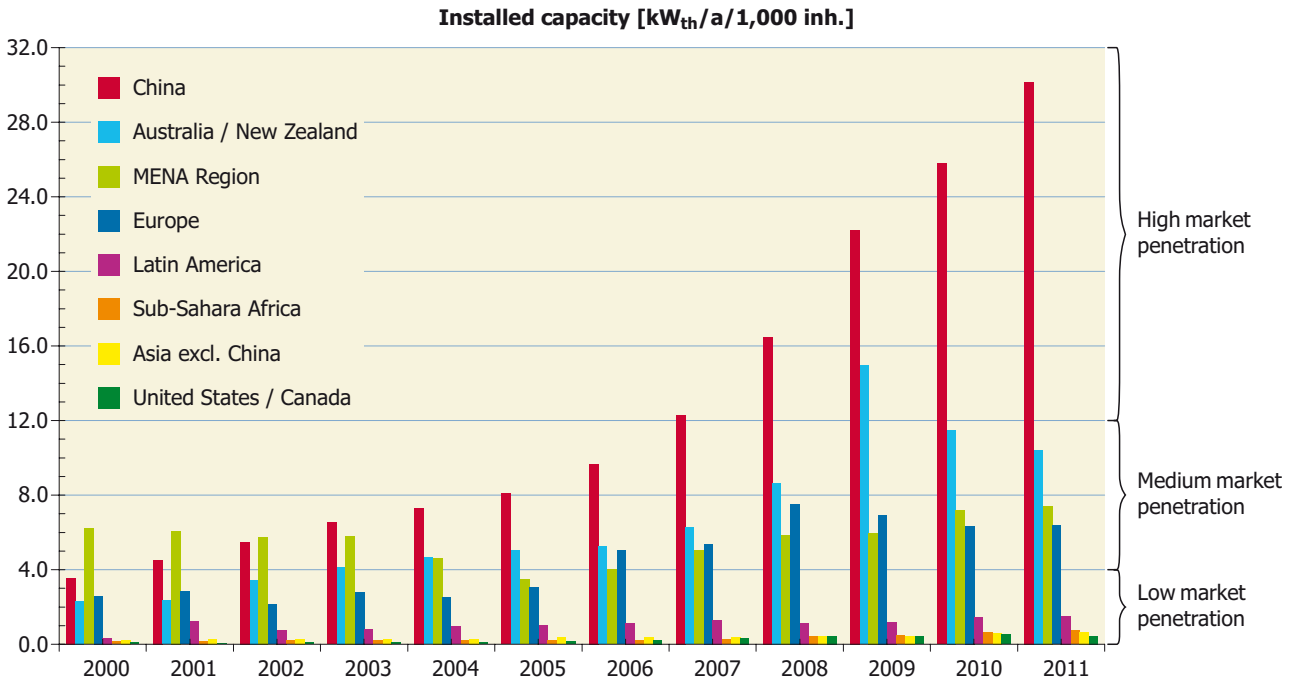


Figure 22: Annual installed capacity of flat plate and evacuated tube collectors in kW_{th} per 1,000 inhabitants from 2000 to 2011

4.4 Market development of unglazed water collectors between 2000 and 2011

In the period 2010/2011 the market for unglazed water collectors decreased significantly by -10.2% due to market declines in the United States (-20.3%), Canada (-12.0%), Australia (-11.8%) and South Africa (-3.6%). Positive market development was only reported from Brazil (+3.7%) and Europe (+9.5%). In summary, new installations of unglazed water collectors accounted for 1.55 GW_{th} or 2.22 millions of square meters.

As can be seen in **Figure 23** and **Figure 24** the worldwide market for unglazed water collectors is mainly dominated by three countries, the United States, Australia and Brazil, which accounted for 84% of the newly installed unglazed water collector capacity in the year 2011.

Consequently, major market trends within this sector are highly influenced by these three markets. The remaining unglazed water collector market is shared between Mexico, Canada, South Africa and several European countries, most notably Czech Republic, the Netherlands, Sweden and Switzerland.

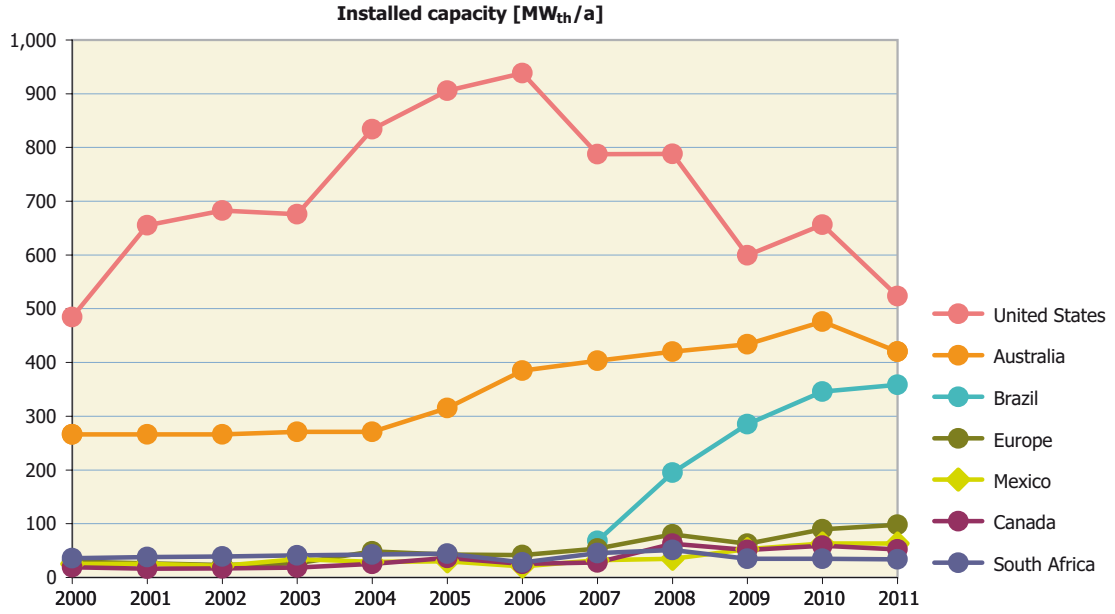


Figure 23: Annual installed capacity of unglazed water collectors from 2000 to 2011

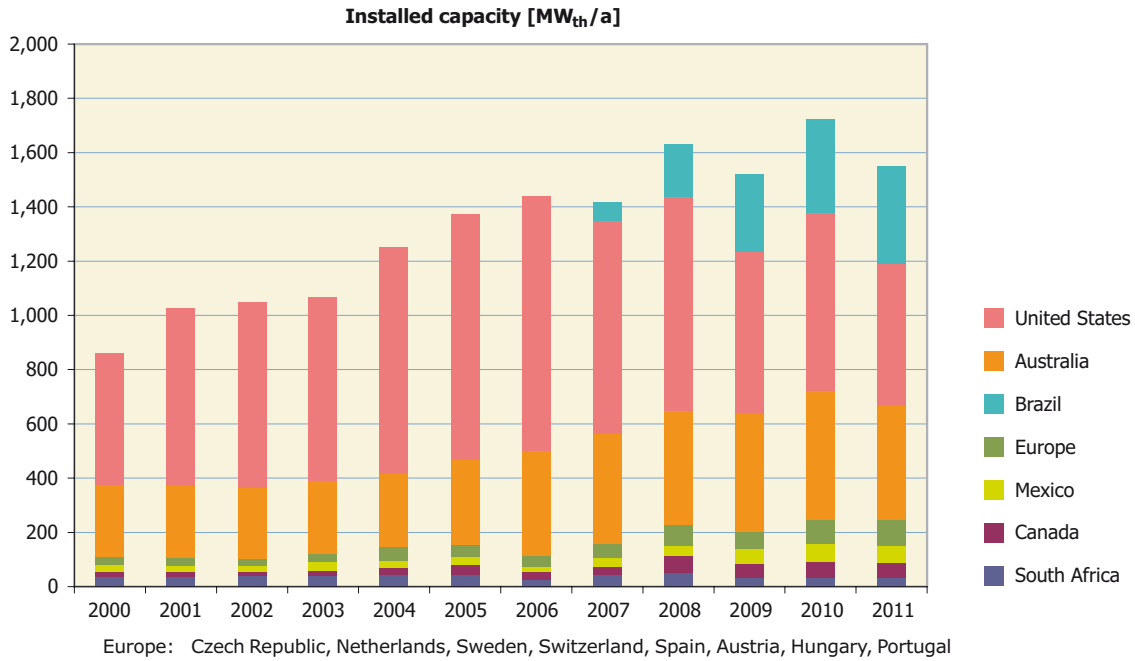


Figure 24: Annual installed capacity of unglazed water collectors from 2000 to 2011

5 Contribution to the energy supply and CO_2 reduction

In this section, the contribution of the total installed glazed and unglazed water collectors in operation to the thermal energy supply and CO_2 reduction is shown.

The basis for these calculations is the total glazed and unglazed water collector area in operation in each country as shown in **Table 1**. The corresponding annual energy gains, energy savings expressed as oil equivalents and CO_2 emission savings are based on the systems installed and accounting for different types of solar collectors, geographic regions and types of applications, and calculated using the simulation tool T-SOL expert 4.5 (www.valentin.de).

The annual collector yield of all water-based solar thermal systems in operation by the end of 2011 in the 56 recorded countries was 195.5 TWh/a (= 704.0 PJ/a). This corresponds to an energy savings equivalent to 20.9 million tons of oil per year and 64.1 million tons of CO_2. The calculated number of different types of solar thermal systems in operation was round 67 million by the end of 2011 (see **Table 5**).

For glazed water collectors the cumulated capacity in operation by the end of 2011 was 211.5 GW_{th}, which generated an annual solar thermal collector yield of 183.5 TWh/a (= 660.8 PJ/a). This corresponds to an annual oil savings of 19.7 million tons and an annual CO_2 savings of 60.6 million tons (see **Table 6**).

For unglazed water collectors, the total installed capacity in operation in 2011 was 21.5 GW_{th}, which generated an annual solar thermal collector yield of 12.0 TWh/a (= 43.2 PJ/a). This corresponds to an energy savings equivalent to 1.1 million tons of oil per year and 3.5 million tons of CO_2[4] (see **Table 7**).

The contribution of the total installed air collector capacity in operation in 2011 of 1.55 GW_{th} was not taken into consideration – with a share of around 0.7% of the total installed collector capacity these collectors were omitted from the calculation.

Within the standardization of definitions for renewable heat by EUROSTAT and IEA SHC, a new calculation method for the annual solar yield was used in this report as well as in the 2012 and 2011 editions:

"Solar thermal production (solar yield) is equal to the solar collector output."

This new definition has meant higher annual solar yields than reported in the reports prior to the 2011 edition.

Please find the description of the methodology in the appendix (see **Chapter 7.1**).

Table 5 summarizes the calculated annual collector yields and the corresponding oil equivalents and CO_2 reductions of all water-based solar thermal systems (systems for hot water, space heating and swimming pool heating) in operation by the end of 2011.

Table 6 and **Table 7** show the results for glazed and unglazed water collectors accordingly.

In **Chapters 5.1 to 5.3**, the annual collector yield, energy savings and CO_2 savings by economic regions for total numbers and per 1,000 inhabitants are graphed.

4 This figure decreased compared to the year 2010 due to replacements and low growth rates.

Country	Total collector area [m²]	Total capacity [MW_{th}]	Calculated number of systems	Collector yield [GWh/a]	Collector yield [TJ/a]	Energy savings [t oe/a]	CO_2 reduction [t CO_2/a]
Albania	90,721	64	11,860	66	239	7,142	21,926
Australia	6,588,000	4,612	881,277	4,086	14,711	417,491	1,281,685
Austria	4,762,217	3,334	469,148	1,919	6,909	204,282	627,139
Barbados	131,690	92	32,923	116	418	12,491	38,346
Belgium	368,283	258	81,046	149	535	15,839	48,625
Brazil	7,141,093	4,999	1,174,583	4,885	17,585	517,014	1,587,219
Bulgaria	57,536	40	10,581	30	108	3,224	9,897
Canada	802,601	562	11,366	327	1,177	31,818	97,679
Chile	39,079	27	4,916	29	106	3,155	9,687
China	217,400,000	152,180	49,556,330	126,405	455,056	13,586,045	41,708,771
Cyprus	868,277	608	191,348	772	2,780	82,977	254,737
Czech Republic	792,668	555	53,626	271	976	27,635	84,839
Denmark	603,300	422	86,637	269	970	28,892	88,699
Estonia	4,720	3	1,180	2	7	219	673
Finland	44,181	31	8,275	18	65	1,891	5,804
France (mainland)	2,128,609	1,490	321,348	1,010	3,637	108,188	332,134
Germany	15,299,530	10,710	1,664,368	6,216	22,376	665,762	2,043,871
Greece	4,122,000	2,885	1,591,106	3,164	11,390	340,063	1,043,982
Hungary	174,528	122	17,787	82	294	8,739	26,828
India	4,780,800	3,347	975,283	4,091	14,727	439,682	1,349,810
Ireland	167,308	117	38,629	70	252	7,522	23,094
Israel	4,265,115	2,986	1,411,652	3,692	13,291	396,617	1,217,603
Italy	2,992,095	2,094	737,730	1,969	7,089	211,419	649,051
Japan	4,678,066	3,275	1,148,050	2,724	9,807	292,791	898,861
Jordan	1,055,798	739	186,813	1,000	3,600	107,437	329,828
Korea, South	1,583,349	1,108	228,319	828	2,980	88,977	273,157
Latvia	3,740	3	935	2	6	186	570
Lebanon	441,600	309	95,165	414	1,491	44,519	136,671
Lithuania	4,200	3	1,050	2	7	203	624
Luxembourg	35,850	25	8,963	16	58	1,732	5,319
Macedonia	25,744	18	3,298	15	56	1,665	5,111
Malta	44,433	31	11,108	39	139	4,145	12,724
Mexico	1,729,876	1,211	88,674	923	3,323	96,536	296,362
Morocco	341,260	239	85,315	351	1,263	37,700	115,737
Mozambique	130	0	32	0	0	13	41
Namibia	22,006	15	2,718	20	72	2,158	6,624
Netherlands	842,717	590	127,602	299	1,076	30,781	94,497
New Zealand	159,645	112	38,190	102	366	10,890	33,433
Norway	20,933	15	873	8	28	815	2,501
Poland	873,120	611	109,868	357	1,284	38,322	117,646
Portugal	878,909	615	140,324	672	2,417	72,166	221,547
Romania	105,200	74	26,300	62	225	6,712	20,607
Slovakia	142,250	100	23,708	68	246	7,349	22,562
Slovenia	175,300	123	26,511	73	263	7,839	24,065
South Africa	1,241,924	869	99,389	835	3,005	84,770	260,242
Spain	2,735,550	1,915	269,223	1,887	6,792	202,054	620,300
Sweden	446,000	312	33,198	163	586	17,050	52,343
Switzerland	1,137,860	797	134,599	447	1,610	47,365	145,408
Taiwan	2,157,294	1,510	427,938	1,317	4,742	141,570	434,617
Thailand	91,392	64	22,848	78	281	8,385	25,741
Tunisia	540,288	378	189,317	486	1,748	52,200	160,252
Turkey	14,519,361	10,164	3,362,684	13,028	46,901	1,400,259	4,298,756
United Kingdom	656,998	460	164,250	273	982	29,323	90,020
United States	22,548,178	15,784	527,806	9,394	33,819	917,296	2,816,071
Uruguay	12,571	9	3,143	9	31	921	2,827
Zimbabwe	18,196	13	4,549	16	56	1,671	5,128
TOTAL	332,894,087	233,026	66,925,759	195,544	703,959	20,873,904	64,082,290

Table 5: Calculated annual collector yield and corresponding oil equivalent and CO_2 reduction of glazed and unglazed water collectors in operation by the end of 2011

Country	Total collector area [m²]	Total capacity [MW_{th}]	Calculated number of systems	Collector yield [GWh/a]	Collector yield [TJ/a]	Energy savings [t oe/a]	CO_2 reduction [t CO_2/a]
Albania	90,721	64	11,860	66	239	7,142	21,926
Australia	2,688,000	1,882	766,572	2,268	8,167	243,818	748,516
Austria	4,176,026	2,923	466,217	1,753	6,311	188,406	578,402
Barbados	131,690	92	32,923	116	418	12,491	38,346
Belgium	323,283	226	80,821	137	493	14,710	45,158
Brazil	5,351,866	3,746	1,165,636	4,215	15,173	452,992	1,390,673
Bulgaria	57,536	40	10,581	30	108	3,224	9,897
Canada	83,237	58	7,769	49	176	5,269	16,176
Chile	39,079	27	4,916	29	106	3,155	9,687
China	217,400,000	152,180	49,556,330	126,405	455,056	13,586,045	41,708,771
Cyprus	866,239	606	191,338	771	2,775	82,864	254,390
Czech Republic	374,668	262	51,536	145	521	15,549	47,735
Denmark	583,605	409	86,539	264	949	28,338	86,996
Estonia	4,720	3	1,180	2	7	219	673
Finland	32,873	23	8,218	14	52	1,558	4,782
France (mainland)	2,027,138	1,419	320,841	977	3,517	105,008	322,371
Germany	14,688,000	10,282	1,661,311	6,024	21,686	647,441	1,987,626
Greece	4,122,000	2,885	1,591,106	3,164	11,390	340,063	1,043,982
Hungary	163,008	114	17,730	78	280	8,360	25,665
India	4,780,800	3,347	975,283	4,091	14,727	439,682	1,349,810
Ireland	166,904	117	38,627	70	252	7,511	23,058
Israel	4,234,498	2,964	1,411,499	3,675	13,229	394,956	1,212,505
Italy	2,950,080	2,065	737,520	1,951	7,022	209,645	643,605
Japan	4,678,066	3,275	1,148,050	2,724	9,807	292,791	898,861
Jordan	1,049,858	735	186,783	996	3,586	107,069	328,698
Korea, South	1,583,349	1,108	228,319	828	2,980	88,977	273,157
Latvia	3,740	3	935	2	6	186	570
Lebanon	441,600	309	95,165	414	1,491	44,519	136,671
Lithuania	4,200	3	1,050	2	7	203	624
Luxembourg	35,850	25	8,963	16	58	1,732	5,319
Macedonia	25,744	18	3,298	15	56	1,665	5,111
Malta	44,433	31	11,108	39	139	4,145	12,724
Mexico	1,007,868	706	85,064	698	2,514	75,057	230,422
Morocco	341,260	239	85,315	351	1,263	37,700	115,737
Mozambique	130	0	32	0	0	13	41
Namibia	22,006	15	2,718	20	72	2,158	6,624
Netherlands	432,478	303	125,550	187	674	20,114	61,751
New Zealand	152,620	107	38,155	99	355	10,613	32,580
Norway	18,843	13	863	7	25	752	2,308
Poland	873,120	611	109,868	357	1,284	38,322	117,646
Portugal	876,963	614	140,314	671	2,415	72,087	221,306
Romania	105,200	74	26,300	62	225	6,712	20,607
Slovakia	142,250	100	23,708	68	246	7,349	22,562
Slovenia	175,300	123	26,511	73	263	7,839	24,065
South Africa	424,121	297	95,300	421	1,517	45,301	139,073
Spain	2,604,950	1,823	268,570	1,825	6,571	196,169	602,234
Sweden	316,000	221	32,548	125	448	13,389	41,104
Switzerland	925,600	648	133,537	388	1,399	41,756	128,190
Taiwan	2,157,208	1,510	427,937	1,317	4,742	141,568	434,609
Thailand	91,392	64	22,848	78	281	8,385	25,741
Tunisia	540,288	378	189,317	486	1,748	52,200	160,252
Turkey	14,519,361	10,164	3,362,684	13,028	46,901	1,400,259	4,298,756
United Kingdom	656,998	460	164,250	273	982	29,323	90,020
United States	2,567,416	1,797	427,903	1,657	5,966	178,130	546,853
Uruguay	12,571	9	3,143	9	31	921	2,827
Zimbabwe	18,196	13	4,549	16	56	1,671	5,128
TOTAL	302,184,949	211,529	66,677,007	183,545	660,761	19,727,519	60,562,922

Table 6: Calculated annual collector yield and corresponding oil equivalent and CO_2 reduction of glazed (FPC + ETC) water collectors in operation by the end of 2011

Country	Total collector area [m²]	Total capacity [MW_{th}]	Calculated number of systems	Collector yield [GWh/a]	Collector yield [TJ/a]	Energy savings [t oe/a]	CO_2 reduction [t CO_2/a]
Albania							
Australia	3,900,000	2,730	114,706	1,818	6,544	173,672	533,169
Austria	586,191	410	2,931	166	598	15,875	48,737
Barbados							
Belgium	45,000	31	225	12	43	1,129	3,467
Brazil	1,789,227	1,252	8,946	670	2,412	64,022	196,546
Bulgaria							
Canada	719,364	504	3,597	278	1,000	26,548	81,503
Chile							
China							
Cyprus	2,038	1	10	1	4	113	347
Czech Republic	418,000	293	2,090	127	455	12,086	37,103
Denmark	19,695	14	98	6	21	555	1,703
Estonia							
Finland	11,308	8	57	3	13	333	1,022
France (mainland)	101,471	71	507	33	120	3,180	9,764
Germany	611,530	428	3,058	192	690	18,321	56,244
Greece							
Hungary	11,520	8	58	4	14	379	1,163
India							
Ireland	404	0	2	0	0	12	36
Israel	30,617	21	153	17	63	1,661	5,098
Italy	42,015	29	210	19	67	1,774	5,445
Japan							
Jordan	5,940	4	30	4	14	368	1,130
Korea, South							
Latvia							
Lebanon							
Lithuania							
Luxembourg							
Macedonia							
Malta							
Mexico	722,008	505	3,610	225	809	21,479	65,939
Morocco							
Mozambique							
Namibia							
Netherlands	410,239	287	2,051	112	402	10,667	32,746
New Zealand	7,025	5	35	3	10	278	853
Norway	2,090	1	10	1	2	63	194
Poland							
Portugal	1,946	1	10	1	3	78	240
Romania							
Slovakia							
Slovenia							
South Africa	817,803	572	4,089	413	1,487	39,469	121,168
Spain	130,600	91	653	62	222	5,885	18,066
Sweden	130,000	91	650	38	138	3,661	11,240
Switzerland	212,260	149	1,061	59	211	5,608	17,217
Taiwan	85	0	0	0	0	3	8
Thailand							
Tunisia							
Turkey							
United Kingdom							
United States	19,980,762	13,987	99,904	7,737	27,853	739,166	2,269,218
Uruguay							
Zimbabwe							
TOTAL	30,709,138	21,496	248,752	11,999	43,197	1,146,385	3,519,368

Table 7: Calculated annual collector yield and corresponding oil equivalent and CO_2 reduction of unglazed water collectors in operation by the end of 2011

5.1 Annual collector yield by economic region

5.1.1 Annual collector yield of glazed water collectors by economic region in 2011

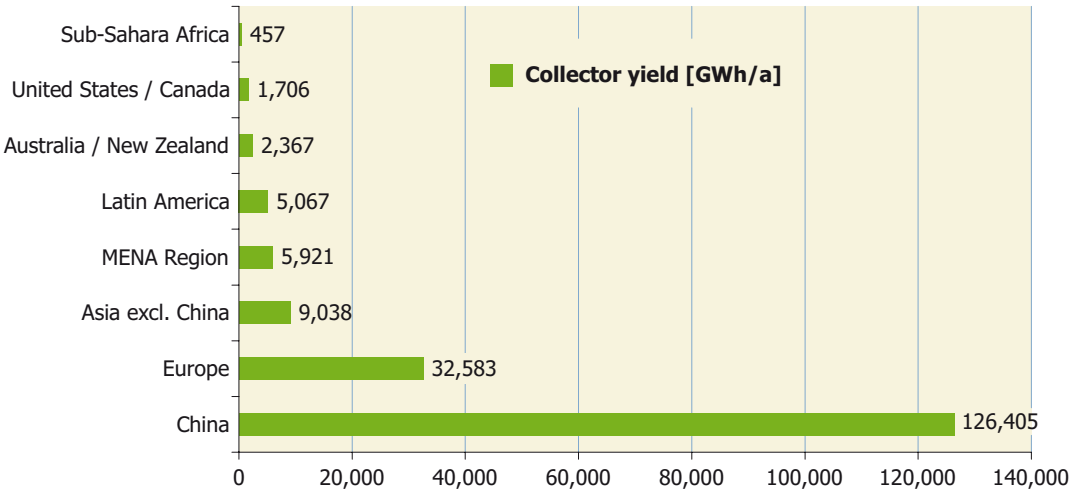
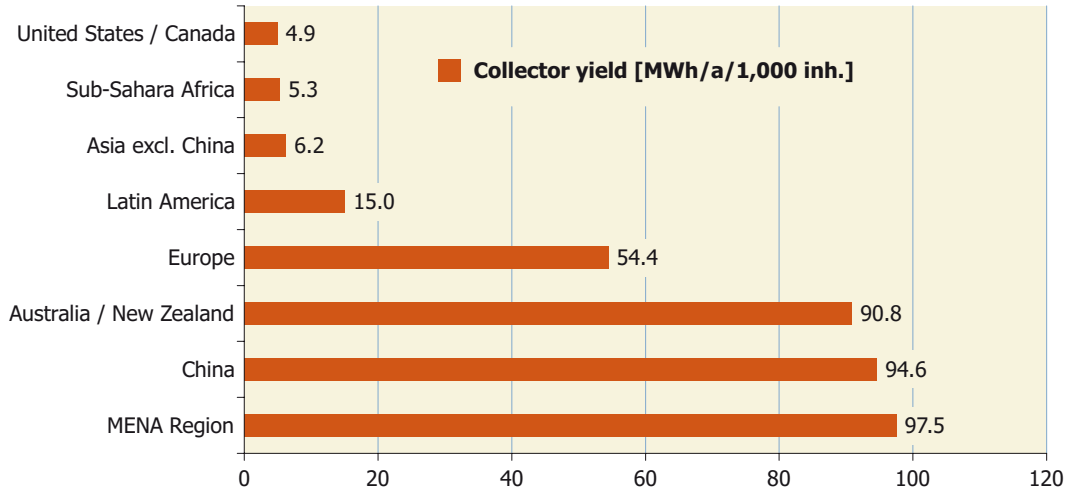


Figure 25: Annual collector yield of glazed (FPC + ETC) water collectors in operation by economic region in 2011



Asia excluding China:	India, Japan, Korea South, Taiwan, Thailand
Latin America:	Brazil, Chile, Mexico, Uruguay
Europe:	EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Sahara Africa:	Mozambique, Namibia, South Africa, Zimbabwe

Figure 26: Annual collector yield of glazed (FPC + ETC) water collectors in operation by economic region in MWh per 1,000 inhabitants in 2011

5.1.2 Annual collector yield of unglazed water collectors by economic region in 2011

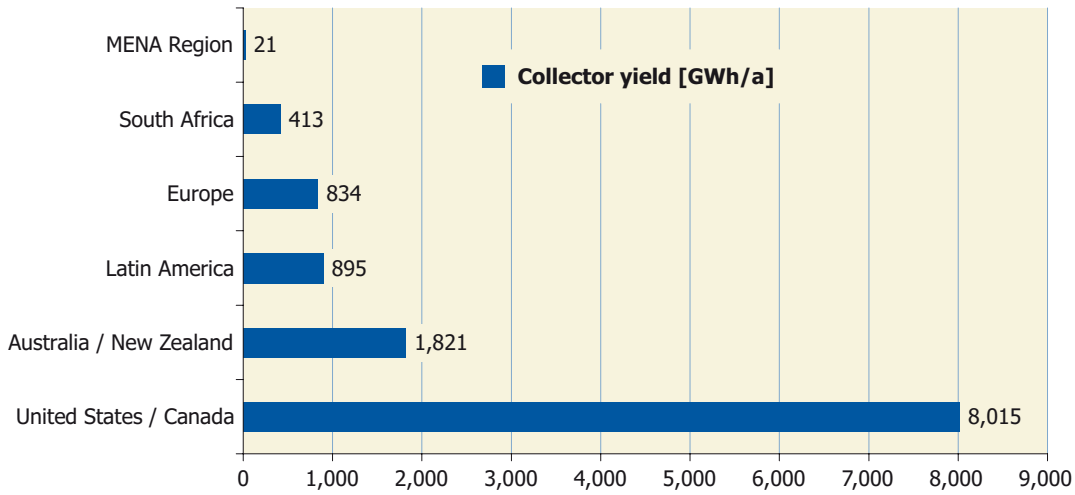
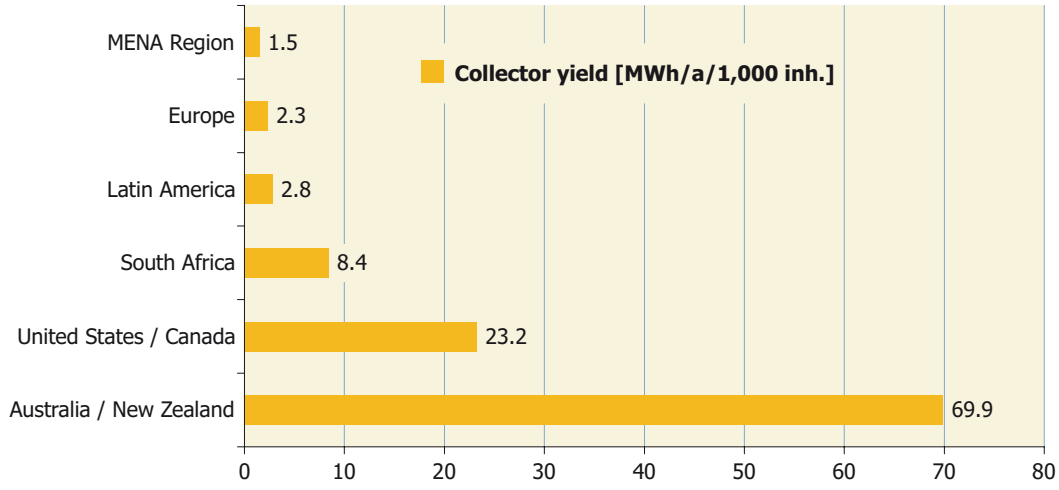


Figure 27: Annual collector yield of unglazed water collectors in operation by economic region in 2011



Latin America: Brazil, Mexico
Europe: Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland
MENA Region: Israel, Jordan

Figure 28: Annual collector yield of unglazed water collectors in operation by economic region in MWh per 1,000 inhabitants in 2011

5.2 Annual energy savings by economic region

5.2.1 Annual energy savings in oil equivalents by glazed water collectors by economic region in 2011

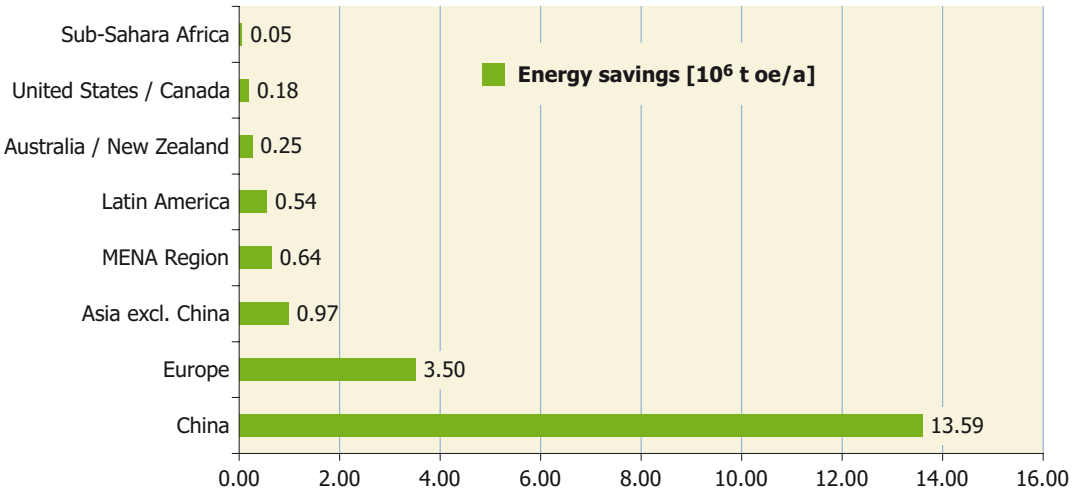
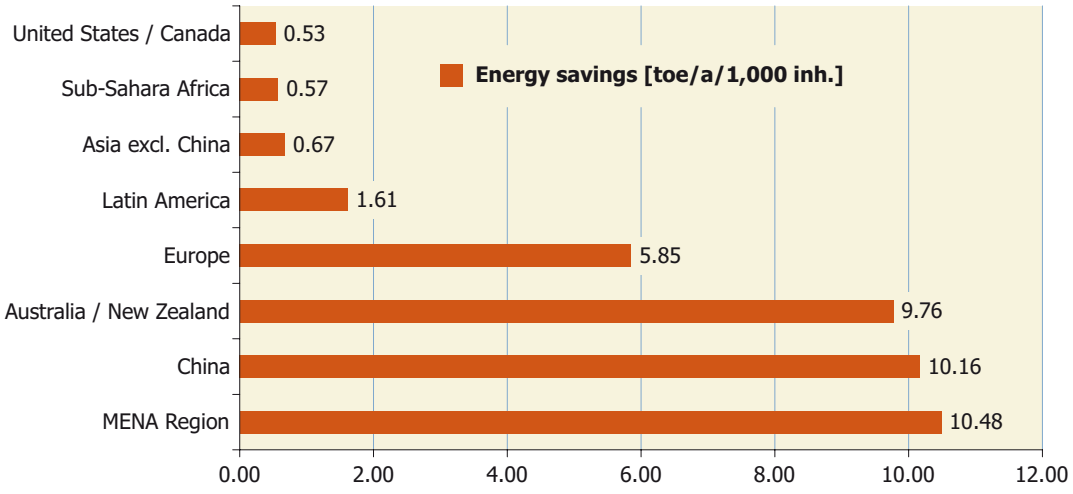


Figure 29: Annual energy savings in oil equivalent by glazed (FPC + ETC) water collectors in operation by economic region in 2011



Asia excluding China:	India, Japan, Korea South, Taiwan, Thailand
Latin America:	Brazil, Chile, Mexico, Uruguay
Europe:	Albania, EU 27, Macedonia, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Sahara Africa:	Mozambique, Namibia, South Africa, Zimbabwe

Figure 30: Annual energy savings in oil equivalent by glazed (FPC + ETC) water collectors in operation by economic region per 1,000 inhabitants in 2010

5.2.2 Annual energy savings in oil equivalents by unglazed water collectors by economic region in 2011

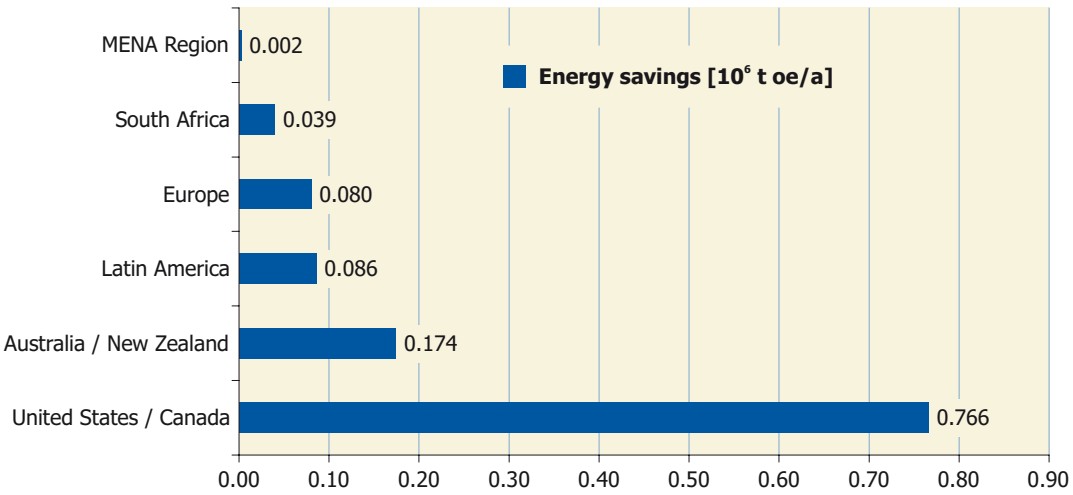
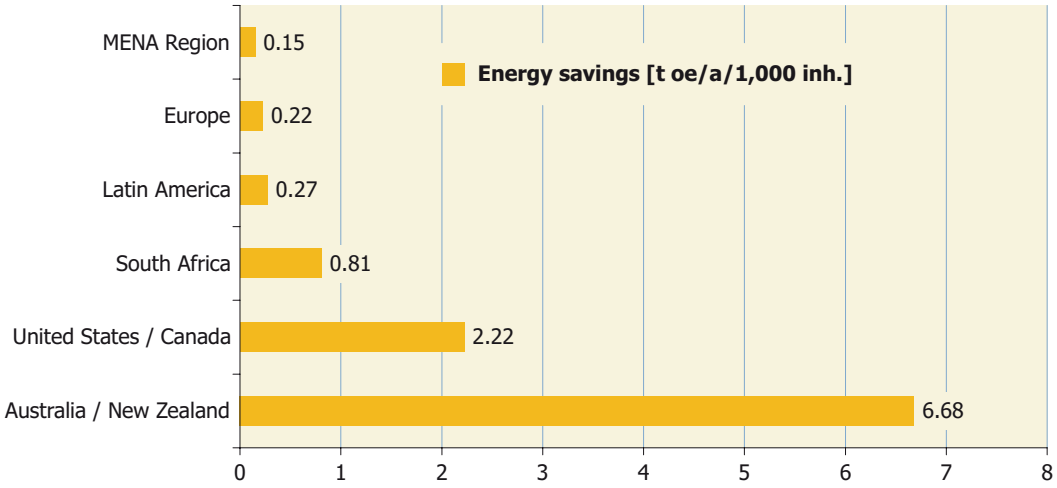


Figure 31: Annual energy savings in oil equivalents by unglazed water collectors in operation by economic region in 2011



Latin America: Brazil, Mexico
Europe: Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland
MENA Region: Israel, Jordan

Figure 32: Annual energy savings in oil equivalent by unglazed water collectors in operation by economic region per 1,000 inhabitants in 2011

5.3 Annual contribution to CO_2 reduction by economic region

5.3.1 Annual CO_2 reduction by glazed water collectors and economic region in 2011

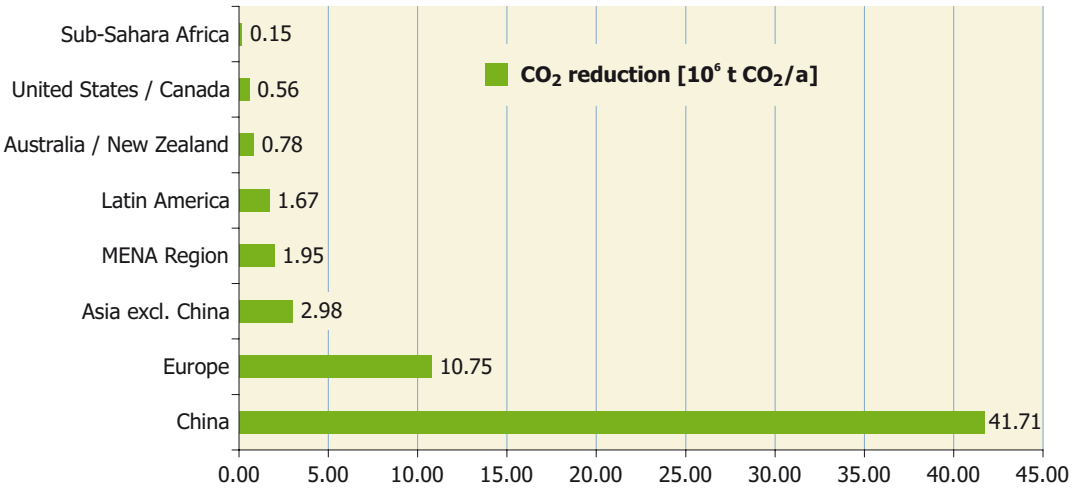
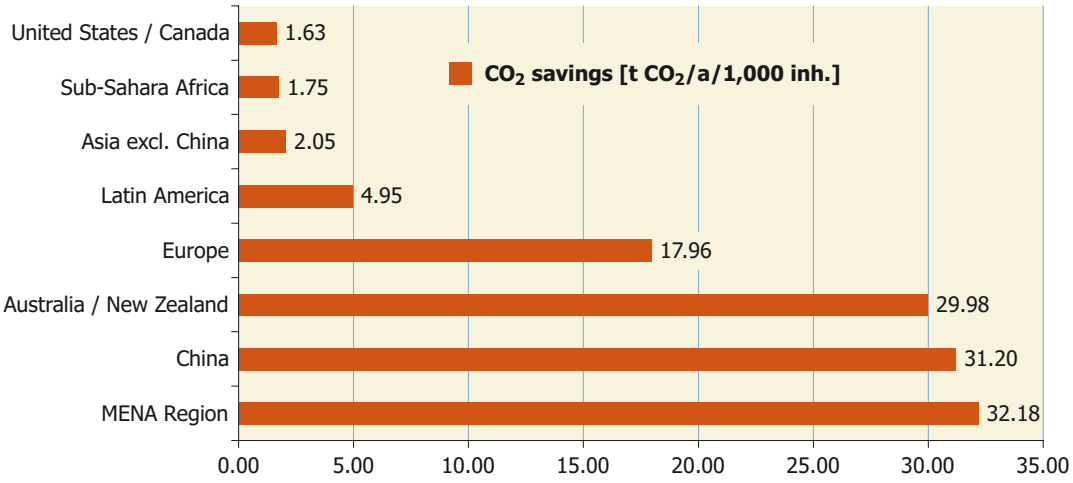


Figure 33: Contribution to CO_2 reduction by glazed (FPC + ETC) water collectors in operation by economic region in 2011



Asia excluding China:	India, Japan, Korea South, Taiwan, Thailand
Latin America:	Brazil, Chile, Mexico, Uruguay
Europe:	EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Saharan Africa:	Mozambique, Namibia, South Africa, Zimbabwe

Figure 34: Contribution to CO_2 reduction by glazed (FPC + ETC) water collectors in operation by economic region per 1,000 inhabitants in 2011

5.3.2 Annual CO_2 reduction by unglazed water collectors and economic region in 2011

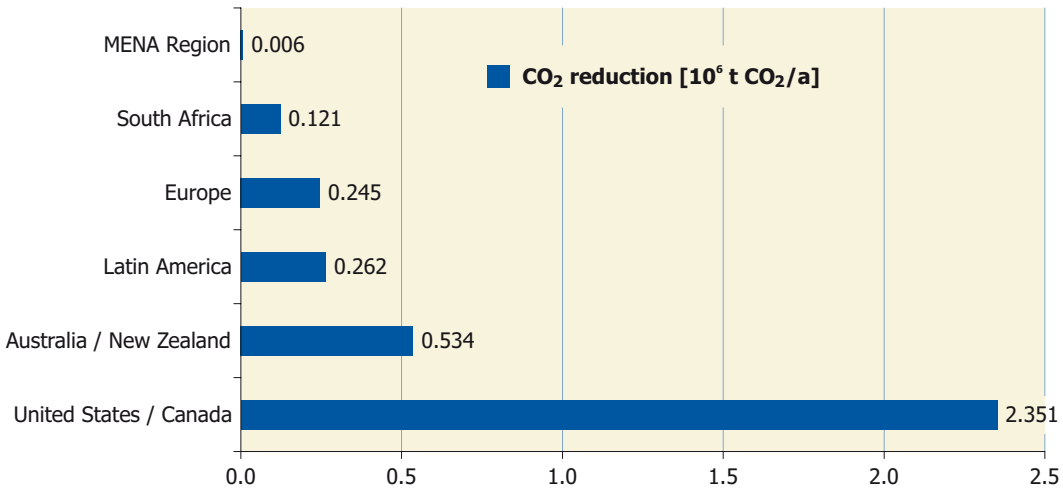
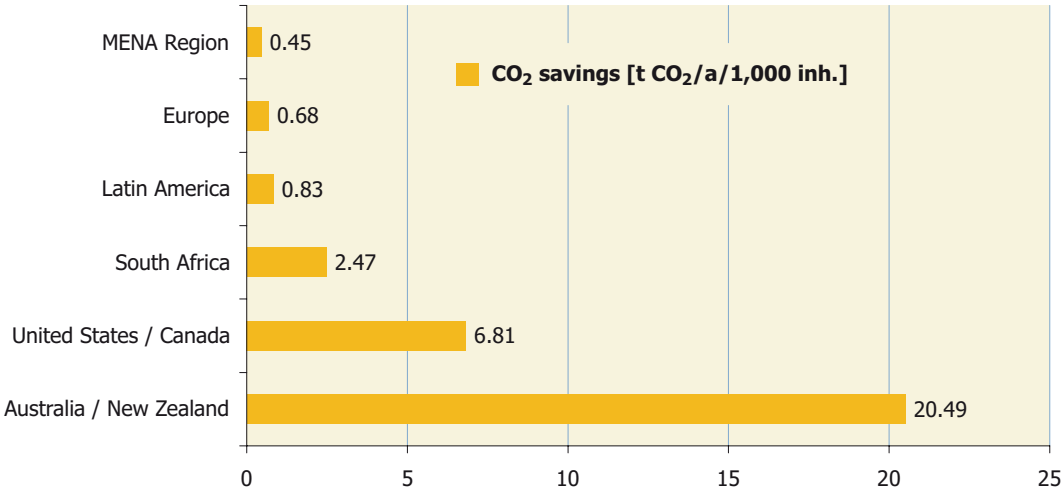


Figure 35: Contribution to CO_2 reduction by unglazed water collectors in operation by economic region in 2011



Latin America: Brazil, Mexico
Europe: Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland
MENA Region: Israel, Jordan

Figure 36: Contribution to CO_2 reduction by unglazed water collectors in operation by economic region per 1,000 inhabitants in 2011

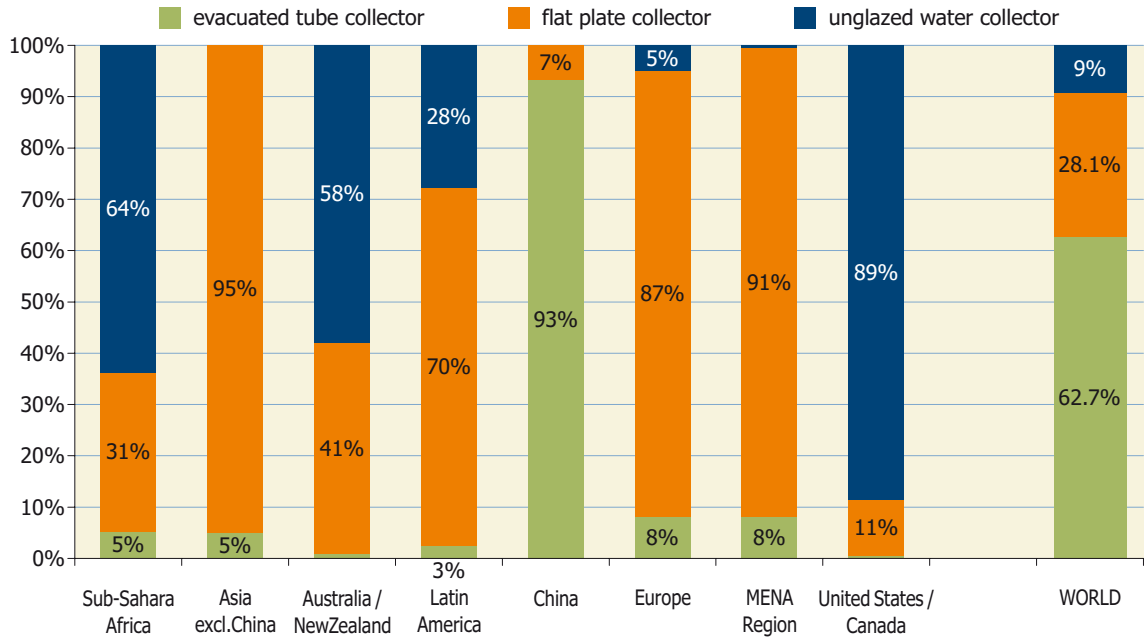
6 Distribution of systems by system type and application

The use of solar thermal energy varies greatly from region to region. It can be roughly distinguished by the type of solar thermal collector used, the operation of the system (pumped solar thermal system or thermosiphon systems) and the main application of the system (hot water preparation, space heating, industrial processes, cooling).

In **chapters 6.1 to 6.4**, these system types and applications are shown by different economic regions for both the cumulated capacity in operation and the newly installed capacity in 2011[5]. Finally in **chapter 6.5**, an overview of large scale solar thermal applications in Europe and worldwide is given.

6.1 Distribution by type of solar thermal collector

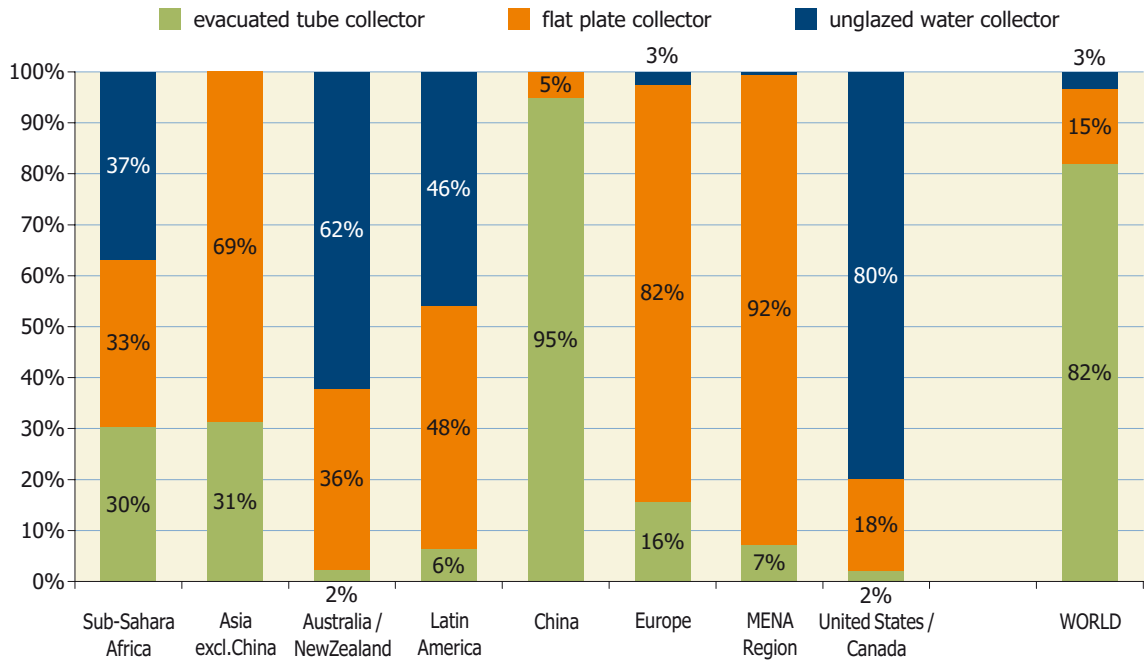
Referring to the total water collector area, evacuated tube collectors dominated with a share of 63% of the cumulated capacity in operation (see **Figure 37**) and a share of 82% of the newly installed capacity (see **Figure 38**). Especially in China, vacuum tube collectors played an important role and since this was by far the largest market supported by high growth rates, the worldwide figures tend towards a higher share of this type of solar thermal collector. Unglazed water collectors accounted for 9% of the cumulated water collectors installed worldwide (see **Figure 37**) and the share tended to decrease: in 2011 the share of unglazed water collectors was just slightly higher than 3% of the newly installed capacity (see **Figure 38**).



Asia excluding China: India, Japan, Korea South, Taiwan, Thailand
Latin America: Brazil, Chile, Mexico, Uruguay
Europe: EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region: Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Sahara Africa: Mozambique, Namibia, South Africa, Zimbabwe

Figure 37: Distribution by type of solar thermal collector for the total installed water collector capacity in operation by the end of 2011

5 It has to be considered that statistical information summarized in Chapters 6.1 to 6.4 is sometimes based on rough expert estimations by country representatives only and hence especially the share by type of system and application of the cumulated installed capacity in operation can deviate significantly from figures published in previous editions of this report.



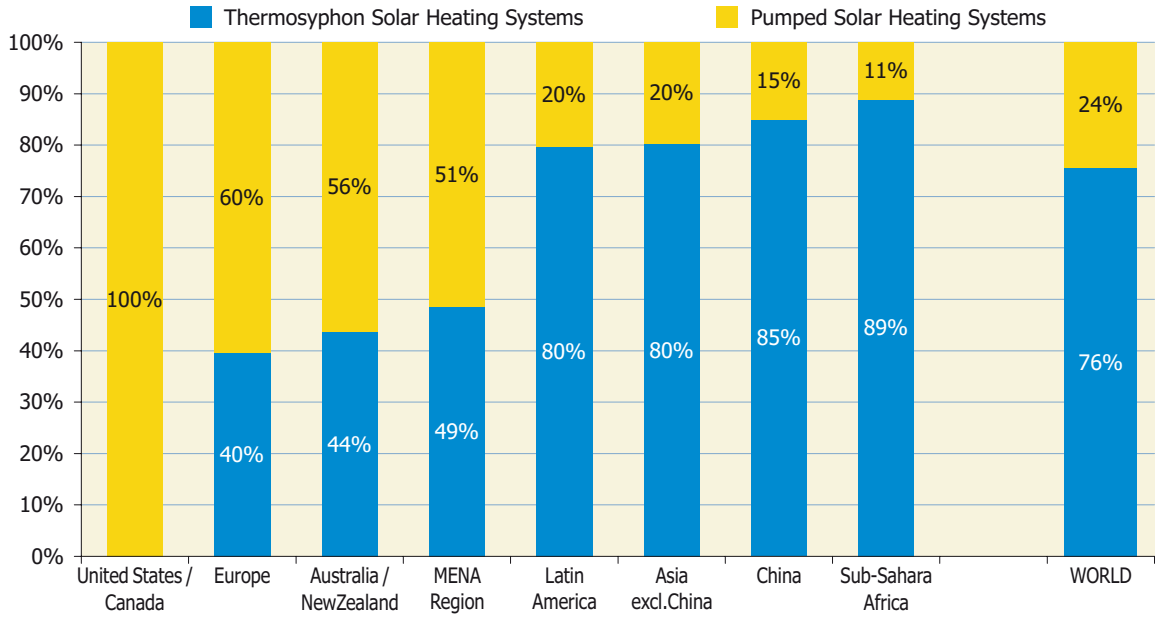
Asia excluding China: India, Japan, Korea South, Taiwan
Europe: EU 27, Albania, Norway, Switzerland, Turkey
Latin America: Brazil, Chile, Mexico
MENA Region: Israel, Jordan, Lebanon, Tunisia
Sub-Sahara Africa: Mozambique, Namibia, South Africa, Zimbabwe

Figure 38: Distribution by type of solar thermal collector for the newly installed water collector capacity in 2011

6.2 Distribution by type of system

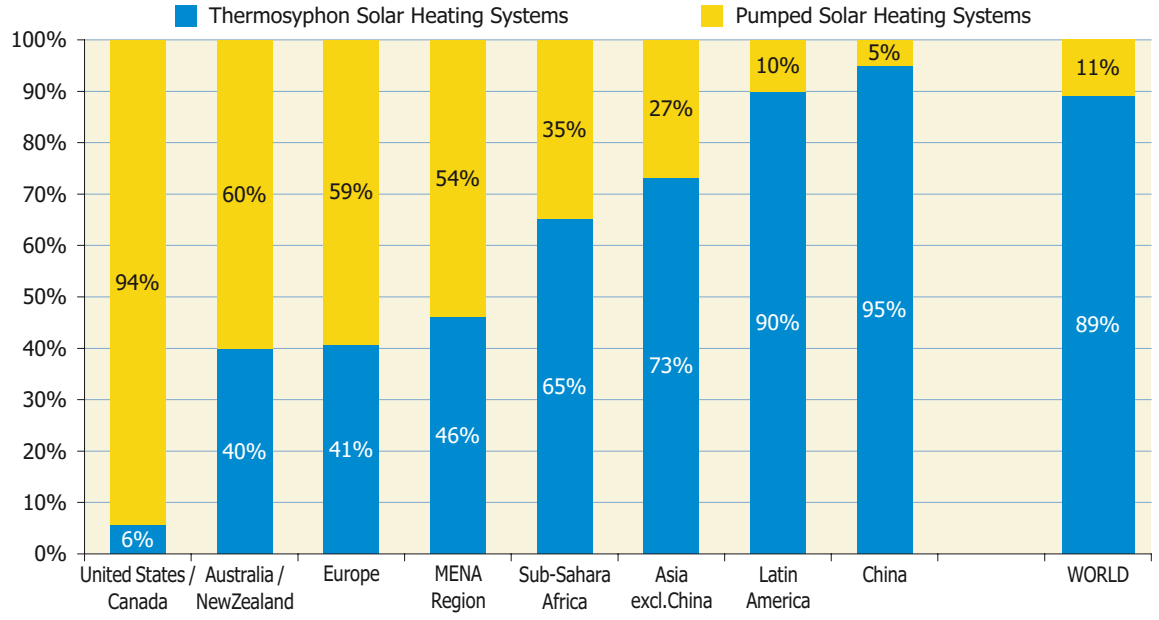
Worldwide, more than three quarters of all solar thermal systems installed are thermosiphon systems and the rest are pumped solar heating systems (see **Figure 39**). Similar to the distribution by type of solar thermal collector in total numbers the Chinese market influenced the overall figures most, and in 2011 89% of the newly installed systems were estimated to be thermosiphon systems while pumped systems only accounted for 11% (see **Figure 40**).

In general, thermosiphon systems are more common in warm climates such as in Africa, South America, South of Europe and the MENA region. In these regions thermosiphon systems are more often equipped with flat plate collectors while in China the typical thermosiphon system for domestic hot water preparation is equipped with evacuated tubes.



Asia excluding China: Japan, Korea South, Taiwan
Europe: EU 27, Albania, Norway, Switzerland, Turkey
Latin America: Brazil, Chile
MENA Region: Israel, Jordan, Lebanon, Tunisia
Sub-Sahara Africa: Namibia, South Africa

Figure 39: Distribution by type of system for the total installed glazed water collector capacity in operation by the end of 2011



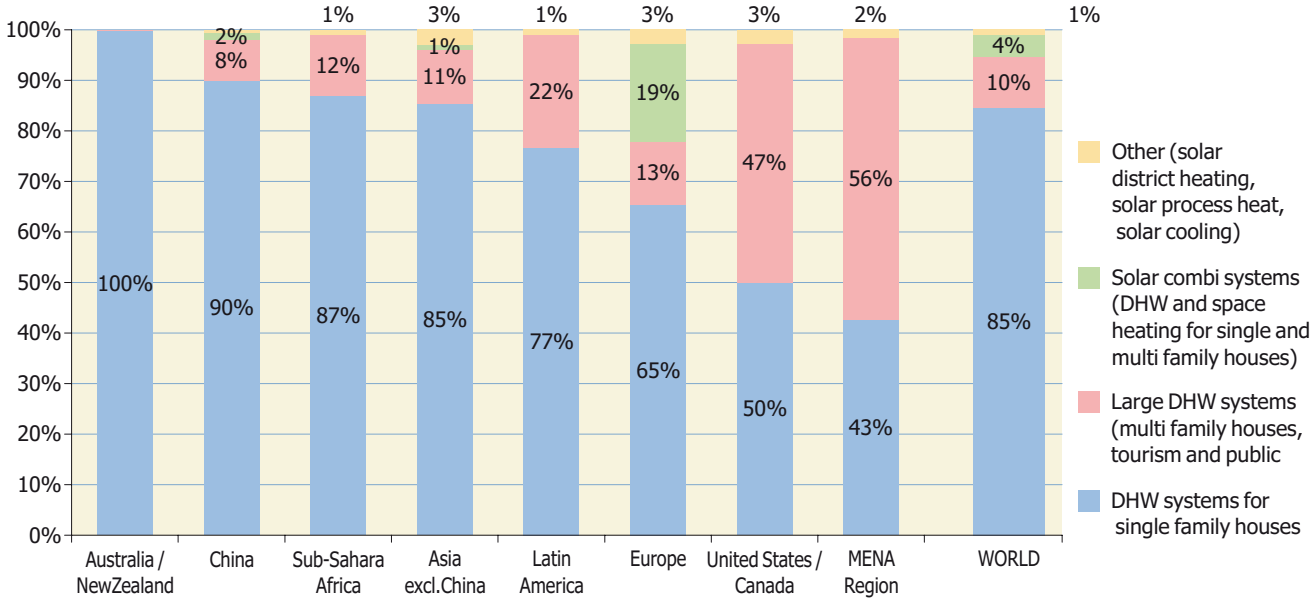
Asia excluding China: India, Japan, Korea South, Taiwan
Europe: EU 21, Albania, Norway, Turkey
Latin America: Brazil, Chile
MENA Region: Israel, Jordan, Lebanon, Tunisia
Sub-Sahara Africa: Mozambique, South Africa

Figure 40: Distribution by type of system for the newly installed glazed water collector capacity in 2011

6.3 Distribution by application of the total installed capacity[6]

The calculated number of water based solar thermal systems in operation was about 67 million by the end of 2011 (see **Table 5**). Hereof, 85% were used for domestic hot water preparation in single family houses and 10% were attached to larger domestic hot water consumers such as multifamily houses, hotels, hospitals, schools, etc. Around 4% of the worldwide installed capacity supplied heat for both domestic hot water and space heating (solar combi systems). The remaining systems amounted for round 1% or almost 3 million square meters of solar thermal collectors and delivered heat to district heating networks, industrial processes or thermally driven solar cooling applications (see **Figure 41**).

The market for solar combi systems is well established in some mature European markets such as in Germany and Austria accounting for more than 40% in these local markets (see **Figure 42**).



DHW	Domestic hot water
Asia excluding China:	India, Japan, Korea South, Taiwan
Latin America:	Brazil, Chile, Mexico
Europe:	EU 16, Albania, Macedonia, Switzerland, Turkey
MENA Region:	Israel, Jordan, Lebanon, Tunisia
Sub-Sahara Africa:	Namibia, South Africa

Figure 41: Distribution of solar thermal systems by application for the total installed glazed water collector capacity in operation by the end of 2011

6 In the MENA region (especially in Israel) but also in China, it is very common to equip multifamily houses with thermosiphon systems for domestic hot water preparation. A typical system is connected to one flat. By contrast in many European countries large pumped DHW systems in multifamily houses supply DHW or both DHW and space heating to the entire building. When interpreting the figures in **Chapter 6.3** this has to be considered.

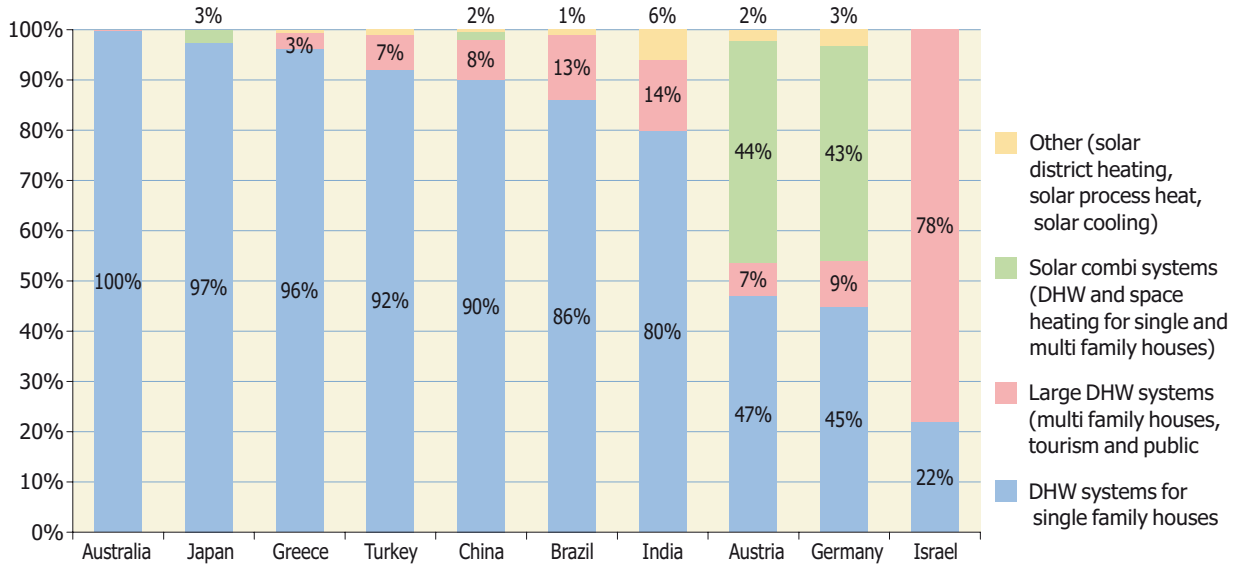


Figure 42: Distribution of solar thermal systems by application for the 10 leading markets of the total installed glazed water collector capacity in operation by the end of 2011

6.4 Distribution by application of the newly installed capacity in 2011[7]

In a world-wide context the share of large scale domestic hot water applications is increasing (10% of total installed capacity vs. 17% of new installed capacity in 2011) while the share of the dominating domestic hot water applications is decreasing: Share of domestic hot water systems was 85% of the total installed capacity in operation (see **Figure 41**) and 78% of the newly installed capacity in 2011 (see **Figure 43**).

A diversification of the market by types of applications can hardly be detected in a world-wide context but in several well-established markets in Europe, the market penetration of solar combi-systems, solar supported district heating networks, industrial applications and solar cooling systems is increasing.

From the top 10 European markets in terms of newly installed glazed water capacity in the year 2011 Germany, Spain, Italy and Austria have the most sophisticated markets for different solar thermal applications (see **Figure 44**). They include systems for hot water preparation, systems for space heating of single- and multifamily houses and hotels, large-scale systems for district heating as well as a growing number of systems for air conditioning, cooling and industrial applications.

In other markets specialization in the field of certain applications became obvious: In Denmark for example almost two thirds of the newly installed capacity in the year 2011 were large-scale solar thermal systems attached to district heating systems (also see **chapter 6.6**).

7 In the MENA region (especially in Israel) but also in China, it is very common to equip multifamily houses with thermosiphon systems for domestic hot water preparation. A typical system is connected to one flat. By contrast in many European countries large pumped DHW systems in multifamily houses supply DHW or both DHW and space heating to the entire building. When interpreting the figures in **Chapter 6.4** this has to be considered.

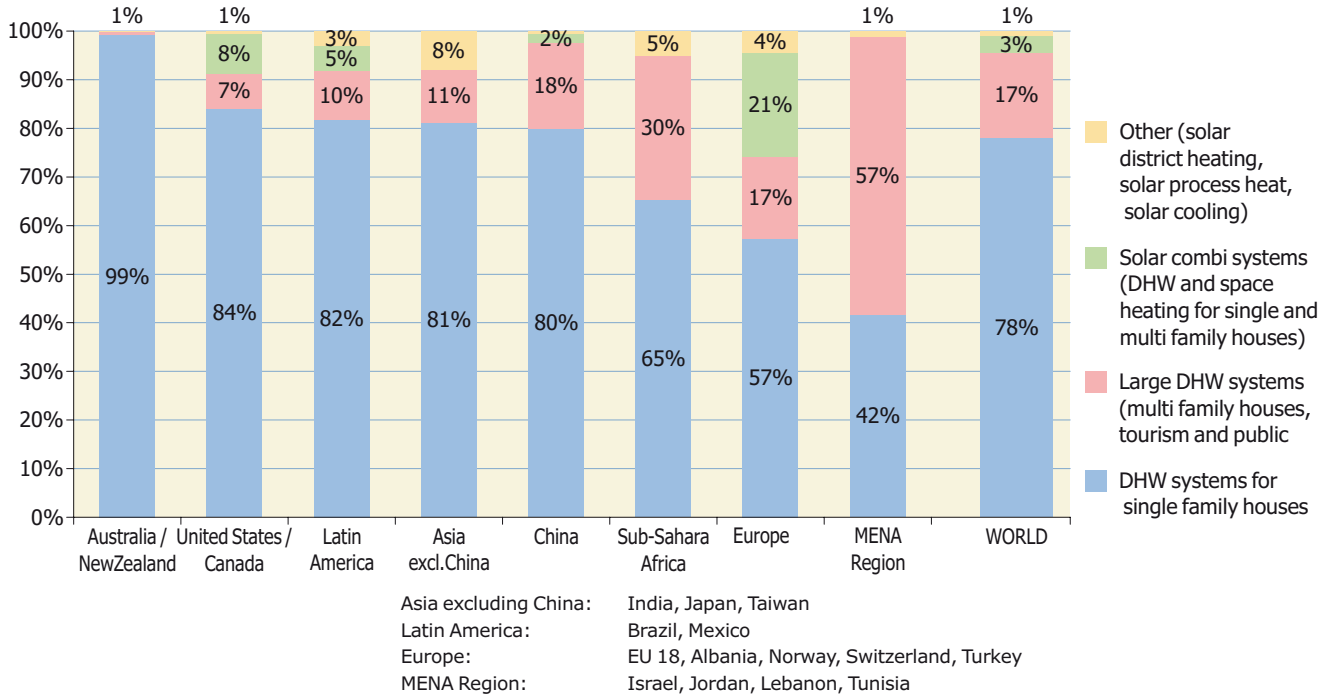


Figure 43: Distribution of solar thermal systems by application for the newly installed glazed water collector capacity of by economic region in 2011

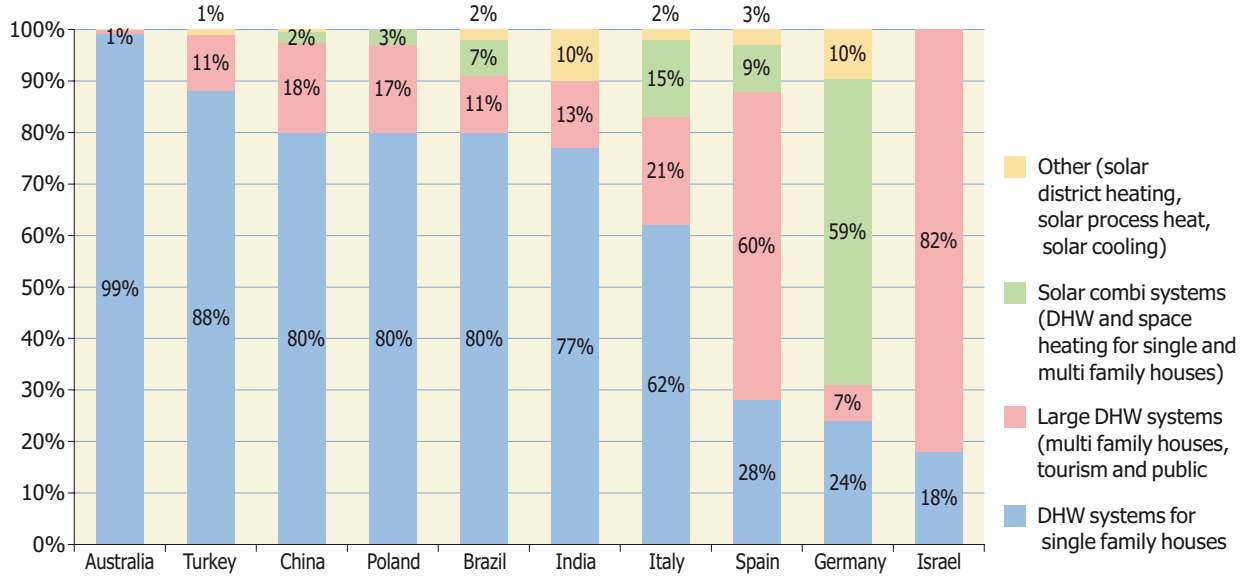


Figure 44: Distribution of solar thermal systems by application for the 10 leading markets of the newly installed glazed water collector capacity in 2011

6.5 Worldwide large-scale solar thermal applications

Megawatt-scale solar supported district heating systems and solar heating and cooling applications in the commercial and industrial sector have gained increasing interest all over the world in recent years and several ambitious projects have been successfully implemented in the past.

In July 2011, the world's largest solar thermal system connected to a district heating system was commissioned in Riyadh, Saudi Arabia. The solar thermal plant, with a total capacity of 25 MW_{th} (36.305 m²), is connected to a heating network for the supply of space heating and domestic hot water of a university campus[8]. Another successful solar supported heating network was implemented in Alberta, Canada. The Drake Landing community uses a 1.6 MW_{th} (2.293 m²) centralized solar thermal plant connected to a seasonal storage to supply more than 90% of the energy needed for space heating 52 detached energy efficient homes[9].

In Singapore, a large-scale solar thermal heating and cooling installation with a total capacity of 2.73 MW_{th} (3,900 m²) started operation in 2011 as well. The roof mounted solar thermal plant is connected to a 1.76 MW_{th} absorption chiller and supplies hot water and cooling to around 2,500 students, who live and study at a newly created 76,000 m^2 campus[10].

In summer 2013, the world´s largest collector field will be completed in Chile. The installation will cover a total of 39,300 m^2 with an annual output of 50 GWh. The solar thermal system is designed to cover more than 80% of the heat used to refine copper at the world´s largest copper mine[11].

Another large-scale process heat application, and the largest solar thermal system in the United States, was dedicated in April 2012 in North Carolina. The 5.5 MW_{th} (7,800 m²) solar thermal system equipped with flat plate collectors supplies hot water to a turkey processing plant, lessening the use of propane gas[12].

The largest solar process heat applications installed in China are connected to dyeing and weaving mill factories. A system with a thermal peak capacity of 9.1 MW_{th} (13,000 m^2) was constructed in the province of Zhejiang and two other projects of 10.5 MW_{th} (15,000 m^2) have been commissioned in the neighboring province of Jiangsu.

8 http://solarthermalworld.org/content/saudi-arabia-worlds-biggest-solar-thermal-plant-operation

9 http://www.dlsc.ca/

10 http://www.solid.at/

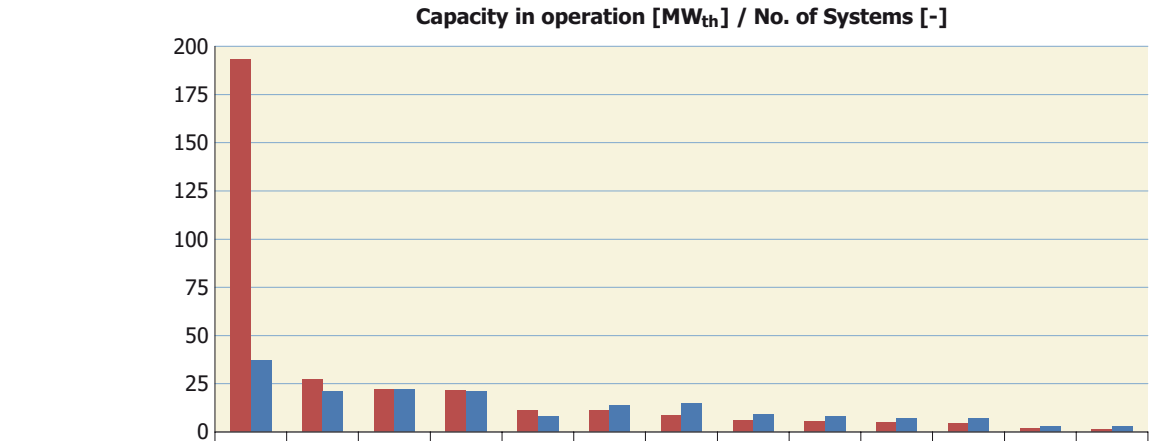
11 http://www.sunmark.com/

12 http://solarthermalworld.org/content/usa-contractor-runs-7804-m2-collector-system-prestage-foods-factory

6.6 European large-scale solar thermal applications

In the Scandinavian countries of Denmark and Sweden, but also in Germany, Austria, Spain and Greece large-scale solar thermal applications connected to local or district heating grids have been in use since the early 1980s.

By the end of 2012, 175 large scale solar thermal systems >350 kW_{th} (500 m²) connected to heating networks were in operation in Europe. The total installed capacity of those systems amounted to 319 MW_{th} (456,000 m²). The average system size was 1.8 MW_{th} or 2,600 m². In summary, 96 systems larger than 0.7 MW_{th} or 1,000 m² were reported.



	DK	DE	AT	SE	NL	GR	ES	CH	PL	Oth.	IT	FR	CZ
Capacity [MW_{th}]	193.0	27.3	22.0	21.8	11.4	11.0	8.5	5.8	5.7	5.2	4.5	2.0	1.3
No. of Systems [-]	37	21	22	21	8	14	15	9	8	7	7	3	3

Figure 45: European large-scale solar heating systems by the end of 2012
(Source: Jan-Olof Dalenbäck - Chalmers University of Technology)

By end of 2012, the 10 largest European solar thermal systems were installed in Denmark: Marstal (33,300 m², extended in 2012), Braedstrup (18,612 m²), Vojens (17,500 m²), Gråsten (17,200 m²), Ringkøbing (15,000 m²), Veggerløse (12,075 m²), Sæby (11,921 m²), Gram (10,073 m²), Jægerspris (10,000 m²) and Oksbøl (10,000 m²).

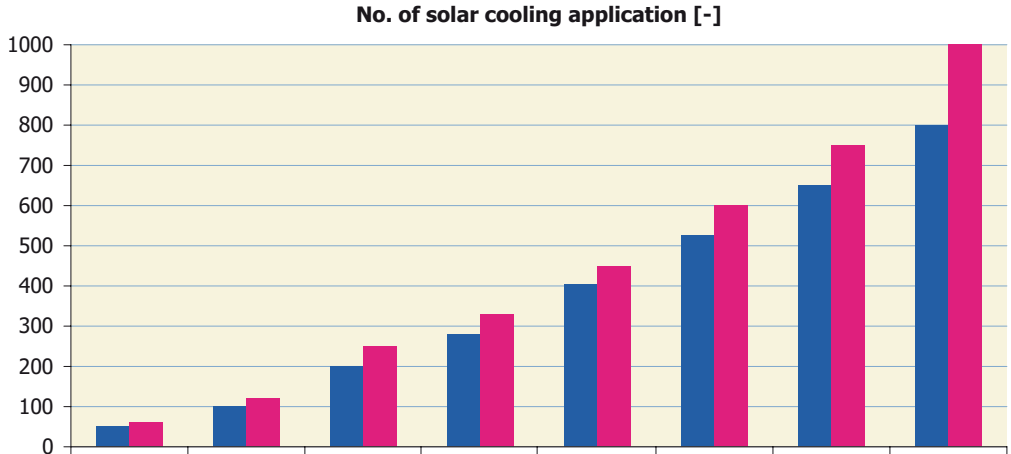
The market for solar supported district heating networks in Denmark has been booming for several years and is driven by high taxes for fossil fuels and an energy supply system that is characterized by decentralization on the one hand and a high share of wind energy for electricity production on the other hand. This together with the liberalized market mechanisms for electricity in Europe and low solar thermal system prices for large-scale systems make solar thermal heat in Denmark even competitive against natural gas driven combined heat and power systems in many cases[13].

13 More information about the (Danish) Solar Heating success story in Europe can be found here:
http://www.solar-district-heating.eu/
http://www.solvarmedata.dk/side5696.html

6.7 Market for solar air conditioning and cooling applications

Solar cooling applications convert the energy from the sun into cold by means of driving a thermal cooling machine with thermal energy generated with solar thermal collectors.

By the end of 2012 an estimated 1,000 solar cooling systems were installed worldwide and the market grew steadily between 40 and 70% per year in the past eight years. Around 80% of the solar cooling installations world-wide can be found in Europe, most notably in Spain, Germany and Italy and the majority of these systems are equipped with flat plate or evacuated tube collectors. By contrast some examples for thermal cooling machines driven by concentrated solar thermal energy (with concentrating solar thermal collectors such as parabolic through or Fresnel collectors) were reported from India, Australia and Turkey[14].



	2004	2006	2007	2008	2009	2010	2011	2012
Europe	50	100	200	280	405	525	650	800
World	60	120	250	330	450	600	750	1000

Figure 46: Market development of small to large-scale solar air conditioning and cooling systems
(Source: Solem Consulting / Green Chiller)

The overall number of systems installed to date indicates that solar cooling is still a niche market, but one which is developing. Since 2007, a cost reduction of about 50% was realized within the last six years, because of the further standardization of the solar cooling kits.

14 Jakob U. (2013): Status and Perspective of Solar Cooling outside of Australia; Australian Solar Cooling 2013 Conference, Sydney 2013

7 Appendix

7.1 Methodological approach for the energy calculation

In order to obtain the energy yield of solar thermal systems, the oil equivalent saved and the CO_2 emissions avoided, the following procedure was used:

- Only water collectors were used in the calculations (unglazed, flat-plate and evacuated tube collectors). Air collectors were not included.
- For each country, the cumulated water collector area was allocated to the following applications:

Solar thermal systems for swimming pool heating with unglazed water collectors,
Solar domestic hot water systems for single-family houses,
Solar domestic hot water systems for multifamily houses including the tourism sector as well as the public sector (to simplify the analysis solar district heating systems, solar process heat and solar cooling applications were also allocated here), and
Solar combi systems[15] for domestic hot water and space heating for single- and multifamily houses.

- Reference systems were defined for each country and for each type of application.
- The number of systems per country was determined from the share of collector area for each application and the collector area defined for the reference system.

Reference collectors and a reference climate were determined for each country apart from the reference systems. On the basis of these reference conditions, simulations were performed with the simulation program T-Sol [T-Sol, Version 4.5 Expert, Valentin Energiesoftware, www.valentin.de] to obtain the solar yields.

Finally, the annual collector yield per square meter of collector area, depending on the application, the local climatic conditions and the plant dimensions (high or low solar fraction) were calculated for each country and each system.

The amount of energy saved considering the utilization rate of the auxiliary heating system[16] is expressed in tons of oil equivalent (toe): 1 toe = 11,630 kWh.

The CO_2 emissions avoided by the different solar thermal applications were ascertained from the energy savings (oil equivalent): 1 t oe = 3.1 t CO_2[17]

To obtain an exact statement about the CO_2 emissions avoided, the substituted energy medium would have to be ascertained for each country. Since this could only be done in a very detailed survey, which goes beyond the scope of this report, the energy savings and the CO_2 emissions avoided therefore relate to fuel oil. It is obvious that not all solar thermal systems just replace systems running on oil. This represents a simplification since gas, coal, biomass or electricity can be used as the energy source for the auxiliary heating system instead of oil.

The following tables describe the key data of the reference systems in the different countries, the location of the reference climate used and the share of the total collector area in use for the respective application. Furthermore, a hydraulic scheme is shown for each reference system.

15 Solar combi-systems are solar heating installations that provide both space heating and domestic hot water.

16 For the swimming pool applications a utilization rate of 0.9 is assumed in the calculation and for all other applications an average utilization rate of 0.8 is used.

17 Only direct emissions for fuel oil are considered referring to GEMIS database, version 4.6.

7.1.1 Solar thermal systems for swimming pool heating with unglazed collectors

The information in **Table 8** refers to the total capacity in operation of unglazed water collectors by the end of 2011 for each country.

Country	Reference climate	Collector area (gross area) for single system [m²]	Total collector area unglazed 2011 [m²]	Total number of systems unglazed 2011 [-]
Australia	Sydney	34	3,900,000	114,706
Austria	Graz	200	586,191	2,931
Belgium	Brussels	200	45,000	225
Brazil	Brasília	200	1,789,227	8,946
Canada	Montreal	200	719,364	3,597
Cyprus	Nicosia	200	2,038	10
Czech Republic	Prague	200	418,000	2,090
Denmark	Copenhagen	200	19,695	98
Finland	Helsinki	200	11,308	57
France	Paris	200	101,471	507
Germany	Wurzburg	200	611,530	3,058
Hungary	Budapest	200	11,520	58
Ireland	Dublin	200	404	2
Israel	Jerusalem	200	30,617	153
Italy	Bologna	200	42,015	210
Jordan	Amman	200	5,940	30
Mexico	Mexico City	200	722,008	3,610
Netherlands	Amsterdam	200	410,239	2,051
New Zealand	Wellington	200	7,025	35
Norway	Oslo	200	2,090	10
Portugal	Lisbon	200	1,946	10
South Africa	Johannesburg	200	817,803	4,089
Spain	Madrid	200	130,600	653
Sweden	Gothenburg	200	130,000	650
Switzerland	Zürich	200	212,260	1,061
Taiwan	Taipei	200	85	0
United States	LA, Indianapolis	200	19,980,762	99,904
TOTAL			30,709,138	248,752

Countries not listed in this table means that there was no reliable database for unglazed collectors available

Table 8: Solar thermal swimming pool heating reference systems with unglazed water collectors and the total collector area in operation by the end of 2011

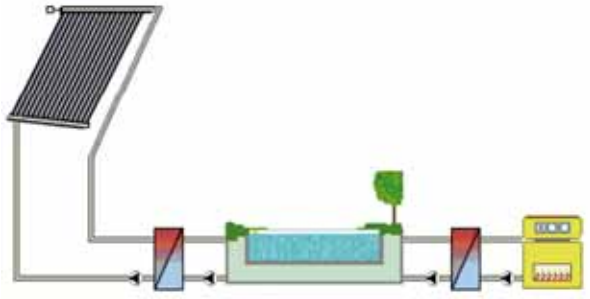


Figure 47: Hydraulic scheme of the swimming pool reference system

7.1.2 Solar domestic hot water systems for single-family houses

The information in **Table 9** refers to the total capacity in operation of glazed water collectors (FPC + ETC) by the end of 2011 for each country. The market share of the new installed capacity in the year 2011 can differ significantly from the total market share.

Country	Reference climate	Collector area (gross area) for single sys. [m²]	Total collector area-SFH 2011 [m²]	Share of DHW-SFH [%]	Total number of systems SFH 2011 [-]	Type of system [-]
Albania	Tirana	2.5	26,436	29.1%	10,574	TS
Australia	Sydney	3.5	2,682,624	99.8%	766,464	PS
Austria	Graz	6.0	1,960,738	47.0%	326,790	PS
Barbados	Grantley Adams	4.0	131,690	100.0%	32,923	TS
Belgium	Brussels	4.0	323,283	100.0%	80,821	PDS
Brazil	Brasília	4.0	4,602,605	86.0%	1,150,651	TS
Bulgaria	Sofia	4.0	41,003	71.3%	10,251	PS
Canada	Montreal	6.0	41,619	50.0%	6,936	PS
Chile	Santiago de Chile	4.0	17,976	46.0%	4,494	PS
China	Shanghai	4.0	195,660,000	90.0%	48,915,000	TS
Cyprus	Nicosia	4.0	752,761	86.9%	188,190	TS
Czech Republic	Prague	4.7	154,940	41.4%	32,966	PS
Denmark	Copenhagen	4.0	323,901	55.5%	80,975	PS
Estonia	Tallinn	4.0	4,720	100.0%	1,180	PS
Finland	Helsinki	4.0	32,873	100.0%	8,218	PS
France	Paris	3.2	810,855	40.0%	253,392	PS
Germany	Wurzburg	6.0	6,609,600	45.0%	1,101,600	PS
Greece	Athens	2.5	3,969,486	96.3%	1,587,794	TS
Hungary	Budapest	6.0	88,024	54.0%	14,671	PS
India	New-Delhi	4.0	3,824,640	80.0%	956,160	TS
Ireland	Dublin	4.0	150,213	90.0%	37,553	PS
Israel	Jerusalem	3.0	931,590	22.0%	310,530	TS
Italy	Bologna	4.0	2,950,080	100.0%	737,520	PS
Japan	Tokyo	4.0	4,551,758	97.3%	1,137,940	TS
Jordan	Amman	4.6	839,886	80.0%	182,584	TS
Korea, South	Seoul	4.0	855,009	54.0%	213,752	PS
Latvia	Riga	4.0	3,740	100.0%	935	PS
Lebanon	Beirut	4.0	375,360	85.0%	93,840	TS
Lithuania	Vilnius	4.0	4,200	100.0%	1,050	PS
Luxembourg	Luxembourg	4.0	35,850	100.0%	8,963	PS
Macedonia	Skopje	4.0	12,100	47.0%	3,025	PS
Malta	Luqa	4.0	44,433	100.0%	11,108	PS
Mexico	Mexico City	4.0	282,203	28.0%	70,551	PS
Morocco	Rabat	4.0	341,260	100.0%	85,315	TS
Mozambique	Maputo	4.0	130	100.0%	32	PS
Namibia	Windhoek	4.0	9,903	45.0%	2,476	TS
Netherlands	Amsterdam	2.8	337,333	78.0%	120,476	PDS
New Zealand	Wellington	4.0	152,620	100.0%	38,155	PS
Norway	Oslo	6.0	1,131	6.0%	188	PS
Poland	Warsaw	6.0	611,184	70.0%	101,864	PS
Portugal	Lisbon	4.0	526,178	60.0%	131,544	PS
Romania	Bucharest	4.0	105,200	100.0%	26,300	PS
Slovakia	Bratislava	6.0	142,250	100.0%	23,708	PS
Slovenia	Ljubljana	6.0	145,499	83.0%	24,250	PS
South Africa	Johannesburg	4.0	377,468	89.0%	94,367	TS
Spain	Madrid	4.0	859,634	33.0%	214,908	PS
Sweden	Gothenburg	4.0	31,600	10.0%	7,900	PS
Switzerland	Zürich	5.7	620,152	67.0%	108,799	PS
Taiwan	Taipei	4.8	2,037,033	94.4%	424,382	TS
Thailand	Bangkok	4.0	91,392	100.0%	22,848	TS
Tunisia	Tunis	2.8	529,482	98.0%	189,101	TS
Turkey	Antalya	4.0	13,357,812	92.0%	3,339,453	TS
United Kingdom	London	4.0	656,998	100.0%	164,250	PS
United States	LA, Indianapolis	6.0	2,567,416	100.0%	427,903	PS
Uruguay	Montevideo	4.0	12,571	100.0%	3,143	PS
Zimbabwe	Harare	4.0	18,196	100.0%	4,549	PS
TOTAL			256,628,635		63,895,312	

DHW-SFH: domestic hot water systems for single-family houses
TS thermosiphon system
PS: pumped system
PDS: pumped drain back system Auxiliary heating device oil boiler

Table 9: Domestic hot water reference systems for single family houses and the total collector area in operation by the end of 2011

Figure 48 shows the hydraulic scheme used for the energy calculation for all pumped solar thermal systems and **Figure 49** refers to the thermosiphon systems.

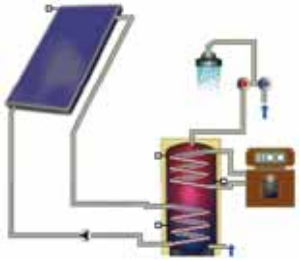


Figure 48: Hydraulic scheme of the DHW pumped reference system

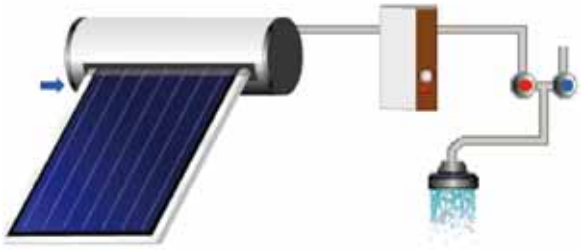


Figure 49: Hydraulic scheme of the DHW thermo-siphon reference system

For the Chinese thermosiphon systems the reference system above was used, but instead of a flat plate collector as shown in **Figure 49** a representative Chinese vacuum tube collector was used for the simulation.

7.1.3 Solar domestic hot water systems for multifamily houses, hotels and district heating

The information in **Table 10** refers to the total capacity in operation of glazed water collectors (FPC + ETC) by the end of 2011 for each country. The market share of the new installed capacity in the year 2011 can differ significantly from the total market share.

Country	Reference climate	Collector area (gross area) for single sys. [m²]	Total collector area-MFH 2011 [m²]	Share of DHW-MFH [%]	Total number of systems SFH 2011 [-]	Type of System [-]
Albania	Tirana	50.0	64,285	70.9%	1,286	PS
Australia	Sydney	50.0	5,376	0.2%	108	PS
Austria	Graz	50.0	365,702	8.8%	7,314	PS
Brazil	Brasília	50.0	749,261	14.0%	14,985	PS
Bulgaria	Sofia	50.0	16,533	28.7%	331	PS
Canada	Montreal	50.0	41,619	50.0%	832	PS
Chile	Santiago de Chile	50.0	21,103	54.0%	422	PS
China	Shanghai	50.0	18,479,000	8.5%	369,580	PS
Cyprus	Nicosia	50.0	99,617	11.5%	1,992	PS
Czech Republic	Prague	42.4	79,491	21.2%	1,875	PS
Denmark	Copenhagen	50.0	253,868	43.5%	5,077	PS
France	Paris	20.0	1,054,112	52.0%	52,706	PS
Germany	Wurzburg	50.0	1,791,936	12.2%	35,839	PS
Greece	Athens	50.0	148,392	3.6%	2,968	PS
Hungary	Budapest	50.0	41,567	25.5%	831	PS
India	New-Delhi	50.0	956,160	20.0%	19,123	PS
Ireland	Dublin	50.0	5,007	3.0%	100	PS
Israel	Jerusalem	3.0	3,302,908	78.0%	1,100,969	PS
Japan	Tokyo	50.0	6,549	0.1%	131	PS
Jordan	Amman	50.0	209,972	20.0%	4,199	PS
Korea, South	Seoul	50.0	728,341	46.0%	14,567	PS
Lebanon	Beirut	50.0	66,240	15.0%	1,325	PS
Macedonia	Skopje	50.0	13,644	53.0%	273	PS
Mexico	Mexico City	50.0	725,665	72.0%	14,513	PS
Namibia	Windhoek	50.0	12,103	55.0%	242	PS
Netherlands	Amsterdam	50.0	73,521	17.0%	1,470	PS
Norway	Oslo	50.0	5,464	29.0%	109	PS
Poland	Warsaw	50.0	218,280	25.0%	4,366	PS
Portugal	Lisbon	40.0	350,785	40.0%	8,770	PS
Slovenia	Ljubljana	50.0	3,506	2.0%	70	PS
South Africa	Johannesburg	50.0	46,653	11.0%	933	PS
Spain	Madrid	50.0	1,510,871	58.0%	30,217	PS
Sweden	Gothenburg	50.0	47,400	15.0%	948	PS
Switzerland	Zürich	20.0	74,048	8.0%	3,702	PS
Taiwan	Taipei	33.8	120,175	5.6%	3,555	PS
Tunisia	Tunis	50.0	10,806	2.0%	216	PS
Turkey	Antalya	50.0	1,161,549	8.0%	23,231	PS
TOTAL			32,861,511		1,729,177	

DHW-MFH: domestic hot water systems for multifamily houses PS: pumped system

Table 10: Domestic hot water reference systems for multifamily houses, hotels and district heating and the total collector area in operation in 2011

Figure 50: Hydraulic scheme of the DHW system for multifamily houses

7.1.4 Solar combi-systems for domestic hot water and space heating for single- family houses

The information in **Table 11** refers to the total capacity in operation of glazed water collectors (FPC + ETC) by the end of 2011 for each country. The market share of the new installed capacity in the year 2011 can differ significantly from the total market share. The reference system is designed for a single-family house with 140 m² heated floor area.

Country	Reference climate	Collector area (gross area) for single sys. [m²]	Total collector area-combi sys. 2011 [m²]	Share of combi systems [%]	Total number of systems SFH 2011 [-]	Type of system [-]
Austria	Graz	14.0	1,849,586	44.3%	132,113	PS
China	Shanghai	12.0	3,261,000	1.5%	271,750	PS
Cyprus	Nicosia	12.0	13,860	1.6%	1,155	PS
Czech Republic	Prague	8.4	140,238	37.4%	16,695	PS
Denmark	Copenhagen	12.0	5,836	1.0%	486	PS
France	Paris	11.0	162,171	8.0%	14,743	PS
Germany	Wurzburg	12.0	6,286,464	42.8%	523,872	PS
Greece	Athens	12.0	4,122	0.1%	344	PS
Hungary	Budapest	15.0	33,417	20.5%	2,228	PS
Ireland	Dublin	12.0	11,683	7.0%	974	PS
Japan	Tokyo	12.0	119,758	2.6%	9,980	PS
Netherlands	Amsterdam	6.0	21,624	5.0%	3,604	PS
Norway	Oslo	20.0	12,248	65.0%	612	PS
Poland	Warsaw	12.0	43,656	5.0%	3,638	PS
Slovenia	Ljubljana	12.0	26,295	15.0%	2,191	PS
Spain	Madrid	10.0	234,446	9.0%	23,445	PS
Sweden	Gothenburg	10.0	237,000	75.0%	23,700	PS
Switzerland	Zürich	11.0	231,400	25.0%	21,036	PS
TOTAL			12,694,803		1,052,566	

Combi-system: system for the supply of domestic hot water and space heating
PS: pumped system

Table 11: Solar combi reference systems for single and multifamily houses and the total collector area in operation in 2011

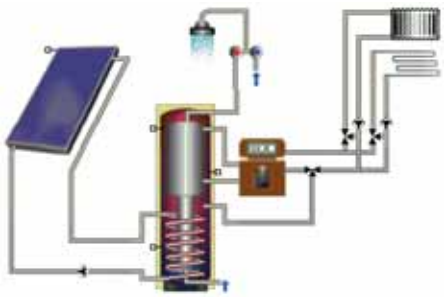


Figure 51: Hydraulic scheme of the solar combi reference system

7.2 Reference collectors

7.2.1 Data of the reference unglazed water collector for swimming pool heating

$\eta = 0.85$ $a_1 = 20$ [W/m²K] $a_2 = 0.1$ [W/m²·K²]

7.2.2 Data of the reference collector for all other applications except for China

$\eta = 0.8$ $a_1 = 3.69$ [W/m²K] $a_2 = 0.007$ [W/m²·K²]

7.2.3 Data of the Chinese reference vacuum tube collector

$\eta = 0.74$ $a_1 = 2.5$ [W/m²K] $a_2 = 0.013$ [W/m²·K²]

7.3 Reference climates

No.	Country	Reference climate	Horizontal irradiation	Inclined irradiation	Avg. Outside air temp.
			[kWh/m²·a]	[kWh/m²·a]	[°C]
1	Albania	Tirana	1,604	1,835	13.5
2	Australia	Sydney	1,674	1,841	18.1
3	Austria	Graz	1,126	1,280	9.2
4	Barbados	Grantley Adams	2,016	2,048	27.4
5	Belgium	Brussels	971	1,095	10.0
6	Brazil	Brasília	1,793	1,838	22.0
7	Bulgaria	Sofia	1,188	1,304	10.1
8	Canada	Montreal	1,351	1,568	6.9
9	Chile	Santiago de Chile	1,753	1,850	14.5
10	China	Shanghai	1,282	1,343	17.1
11	Cyprus	Nicosia	1,886	2,098	19.9
12	Czech Republic	Prague	998	1,111	7.9
13	Denmark	Copenhagen	989	1,164	8.1
14	Estonia	Tallinn	960	1,126	5.3
15	Finland	Helsinki	948	1,134	4.6
16	France	Paris	1,112	1,246	11.0
17	Germany	Wurzburg	1,091	1,225	9.5
18	Greece	Athens	1,585	1,744	18.5
19	Hungary	Budapest	1,199	1,346	11.0
20	India	New-Delhi	1,961	2,275	24.7
21	Ireland	Dublin	949	1,091	9.5
22	Israel	Jerusalem	2,198	2,400	17.3
23	Italy	Bologna	1,419	1,592	14.3
24	Japan	Tokyo	1,175	1,287	16.7
25	Jordan	Amman	2,145	2,341	17.9
26	Korea, South	Seoul	1,161	1,280	12.7
27	Latvia	Riga	991	1,187	6.3
28	Lebanon	Beirut	1,935	2,132	
29	Lithuania	Vilnius	1,001	1,161	6.2
30	Luxembourg	Luxembourg	1,037	1,158	8.4
31	Macedonia	Skopje	1,381	1,521	12.5
32	Malta	Luqa	1,902	2,115	18.7
33	Mexico	Mexico City	1,706	1,759	16.6
34	Morocco	Rabat	2,011	2,281	
35	Mozambique	Maputo	1,927	2,135	
36	Namibia	Windhoek	2,363	2,499	21.0
37	Netherlands	Amsterdam	999	1,131	10.0
38	New Zealand	Wellington	1,401	1,542	13.6
39	Norway	Oslo	971	1,208	5.8
40	Poland	Warsaw	1,024	1,156	8.1
41	Portugal	Lisbon	1,686	1,875	17.4
42	Romania	Bucharest	1,324	1,473	10.6
43	Slovakia	Bratislava	1,214	1,374	10.3
44	Slovenia	Ljubljana	1,115	1,231	9.8
45	South Africa	Johannesburg	2,075	2,232	15.6
46	Spain	Madrid	1,644	1,844	15.5
47	Sweden	Gothenburg	934	1,105	7.2
48	Switzerland	Zürich	1,094	1,218	9.6
49	Taiwan	Taipei	1,372	1,398	20.8
50	Thailand	Bangkok	1,765	1,898	29.1
51	Tunisia	Tunis	1,808	2,038	19.3
52	Turkey	Antalya	1,795	1,958	18.4
53	United Kingdom	London	943	1,062	12.0
54	United States	LA, Indianapolis	1,646	1,816	14.3
55	Uruguay	Montevideo	1,534	1,647	15.9
56	Zimbabwe	Harare	2,017	2,087	18.9

Source: T-Sol expert version 4.5 and Meteonorm version 6.1.

Table 12: Reference climates for the 56 countries surveyed

7.4 Population data

No	Country	2011	Region code
1	Albania	2,994,667	6
2	Australia	21,766,711	3
3	Austria	8,217,280	6
4	Barbados	286,705	4
5	Belgium	10,431,477	6
6	Brazil	203,429,773	4
7	Bulgaria	7,093,635	6
8	Canada	34,030,589	8
9	Chile	16,888,760	4
10	China	1,336,718,015	5
11	Cyprus	1,120,489	6
12	Czech Republic	10,190,213	6
13	Denmark	5,529,888	6
14	Estonia	1,282,963	6
15	Finland	5,259,250	6
16	France	65,102,719	6
17	Germany	81,471,834	6
18	Greece	10,760,136	6
19	Hungary	9,976,062	6
20	India	1,189,172,906	2
21	Ireland	4,670,976	6
22	Israel	7,473,052	7
23	Italy	61,016,804	6
24	Japan	127,469,543	2
25	Jordan	6,508,271	7
26	Korea, South	48,754,657	2
27	Latvia	2,204,708	6
28	Lebanon	4,143,101	7
29	Lithuania	3,535,547	6
30	Luxembourg	503,302	6
31	Macedonia	2,077,328	6
32	Malta	408,333	6
33	Mexico	113,724,226	4
34	Morocco	31,968,361	7
35	Mozambique	22,948,858	1
36	Namibia	2,147,585	1
37	Netherlands	16,653,734	6
38	New Zealand	4,290,347	3
39	Norway	4,691,849	6
40	Poland	38,441,588	6
41	Portugal	10,760,305	6
42	Romania	21,904,551	6
43	Slovakia	5,477,038	6
44	Slovenia	2,000,092	6
45	South Africa	49,004,031	1
46	Spain	46,754,784	6
47	Sweden	9,088,728	6
48	Switzerland	7,639,961	6
49	Taiwan	23,071,779	2
50	Thailand	66,720,153	2
51	Tunisia	10,629,186	7
52	Turkey	78,785,548	6
53	United Kingdom	62,698,362	6
54	United States	311,050,977	8
55	Uruguay	3,308,535	4
56	Zimbabwe	12,084,304	1
Σ Solar Thermal World Statistics		4,246,334,576	61.1%
Σ Inhabitants world		6,946,043,989	100.0%

Data source: International Data Base of the U.S. Census Bureau http://www.census.gov/ipc/www/idb/country.php

Table 13: Inhabitants by the end of 2011 of the 56 surveyed countries in alphabetical order

Region Code / Region		Σ Inhabitants	Share
1	Sub-Sahara Africa	86,184,778	2.0%
2	Asia excl. China	1,455,189,038	34.3%
3	Australia / New Zealand	26,057,058	0.6%
4	Latin America	337,637,999	8.0%
5	China	1,336,718,015	31.5%
6	Europe	598,744,151	14.1%
7	MENA Region	60,721,971	1.4%
8	United States / Canada	345,081,566	8.1%
TOTAL		4,246,334,576	100.0%

Data source: International Data Base of the U.S. Census Bureau
http://www.census.gov/ipc/www/idb/country.php

Asia excluding China: India, Japan, Korea South, Taiwan, Thailand
Latin America: (Barbados,) Brazil, Chile, Mexico, Uruguay
Europe: EU 27, Albania, Macedonia, Norway, Switzerland, Turkey
MENA Region: Israel, Jordan, Lebanon, Morocco, Tunisia
Sub-Saharan Africa: Mozambique, Namibia, South Africa, Zimbabwe

Table 14: Inhabitants per economic region by the end of 2011

7.5 Market data of the previous years

The data presented in **Chapters 3 through 5** were originally collected in square meters. Through an agreement of international experts the collector areas of these solar thermal applications have been converted and are shown in installed capacity as well.

Making the installed capacity of solar thermal collectors comparable with that of other energy sources, solar thermal experts from seven countries agreed upon a methodology to convert installed collector area into solar thermal capacity.

The methodology was developed during a meeting with IEA SHC Programme officials and major solar thermal trade associations in Gleisdorf, Austria in September 2004. The represented associations from Austria, Canada, Germany, the Netherlands, Sweden and the United States as well as the European Solar Thermal Industry Federation (ESTIF) and the IEA SHC Programme agreed to use a factor of 0.7 kW_{th} /m^2 to derive the nominal capacity from the area of installed collectors.

In order to ensure consistency of the calculations within this report the following tables provide data from the previous years. If necessary the numbers have been revised in 2013 compared to the data originally published in earlier editions of this report due to changes in methodology or the origin of the data for each country.

In the following **Table 15**, **Table 16** and **Table 17** these countries are highlighted accordingly and in **Chapter 7.6** (References) the new data source is cited.

Country	Water Collectors			Air Collectors		TOTAL [m²]
	unglazed	FPC	ETC	unglazed	glazed	
Albania		10,035	116			10,151
Australia	620,000	483,019	36,356			1,139,375
Austria	8,342	348,408	7,759	378		364,886
Barbados		7,051				7,051
Belgium		45,500	5,200			50,700
Brazil	407,051	391,089				798,140
Bulgaria		8,000				8,000
Canada	73,026	9,186	1,083	45,331	792	129,418
Chile		7,516				7,516
China		2,000,000	40,000,000			42,000,000
Cyprus		53,000	2,000			55,000
Czech Republic		30,000	10,000			40,000
Denmark		52,000	2,500			54,500
Estonia		60	390			450
Finland		2,800	1,200			4,000
France (mainland)*		254,000	11,000			265,000
Germany		1,430,000	185,000			1,615,000
Greece		204,500	1,500			206,000
Hungary	3,000	14,000	8,000	500	200	25,700
India		376,505	173,495			550,000
Ireland		26,383	16,131			42,514
Israel	2,950	291,900				294,850
Italy		415,625	59,375			475,000
Japan		139,821	1,682		12,110	153,613
Jordan		30,435	9,091			39,526
Korea, South		96,951				96,951
Latvia		40	140			180
Lebanon		18,967	28,451			47,418
Lithuania		50	150			200
Luxembourg		3,650	1,050			4,700
Macedonia		3,002			4	3,006
Malta		4,386	4,122			8,508
Mexico	75,501	82,002	70,430		5,403	233,336
Morocco		40,968				40,968
Mozambique**						
Namibia		3,979	244			4,224
Netherlands	28,814	45,260				74,074
New Zealand	481	24,614				25,095
Norway	270	1,680	210			2,160
Poland		106,494	37,814			144,308
Portugal	1,500	130,000	13,500			145,000
Romania		11,000	9,000			20,000
Slovakia		11,600	1,900			13,500
Slovenia		17,000	5,000			22,000
South Africa	50,000	34,710	4,290			89,000
Spain	11,000	375,000	16,000			402,000
Sweden	24,993	13,126	8,183			46,302
Switzerland	12,057	135,355	10,285	11,000		168,697
Taiwan		104,214	12,305			116,519
Thailand		14,650				14,650
Tunisia		70,188	14,812			85,000
Turkey		1,633,050				1,633,050
United Kingdom		51,975	37,125			89,100
United States	856,517	159,471	26,728		1,793	1,044,509
Uruguay		7,235				7,235
Zimbabwe		217	138			355
TOTAL	2,175,502	9,831,667	40,833,754	57,209	20,302	52,918,434

* revised due to new / adapted database in 2013

** no available data for the year 2009

Table 15: Newly installed collector area in 2009 [m²/a]

Country	Water Collectors			Air Collectors		TOTAL [m²]
	unglazed	glazed	evacuated tube	unglazed	glazed	
Albania		7,480	82			7,562
Australia	680,000	362,351	35,837			1,078,188
Austria	5,539	268,093	11,805	350		285,787
Barbados**						
Belgium		31,306	6,995			38,301
Brazil	493,725	472,956				966,681
Bulgaria		7,750	650			8,400
Canada	84,690	11,481	11,493	89,560	2,267	199,491
Chile		7,937				7,937
China		3,000,000	46,000,000			49,000,000
Cyprus	109	32,931	1,782			34,822
Czech Republic	53,000	73,898	17,719			144,617
Denmark		61,944	400			62,344
Estonia		100	400			500
Finland		4,000	2,000			6,000
France (main-land)*		247,000	9,000			256,000
Germany		1,035,000	115,000			1,150,000
Greece		212,500	1,500			214,000
Hungary	2,400	14,700	6,300	300	150	23,850
India		608,436	280,369			888,805
Ireland		17,472	13,109			30,581
Israel		316,000				316,000
Italy		427,500	62,500			490,000
Japan		146,866	4,794		11,850	163,511
Jordan	5,940	79,621	12,654			98,215
Korea, South		69,805				69,805
Latvia		100	100			200
Lebanon**						
Lithuania		50	150			200
Luxembourg		3,500	1,000			4,500
Macedonia**						
Malta		1,759	1,101			2,860
Mexico	90,000	95,000	85,000		2,580	272,580
Morocco		69,260				69,260
Mozambique**						
Namibia		5,440	860			6,300
Netherlands	26,507	45,862	4,000			76,369
New Zealand**						
Norway	170	2,123	813			3,106
Poland		111,000	35,000			146,000
Portugal	353	186,990	302			187,645
Romania		8,500	7,000			15,500
Slovakia		12,800	2,200			15,000
Slovenia		15,000	4,000			19,000
South Africa	50,000	42,300	7,700			100,000
Spain	11,000	315,500	21,500			348,000
Sweden	17,191	13,567	7,132			37,890
Switzerland	11,944	129,026	15,746	8,000		164,716
Taiwan	2	115,938	11,811			127,751
Thailand**						
Tunisia		72,200	12,500			84,700
Turkey		1,658,000				1,658,000
United Kingdom		75,600	29,600			105,200
United States	937,856	225,383				1,163,239
Uruguay**						
Zimbabwe		450	75			525
TOTAL	2,470,426	10,722,474	46,841,980	98,210	16,847	60,149,937

* revised due to new / adapted database in 2013
** no available data for the year 2010

Table 16: Newly installed collector area in 2010 [m²/a]

Country	Water Collectors			Air Collectors		TOTAL [m²]
	unglazed	glazed	evacuated tube	unglazed	glazed	
Albania		77,185	548			77,733
Australia	5,400,000	2,805,920	109,643			8,315,563
Austria	599,491	3,892,305	66,482	728		4,559,006
Barbados		131,690				131,690
Belgium	46,875	283,926	32,708			363,509
Brazil*	1,277,128	4,865,949				6,143,077
Bulgaria		46,086	650			46,736
Canada	656,485	47,758	18,456	306,549	4,616	1,033,864
Chile		28,159				28,159
China*		14,489,581	170,510,419			185,000,000
Cyprus	3,363	895,503	9,918			908,784
Czech Republic	150,000	249,664	58,275			457,939
Denmark	20,515	521,810	8,084	3,264	18,000	571,673
Estonia		2,051	790			2,841
Finland	11,779	30,118	4,342			46,240
France	89,181	1,762,582	23,596			1,875,359
Germany*	637,010	11,808,000	1,632,000		33,600	14,110,610
Greece		4,070,700	16,300			4,087,000
Hungary	8,088	119,711	30,103	800	350	159,052
India		3,447,384	522,616		16,320	3,986,320
Ireland	421	102,537	48,640			151,598
Israel	29,900	4,137,895		450		4,168,245
Italy	43,766	2,232,097	315,481			2,591,344
Japan		5,207,908	93,075		484,226	5,785,209
Jordan	5,940	768,992	218,570			993,502
Korea, South		1,566,319				1,566,319
Latvia		7,004	240			7,244
Lebanon		348,312				348,312
Lithuania		4,218	300			4,518
Luxembourg		27,982	2,818			30,800
Macedonia		25,020	724		4	25,748
Malta		32,167	11,302			43,469
Mexico	662,092	714,432	155,430		7,983	1,539,937
Morocco		341,260				341,260
Mozambique**						
Namibia		20,699	1,307			22,006
Netherlands	396,410	404,821	10,000			811,231
New Zealand	7,025	142,975	9,644			159,645
Norway	2,011	14,406	1,054		1,062	18,533
Poland		509,800	146,000			655,800
Portugal	2,435	731,693	19,665			753,793
Romania		93,996	16,000			109,996
Slovakia		120,692	15,055			135,746
Slovenia		150,656	13,042			163,698
South Africa	803,678	331,010	28,672			1,163,360
Spain	122,000	2,200,500	137,500			2,460,000
Sweden	140,000	245,000	57,000			442,000
Switzerland	212,850	745,150	50,110	867,000		1,875,110
Taiwan	85	1,970,300	75,461			2,045,847
Thailand		91,392				91,392
Tunisia		456,200	33,500			489,700
Turkey*		12,489,289	829,370			13,318,659
United Kingdom		439,738	125,045			564,783
United States	19,361,098	2,353,565	92,777		73,509	21,880,949
Uruguay		12,096				12,096
Zimbabwe		17,959	237			18,196
TOTAL 2010	30,689,627	88,634,162	175,552,951	1,178,791	639,671	296,695,201

* revised due to new / adapted database in 2013
** no available data for the year 2010

Table 17: Total collector area in operation by the end of 2010 [m²]

7.6 References to reports and persons that have supplied the data

The production of the solar heat worldwide report edition 2012 was kindly supported by national representatives of the recorded countries or other official sources of information as cited below.

COUNTRY	CONTACT	SOURCE REMARKS
Albania	**Dr. Eng. Edmond M. HIDO** EEC - Albania-EU Energy Efficiency Centre (EEC)	EEC
Australia	**Dr. David Ferrari** Sustainability Victoria	Sustainability Victoria
Austria	**Werner Weiss** AEE - Institute for Sustainable Technologies	[Biermayr et al, 2012]
Belgium		[ESTIF 2012]
Brazil*	**Marcelo Mesquita** Depto. Nac. de Aquecimento Solar da ABRAVA	DASOL ABRAVA Data of 2011 version of this report revised according to DASOL ABRAVA database
Bulgaria		[ESTIF 2012] (estimation) new installed according to ESTIF 2012 (estimation) - total installed projected from AEE INTEC database
Canada	**Reda Djebbar, Ph.D., P.Eng.** Natural Resources Canada	ClearSky Advisors Inc. Survey of Active Solar Thermal Collectors, Industry and Markets in Canada (2011)
Chile	**solarthermalworld.org**	Dandilion Energie y Medio Ambiente LTDA http://solarthermalworld.org/print/59391?utm_source=Newswea
China	**Hu Runqing** Center for Renewable Energy Development - Energy Research Institute (NDRC)	CSTIF - Chinese Solar Thermal Industry Federation Data of 2012 version of this report revised according to CSTIF database
Cyprus*	**Soteris Kalogirou, PhD, DSc** Cyprus University of Technology	Cyprus University of Technology; Energy Service, Ministry of Commerce, Industry & Tourism, Cyprus
Czech Republic	**Ales Bufka** Ministry of Industry and Trade	Ministry of Industry and Trade; Bufka, A.: Solar collectors in 2011 - statistical review
Denmark		[ESTIF 2012] total installed air collector and unglazed water collector capacity projected from AEE INTEC database (considering 25 years life-time)
Estonia		[ESTIF 2012] (estimation)
Finland		[ESTIF 2012] (estimation)
France (mainland)*	**Céline Coulaud** ADEME - Centre de Sophia Antipolis	ADEME; Enerplan
	John Hollick SAHWIA - Solar Air Heating World Industry Association	SAHWIA

COUNTRY	CONTACT	SOURCE REMARKS
Germany*	**Hanna Geiger** BSW - Bundesverband Solarwirtschaft e.V. **John Hollick** SAHWIA - Solar Air Heating World Industry Association	Bundesverband Solarwirtschaft e.V. SAHWIA total installed air collector and unglazed water collector capacity projected from AEE INTEC database
Greece	**Vassiliki DROSOU, M.Sc. PhD cand.** CRES - Centre for Renewable Energy Sources	CRES, EBHE (Costas Travasoras)
Hungary*	**Pál Varga** MÉGNAP- Hungarian Solar Thermal Industry Federation	MÉGNAP (expert estimation Pál Varga)
India*	**Janet Sawin** REN21 / solarthermalworld.org	Ministry of New and Renewable Energy (MNRE) http://www.mnre.gov.in/mission-and-vision-2/achievements/
Ireland*	**Mary Holland** Sustainable Energy Authority of Ireland	Grant scheme data; BER database: Source: Energy policy statistical support unit of Sustainable Energy Authority of Ireland
Israel	**Dr. Asher Vaturi** ICTAF - Israel Bureau of Statistics	ICTAF, Tel Aviv University Data of 2011 version of this report revised accordingly
Italy*	**Dott.ssa Valeria Verga** Assolterm - Associazione Italiana Solare Termico	Assolterm processing of data by Price Waterhouse Coopers
Japan*	**Yamashita Noriaki** ISEP - Institute for Sustainable Energy Policies	ISEP; Solar System Development Association (SSDA)
Jordan	**Nidal Abdalla** NERC - Department of Statistics	NERC quick survey
Korea, South*	**Janet Sawin** REN21	KEMCO (Korea Energy Management Corporation), 2012, New & Renewable Energy Statistics 2011 (2012 Edition)
Latvia		[ESTIF 2012] (estimation)
Lebanon*	**Toni Matar** ALMEE	Lebanese Association for Energy Saving & for Environment (ALMEE)
Lithuania		[ESTIF 2012]
Luxembourg		[ESTIF 2012]
Malta*	**Godwin Sant** Malta Resources Authority	Malta Resources Authority
Mexico*	**Bärbel Epp** SOLRICO **John Hollick** SAHWIA - Solar Air Heating World Industry Association	unpublished sources provided by Salvador Steffani (expert estimation) / FAMERAC - Renewable Energy Industry Association unglazed water collector installations in 2011 estimated by AEE INTEC (considering stagnating market)
Mozambique	**unpublished sources provided by Geraldo Nhumaio**	SOLTRAIN survey
Netherlands	**Reinoud Segers** Statistics Netherlands (CBS)	Statistics Netherlands (CBS) Cumulated areas: Statistics Netherlands based on survey of sales. Market Shares: Expert Estimates NL Agency.

COUNTRY	CONTACT	SOURCE REMARKS
Norway	**Peter Bernhard** Asplan Viak AS - KanEnergi	Asplan Viak AS - KanEnergi
Poland*	**Aneta Wiecka** EC BREC Institute for Renewable Energy (EC BREC IEO)	EC BREC IEO
Portugal	**João Farinha Mendes** APISOLAR - Associação Portuguesa da Indústria Solar	APISOLAR (www.apisolar.pt); „Oservatório Solar : Estatisticas Solar Termico 2011"
Romania		[ESTIF 2012] (estimation)
Slovakia		[ESTIF 2012]
Slovenia		[ESTIF 2012]
South Africa*	**Dieter Holm** SOLTRAIN coordinator Southern Africa and SESSA organiser for Gauteng	Eskom's "Dashboard" (2008-2011); Raj Pandaram (2013); SOLTRAIN2 survey in Gauteng (2013)
Spain	**Pascual Polo** ASIT - Asociación Solar de la Industria Térmica	ASIT SAHWIA
Sweden	**Jan-Olof Dalenbäck** Svensk Solenergi / CHALMERS	Svensk solenergi; CHALMERS University of Technology
Switzerland	**Urs Wolfer** SWISSOLAR	[SWISSOLAR 2009] Markterhebung Sonnenergie, 2009
Taiwan	**K.M. Chung** Energy Research Center - National Cheng Kung University	Bureau of Energy, Ministry of Economic Affairs, R.O.C.
Tunisia*	**Moncef Njaimi** ANME - National Agency of Energy Conservation	ANME
Turkey*	**A. Kutay Ulke** EZINC Metal San. Tic. A.S. **John Hollick** SAHWIA - Solar Air Heating World Industry Association	EZINC Metal San. Tic. A.S. SAHWIA
United Kingdom		[ESTIF 2012] SAHWIA new installed according to ESTIF 2011 - total installed projected from AEE INTEC database
United States	**Les Nelson** IAPMO Solar Heating & Cooling Programs **John Hollick** SAHWIA - Solar Air Heating World Industry Association	Water Collectors: IAPMO Solar Heating & Cooling Programs; provided by Les Nelson (Director); Air collectors: SAHWIA - Solar Air Heating World Industry Association; provided by John Hollick Historical data (1975 – 2009) from U.S. Department of Energy (DoE) - Energy Information Administration (EIA)
Zimbabwe	**unpublished sources, provided by Anton Schwarzlmüller**	SOLTRAIN survey

* Out of operation systems calculated by AEE INTEC (25 years)

7.6.1 Additional literature and web sources used

The following reports and statistics were used in this report:

- Bundesamt für Energie (BFE): Markterhebung Sonnenenergie 2011 - Teilstatistik der Schweizerischen Statistik der erneuerbaren Energien; prepared by SWISSOLAR, Thomas Hostettler, Bern, Switzerland June 2012
- Bundesministerium für Verkehr, Innovation und Technologie (BMVIT): Innovative Energietechnologien in Österreich – Marktentwicklung 2011; prepared by Peter Biermayr et al, Vienna, Austria May 2012
- ClearSky Advisors Inc.: Survey of Active Solar Thermal Collectors, Industry and Markets in Canada (2011); Prepared by ClearSky Advisors Inc., Dr. Reda Djebbar, Natural Resources Canada, August 2012
- European Photovoltaic Industry Association (EPIA): Global Market Outlook for Photovoltaics 2013 – 2017, http://www.epia.org/fileadmin/user_upload/Publications/GMO_2013_-_Final_PDF.pdf
- EurObserv'ER: Solar Thermal Barometer, June 2012; http://www.eurobserv-er.org
- European Solar Thermal Industry Federation (ESTIF): Solar Thermal Markets in Europe, Trends and Market Statistics 2011; Belgium - Brussels; June 2012
- The United Nations Development Programme (UNDP): The Residential Solar Water Heaters Market in Lebanon in 2011; The GEF Global Solar Water Heaters Project, The Lebanese Center for Energy Conservation (LCEC); Beirut, Lebanon September 2012
- Observatoire mediterraneen de l'energie (OME): Solar Thermal in the Mediterranean Region: Market Assessment Report, OME report for GSWH-UNEP-UNDP; September 2012
- REN 21: Renewables 2012 Global Status Report; www.ren21.net/gsr

The following online sources were used in this report:

- http://www.anes.org/
- http://www.aderee.ma/
- http://www.apisolar.pt/
- http://www.asit-solar.com/
- http://www.dasolabrava.org.br/
- http://www.epia.org/home/
- http://www.estif.org/
- http://www.gwec.net/
- http://www.iea-shc.org/
- http://www.mnre.gov.in/
- http://www.ome.org/
- http://www.olade.org/
- www.ren21.net/
- http://sahwia.org/
- http://www.solar-district-heating.eu/
- http://www.solarwirtschaft.de/
- http://www.solrico.com/
- http://www.solarthermalworld.org/
- http://www.tech4cdm.com/

7.7 List of Figures

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