Intelligent Energy Europe

TRANS-SOLAR

POLISH NATIONAL REPORT

The Polish National Energy Conservation Agency (KAPE)

December, 2008

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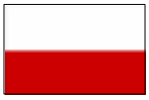
A. Introduction

1. Overview of the country



Poland, officially the Republic of Poland, is a country bordered by Germany to the west, the Czech Republic and Slovakia to the south, Ukraine and Belarus to the east, and the Baltic Sea, Russia (in the form of the Kaliningrad Oblast exclave) and Lithuania to the north. It also shares a maritime border with Denmark and Sweden. The total area of Poland is 312,683 km^2 with population over 38.2 million people concentrated mainly in large cities, including the historical capital of Poland, Krakow, and the present capital, Warsaw.

Figure 1: Poland and neighbouring countries (Source: Wikipedia)

1.1. Geographic location of Poland

The extreme points of Poland, that is to say the points that are farther north, south, east or west than any other location are:

- Northernmost Point: cape Rozewie, part of the town Władysławowo, Pomerania on the Baltic Sea, 54°50′N 18°04′E
- Southernmost Point: Wołosate ridge, near mount Opołonek, Bieszczady mountains, Subcarpathia, 49°04′N 22°40′E
- Easternmost Point: Bug river, near Zosin, Lublin, 50°51′N 24°09′E
- Westernmost Point: Odra river, near Osinów-Dolne, West Pomerania, 52°50′N 14°07′E
- Poland extent is 649 km from south to north (5°50') and 689 km from west to east 689 km (10^{o}50').

The extent from south to north implies that the day in the southern area is an hour longer than in northern one in winter and an hour shorter in summer. In June the day hours (sun hours) in north take 71.5 % of month hours, in central part of Poland 69% and in south 67%. In December this rate goes down to 29.5% in northern area, 31.7% in central part and 34.7% in south.

1.2. Meteorology

The overall climate of Poland has a transitional - and highly variable - character between maritime and continental types. The major elements involved are oceanic air masses from the west, cold polar air from Scandinavia or Russia, and warmer, subtropical air from the south.
Six seasons may be clearly distinguished: a snowy winter of one to three months; an early spring of one or two months, with alternating wintry and spring like conditions; a predominantly sunny spring; a warm summer with plenty of rain and sunshine; a sunny, warm autumn; and a foggy, humid period signifying the approach of winter.
The average air temperature in summer oscillates between 16.5°C and 20°C and between 6°C and 0°C in winter. Annual average air temperature is 7 - 8°C (except in mountain area).

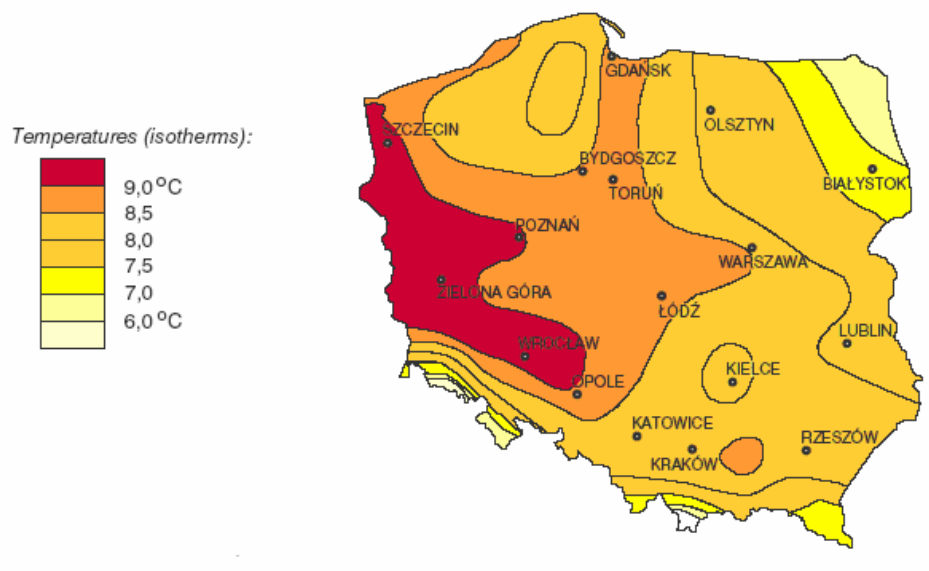


Figure 2: Distribution of average air temperature in 2005 (Source: "Concise statistical yearbook of Poland, 2006", Central Statistical Office)

The average annual precipitation for the whole country is 600 mm, but isolated mountain locations receive as much as 1,300 mm per year. The total is slightly higher in the southern uplands than in the central plains. A few areas, notably along the Vistula between Warsaw and the Baltic Sea and in the far northwest, average less than 500 mm. On the average, precipitation in summer is twice that in winter, providing a dependable supply of water for crops.

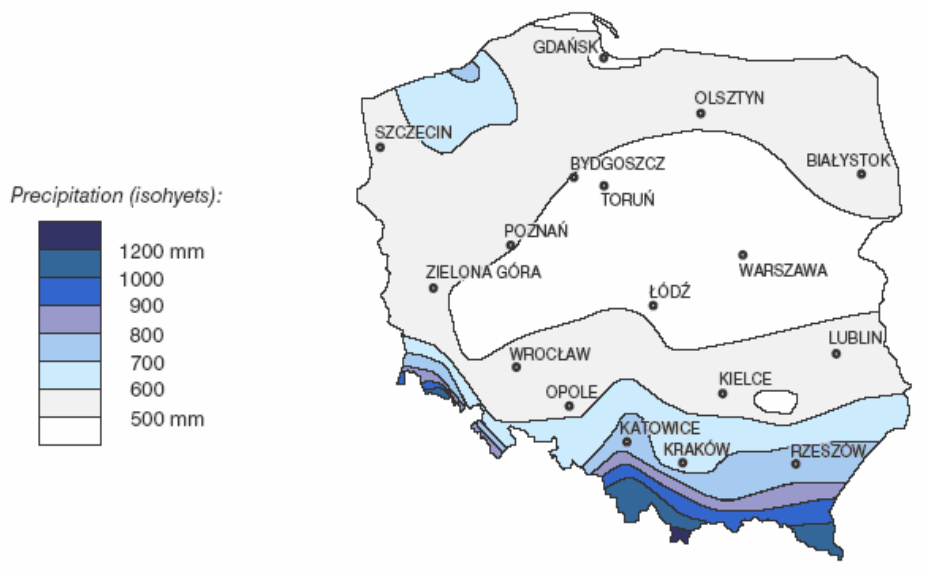


Figure 3: Total monthly insolation on horizontal surface, Warsaw, MJ/m² (Source: "Concise statistical yearbook of Poland, 2006", Central Statistical Office)

An average annual insolation on horizontal plane oscillates between 950 – 1250 kWh/m^2 with 1600 hours of operation. About 80% of total annual radiation occurs from April to September with 16 hours of operation daily. In winter the sun operation is about 8 hours daily.

Table 1: Insolation on horizontal plane in kWh/m2/year in different parts of Poland for different periods of the year (Source: Polish Academy of Sciences)

Region	All year (I-XII)	(IV-IX)	(VI-VIII)	(X-III)
Seaside	1076	881	497	195
East part of Poland	1081	821	461	260
Central part of Poland	985	785	449	200
West part of Poland with upper Odra drainage basin	985	785	438	204
South part of Poland	962	682	373	280
Southwest part of the Poland with Sudeten mountains	950	712	393	238

Table 2: Average value of global daily radiation on ground surface in different places in Poland (years 1961-1995)

Measurement localization	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
	[kWh/m^2/day]											
Gdynia	0,5	1,06	2,28	3,75	5,17	5,72	5,31	4,35	2,83	1,58	0,64	0,39
Kasprowy Wierch	1,28	2,11	3,31	4,25	4,44	4,06	4,08	3,72	3,11	2,33	1,31	0,97
Kołobrzeg	0,53	1,11	2,31	3,92	5,44	5,86	5,53	4,67	2,89	1,61	0,64	0,39
Mikołajki	0,56	1,19	2,28	3,5	5	5,53	5,25	4,39	2,83	1,53	0,61	0,39
Suwałki	0,56	1,22	2,33	3,44	4,83	5,36	5,08	4,19	2,72	1,44	0,58	0,36
Warszawa	0,58	1,14	2,25	3,42	4,8	5,25	5,11	4,28	2,78	1,58	0,64	0,42
Zakopane	0,97	1,72	2,75	3,58	4,17	4,42	4,42	3,86	2,92	2,06	1,08	0,69

In the Fig. 4 below the total monthly insolation as well as its distribution between direct, diffusive and reflected insolation on horizontal, vertical and entitled (45°) surface are shown. In summer there is a direct radiation of about 56%. The average annual percentage of diffuse radiation is of 54%. From November to the end of February the percentage of diffuse radiation varies from 65 to 71%.

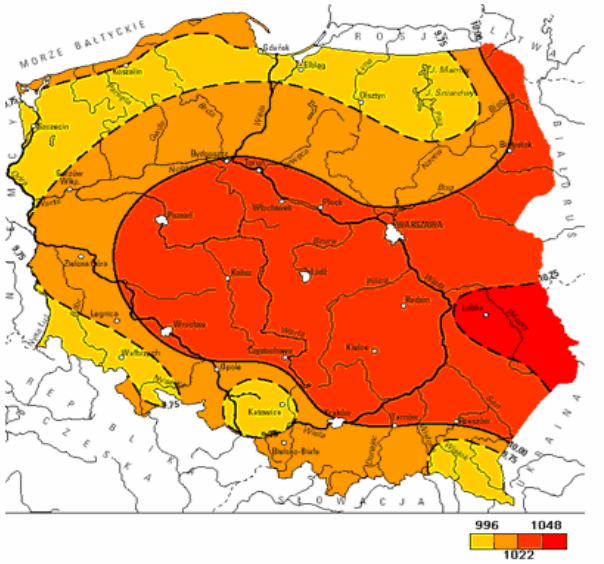


Figure 4: Global insolation – annual average, [kWh/m^2]

1.3. Relief

The total area of the country amounts to 312685km^2 and includes a land area (including inland waters) of 311889 km^2 as well as a part of internal waters — 794 km^2. The average elevation above the sea level is 173 m. The highest point in Poland is Mountain peak Rysy (2499 m) and the lowest point is the village of Raczki Elbląskie (-1,8m).
The relief structure can be divided more specifically into a series of east-west–trending zones. To the north lie the swamps and dunes of the Baltic coast; south of these is a belt of morainic terrain with thousands of lakes. The third zone consists of the central lowlands. This zone is the Polish heartland. The fourth zone is made up of the older mountains and highlands to the south; though limited in extent, it offers spectacular scenery. Along the southern border of the country are the Sudeten and Carpathian ranges and their foothills.

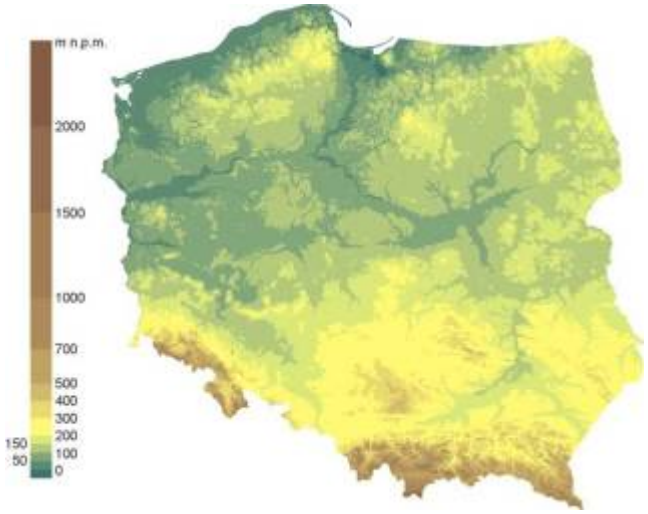


Figure 5: The relief structure of Poland (Source: Wikipedia)

More than a fourth of the country is wooded. Poland lies in the zone of mixed forests, but in the southeast a fragment of the forest-steppe vegetation zone intrudes. In the northeast there are portions of the eastern European subtaiga, with spruce as a characteristic component. In the mountains the vegetation, like the climate, is determined by elevation. Fir and beech woods give way to the spruce of the upper woods, which in turn fade into subalpine, alpine, and snow-line vegetation.

1.4. Population

In recent years Poland's population has stopped increasing because of an increase in emigration and a sharp drop in the birth rate. In 2006 the census office estimated the total population of Poland at 38 536 869, a slight rise on the 2002 figure of 38 219 080.
The forecast results show that the Polish population will constantly decline during the next decades. There is a probability of 50% that in 2025 the population will number between 27 and 35 millions compared to 38.2 in 2004. Besides, Poland will face significant ageing as indicated by a rising old-age dependency-ratio.

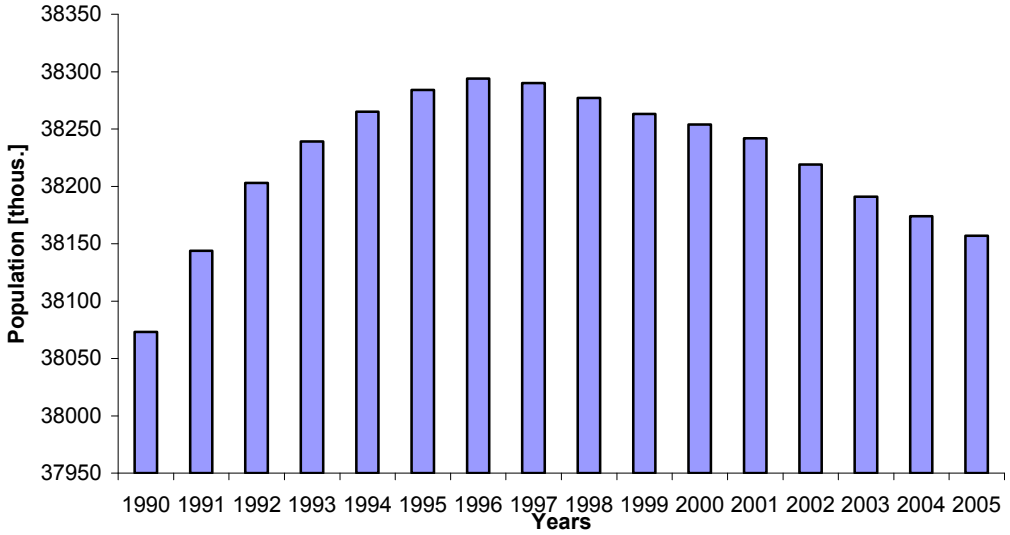


Figure 6: Evolution of population in Poland since 1990 (Source: GUS- Central Statistical Office)

Table 3: Population projection in thousands (Source: GUS- Central Statistical Office)

	2010	2015	2020	2025	2030
Total	37 899	37 626	37 229	36 598	35 693

1.5. Additional available statistics

1.5.1. GDP

GDP growth had been strong and steady from 1993 to 2000 with only a short slowdown from 2001 to 2002. The prospect of closer integration with the European Union has put the economy back on track, with growth of 3.7% annually in 2003, a rise from 1.4% annually in 2002. In 2004, GDP growth equaled 5.4%, in 2005 3.3% and in 2006 5.8%. For 2007, the government has set a target for GDP growth at 6.5 to 7.0%.

Table 4: Gross domestic product (current prices) (Source: GUS- Central Statistical Office)

	GDP [mln PLN]	GDP [mln Euro]	GDP per capita [PLN/capita]	GDP per capita [Euro/capita]
1995	337 222	87 059	8 810	2 274
1996	422 436	109 058	11 031	2 848
1997	515 353	133 046	13 459	3 475
1998	600 902	155 132	15 699	4 053
1999	666 308	172 017	17 414	4 496
2000	744 622	192 235	19 464	5 025
2001	779 205	201 163	20 371	5 259
2002	807 859	208 560	21 130	5 455
2003	842 120	217 405	22 048	5 692
2004	923 248	238 350	24 181	6 243
2005	980 884	253 229	25 704	6 636
2006	1 046 600	270 195	27 426	7 080

1 € = 3.8735 PLN (21.03.07)

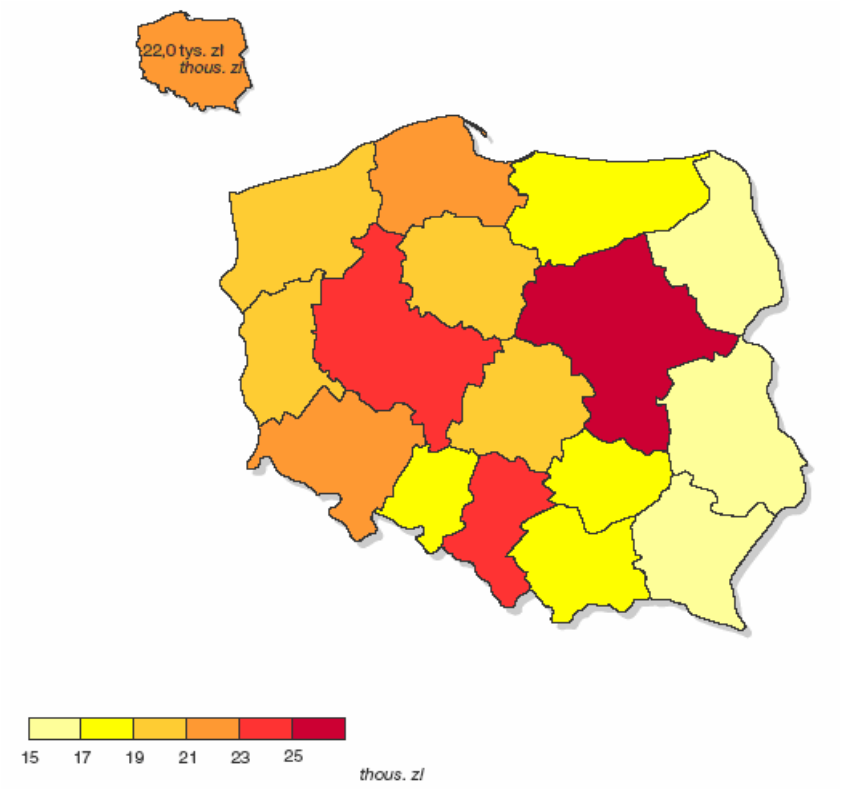


Figure 7: Gross domestic product per capita by voivodeship in 2003 (current prices) Source: GUS- Central Statistical Office

Table 5: Incomes and expenditures Source: GUS- Central Statistical Office

	2003	2004
Average monthly available income per one household [PLN]	2015.40	2081.97
Average monthly available income per capita in households [PLN]	711.96	735.40
Average monthly expenditures per one household [PLN]	1918.71	1966.72
Average monthly expenditures per capita in households [PLN]	677.81	694.70

Table 6: Price indices of goods and services (Source: GUS- Central Statistical Office)

	1999	2000	2001	2002	2003	2004	2005
	previous year =100						
TOTAL	107.4	110.4	105.5	101.8	101.1	104.3	102.4
Consumer goods and services	107.3	110.1	105.5	101.9	100.8	103.5	102.1
Non-consumer goods and services	107.6	111.7	105.6	101.5	102.0	107.3	103.5

1.5.2. Macroeconomic development

In years 1992 - 2004 private consumption of households in Poland was steadily growing. In years 2001 - 2002 value added of industry decreased (Fig. 9), what was partly connected with recession all over Europe. Decrease of value added in other sections and divisions of economy (in constructing, hotels and restaurants, financial intermediation) made GDP growth slower (Fig. 10) in these years. This situation did not impact the private consumption of households, which pace of growth was exceeding those of GDP. Since 2003 the upturn of downtrend concerning value added in industry in years 2001 - 2002 can be observed. Main reason was the growth of production sold of industry by 8.1% in comparison to previous year.

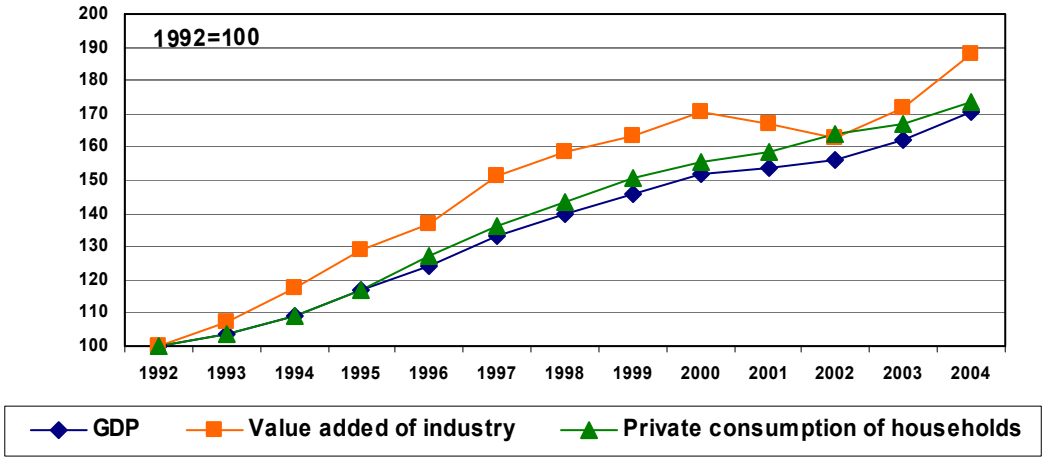


Figure 8: Macro-economic development in Poland: 1992-2004, (Source: Central Statistical Office)

Table 7: Variations of economic and industrial growth indicators in Poland (Source: Central Statistical Office)

% / year	1992-2000	2000-2004	1992-2004
GDP	5,08	2.89	4.54
Value added in industry	6.73	2.48	5.41
Private consumption	5.40	2.83	4.70

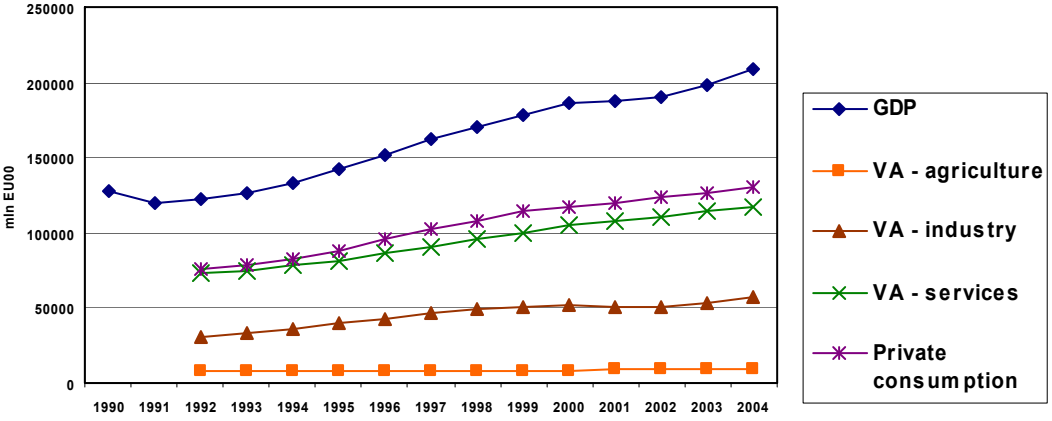


Figure 9: Macro-economic developments in Poland: 1990-2002 at 2000 Euro, Source: Central Statistical Office

1.5.3. Population density and location

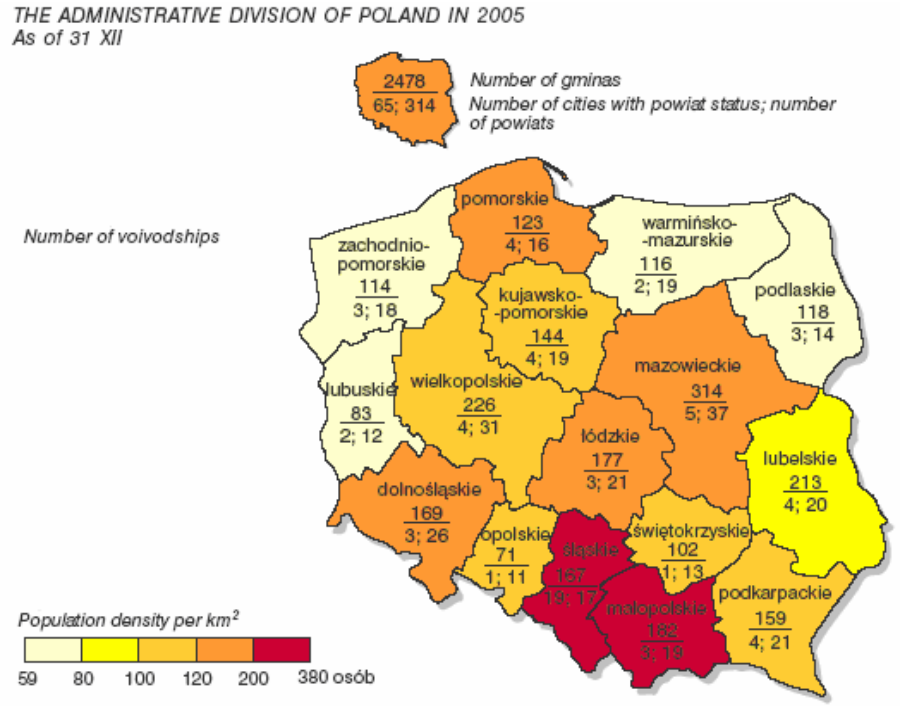


Figure 10: Population density by voivodship, (Source: GUS- Central Statistical Office)

On 1 January 1999, a new fundamental three-tier administrative division of the country was introduced, the entities of which are: gminy (communes, municipalities), powiaty (counties) and województwa (regions, provinces, voivodships). A total of 308 powiats and 65 cities with powiat status as well as 16 voivodships were created. This change did not affect gminas, of which there were 2489.

Table 8: Major data (area, population) by voivodship in 2005 (Source: Central Statistical Office)

Voivodships	Total area in km^2	Population in thousands	Population density per km^2 2005	Population in urban areas in % in 2005
TOTAL	**312 685**	**38157.1**	**122**	**61.4**
Dolnośląskie	19 948	2888.7	145	71.1
Kujawsko-pomorskie	17 969	2068.3	115	61.5
Lubelskie	25 121	2179.6	87	46.7
Lubuskie	13 989	1009.2	72	64.1
Łódzkie	18 219	2577.5	141	64.6
Małopolskie	15 190	3266.2	215	49.6
Mazowieckie	35 559	5157.7	145	64.7
Opolskie	9 412	1047.4	111	52.6
Podkarpackie	17 844	2098.3	118	40.4
Podlaskie	20 187	1199.7	60	59.2
Pomorskie	18 293	2199.0	120	67.3
Śląskie	12 331	4685.8	380	78.6
Świętokrzyskie	11 708	1285.0	110	45.4
Warmińsko-mazurskie	24 192	1428.6	59	60.0
Wielkopolskie	29 826	3372.4	113	57.1
Zachodniopomorskie	22 896	1694.2	74	69.2

B. State of the Market

2. Overview of the market situation

For many years utilisation of solar energy in active systems was rather unknown. Fortunately nowadays different applications of these systems take place much more often. Solar active systems are used mostly for Domestic Hot Water systems in single family houses. There are now many examples of bigger systems (with area of solar collectors above 50 m^2), that are installed in schools, public buildings and multifamily apartment buildings, hospitals, sanatoriums. The solar collector market is growing and that is proved by statistics.

Annual average insolation on horizontal plane is ranges between 950 and 1150 kWh/m^2. In the northern part of Poland the annual average insolation has the highest level. The maximal solar radiation occurs in June and e.g. in Warsaw it is equal to 160 kWh/m^2. The minimum insolation occurs in December and is equal to about 11 kWh/m^2. From October to April only about 20% of annual total radiation is available.

Active systems with flat plate solar collectors can be used with good efficiency for many different applications. The results show, that DHW - Domestic Hot Water systems are very effective during spring and summer, especially from June to the end of August. In average in that time they can provide about 90 - 100% of total demand. When they operate the whole year then they provide about 65% of required energy, the typical flat plate solar collectors with selective surface supply app. 400 kWh/m^2 per year.

The use of solar energy in agriculture is also a very promising solution. In most of agriculture application the low temperature sources of energy are needed. The time and the peak values of solar energy, are very often in quite good accordance with the time and peak values of the heat demand, e.g. in some sectors of agriculture production, domestic hot water heating and solar drying. In Poland most part of agriculture production takes place between May and August, that period of time is also characterised by the best insolation conditions, with monthly average minimum value equal to 135 kWh/m^2. Especially the possibility of applying solar energy for drying purposes is a very promising alternative.

Polish climatic conditions can give also some suggestions for passive solar systems. The proper construction of the house, applying buffer zones, winter gardens, solar collecting surfaces and accumulating massive walls, can give a great positive impact to the total heat balance of the building. However, the passive systems must be considered very carefully. In Polish conditions, too many glass walls and solar collecting surfaces can give an unexpected effect in extreme weather conditions, i.e. too much heat gains in summer, too much heat losses in winter. There is no estimation performed for potential of passive solar in the country; although it is expected the applying rules connected with passive solar design can reduce consumption of energy for space heating by 30%.

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2.1. Problems encountered

Until the present moment the result from the installation of a thermal solar system were calculated by comparing the energy consumed for the necessary DWH before and after the installation of the system. There was no guarantee for the solar energy that had to be supplied.

It is necessary to work up and accept the Law for Renewable Energy Sources to normalize renewable energy market and establish support mechanisms for flat plate solar collectors and solutions for building design and maintenance. Between solar energy and building sector exist strong connections, so that is the reason why should be done evaluation of utilization solar energy in building sector. Additionally, it is necessary to estimate methodology of certificate energy building profile in order to support utilize energy comes from flat plate solar collectors. In near future should be create new dissemination plan for solar energy together with building market chamber, manufacturers, planers and installers.

2.2. Reasons of success or failure

The system of financial support for environmentally clean technologies is based on environmental protection funds, i.e. on the National Fund for Environmental Protection and Water Management and funds of particular provinces (voivodships) and EcoFund. Such funds are managing the environmental fees and penalties, of which some part is fed back to RES investments as low - interest loans or subsidies. Annually EcoFund could co-financed around 10 000 m^2 of solar collectors. Most of large solar collectors installations were co-financed by Eco Fund. EcoFund granted approximately 121 large installations of solar collectors in Poland with total areas of 37 000 m^2. Only in 2006, 32 solar collectors installations were installed with total areas of 6 276 m^2, mainly during the thermo modernization of Public buildings and Health care centers. It coverage more than 62% installed solar collector in 2006.

2.3. Demonstration projects of high visibility

A good example of demonstration project of high visibility is large solar system in the Wlokniarz Sanitorium in Busko Zdroj. It concerns a quite new and big solar system (2005), with a collector area of 569 m², a 10 000 liters storage tanks (5), and internal heat exchangers. Solar installation supports DHW system in Sanatorium in which average daily demand of DHW equal 53 m^3. The main think that distinguish this installation from other is scale, because it is third the biggest solar installation in Poland and for sure the biggest one which have tele-monitoring system. This monitoring system was implemented in frame of EAST-GSR project.

The second good demonstration project was established with cooperation with EcoFund. It is the biggest solar installation in Poland with a collector area of 1500 m² which is located in hospital in Czestochowa.

2.4. Factors which affected the market during the last few years

The system of financial support realized by EcoFund for environmentally clean technologies had affected the solar thermal market during the last few years the most.

2.5. Description of the present situation

In Poland 47 MW_{th} of solar thermal capacity were newly installed in 2007 (67 000 m^2). It gave 62% more than in the previous year. In the last years we can observe steady growth of solar thermal market in Poland. From the big UE countries, only Poland is not yet seen amongst the top solar thermal markets. In 2007, Polish share of the total EU market was estimated for 2% of European sales. But with increasing sales and a growth domestic industry, they are expected to increase this share. With 6,1 m^2 per 1 000 capita, Poland remains one of the most promising markets for strong growth in the coming years in the central part of Europe.

2.6. Imports / exports figures

In case of Poland it has been difficult to find in statistics the all data on exports and imports of solar collectors. Some data concerning exports of main producers in Poland are available and are shown on figure 11 below.

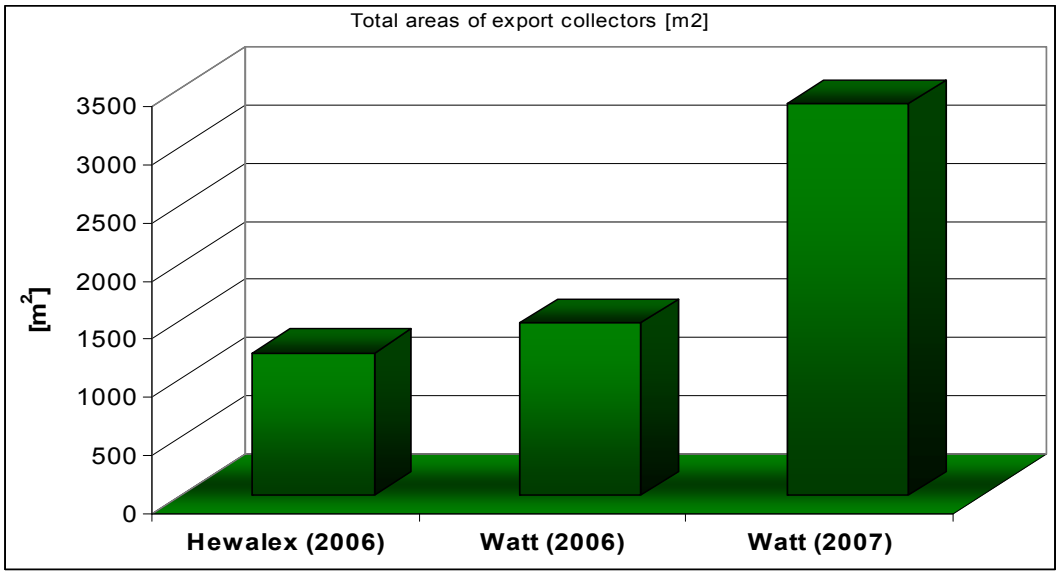

Figure 11: Total area of export collectors [m²]. Source: KAPE.

After analyses the data as above we can make conclusion that this two companies HEWALEX and WATT are the biggest producers and exporters of flat plate solar collectors in Poland. In 2006 they export together more than 2 715 m^2 of solar collectors. It means that average export rate in this companies equal almost 12%. In 2007 WATT company was increased export more than twofold and achieved number of 3 375 m^2 of exported solar collectors.

More than 50% imported solar collectors come from Germany due to numerous distributors of German companies in Poland (Viessmann, Buderus, Vaillant, Wolf…). 12% of imported solar collectors are produced in Austria (Sonnenkraft, Solektor…). Recently we can observe a notable increase number of imported solar collectors or components (vacuum tube collectors) from China. Share of collectors from China was estimated for 9% of foreign collectors on Polish market. Rest of the foreign producers play a minor rule on the polish market.

2.7. Installers organization

The manufacturers and importers of solar collectors in Poland act as technical consultants and executor, i.e. they design the solar thermal systems, they provide the equipment and install it. For the installation of the solar thermal systems in some cases they have their own installers, and in other cases they use subcontractors.

2.8. Types of solar systems

The active solar systems equipped with glazed water collectors and internal exchanger are dominant.

2.8.1. Flat-plate collectors

In Poland almost 31 MW_{th} of solar flat plate collectors capacity were newly installed in 2007 (44 000 m^2). It gave 65,7% of solar thermal market share in 2007.

2.8.2. Evacuated-tube collectors

In Poland more than 16 MW_{th} of solar evacuated tube collectors capacity were newly installed in 2007 (23 000 m^2). It gave 34,3% of solar thermal market share in 2007.

2.9. Solar market key figures

Table 9: Cumulative Collector Area installed at the end of 2003 – 2006, [m²] (*Source: Solar Heat Worldwide 2005, 2006, 2007, 2008, IEA)*

	Water collectors			Air collectors		TOTAL
	unglazed	glazed	evacuated tube	unglazed	glazed	
2003	1 150	65 185	4 334	3 000	2 000	75 669
2004	1 430	89 887	3 270	3,000	2,500	100 087
2005	1 550	113 372	7 318	3 000	2 500	127 740
2006	1 700	148 522	13 608	3 000	2 500	169 330

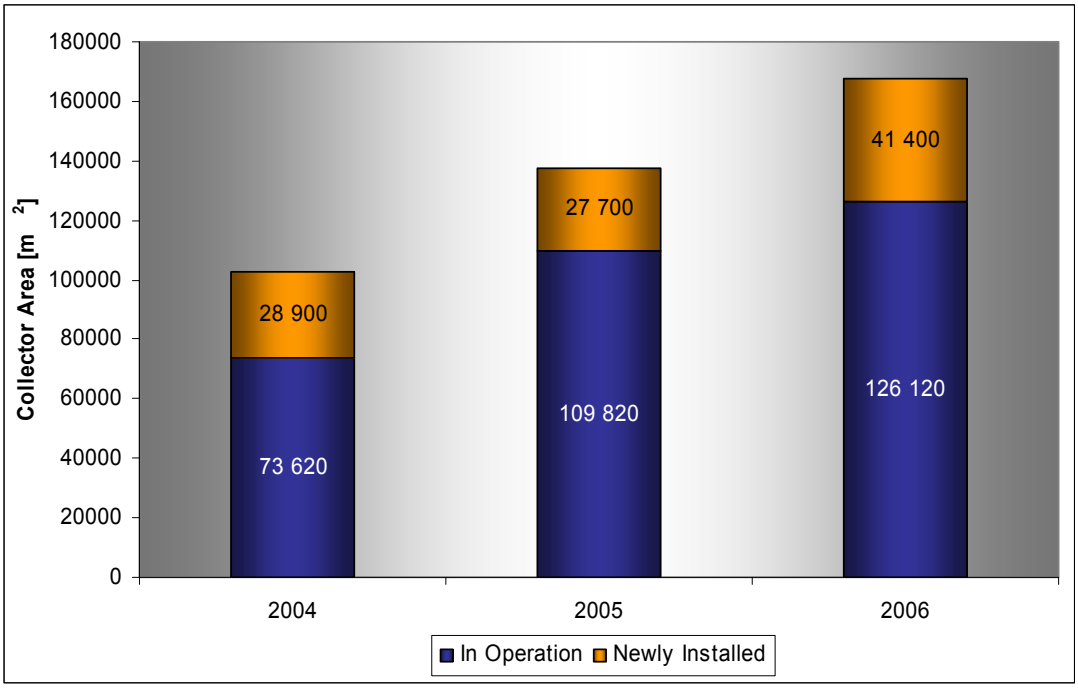

Figure 12: Total capacity in operation at the end of 2003 - 2006 [m²] and installed capacity in 2003 - 2006 [m²]. Source: Solar Heat Worldwide 2005, 2006, 2007, 2008, IEA.

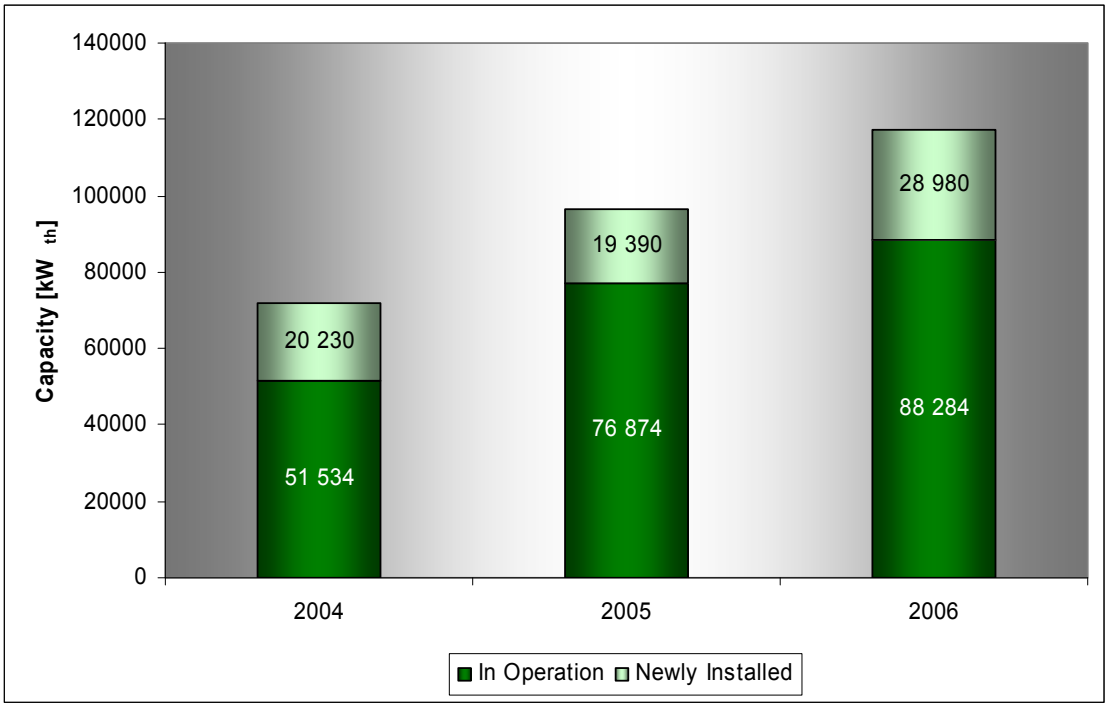

Figure 13: Total capacity in operation at the end of 2003 - 2006 [kW_{th}] and installed capacity in 2003 - 2006 [kW_{th}]. Source: Solar Heat Worldwide 2005, 2006, 2007, 2008, IEA.

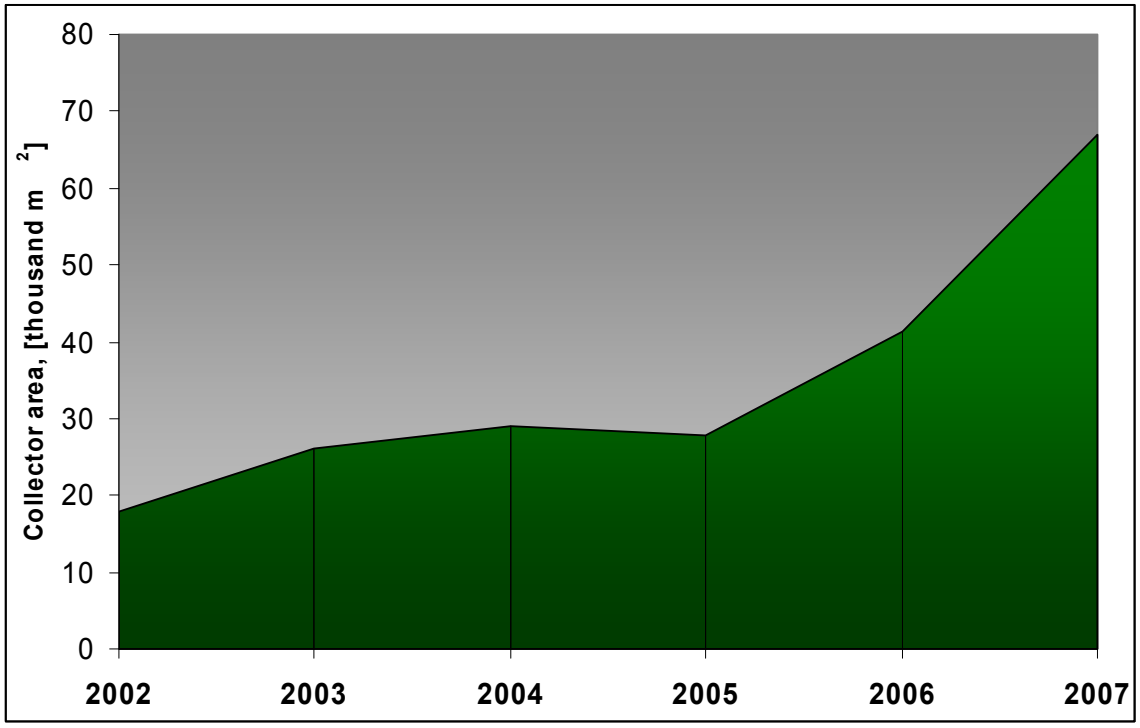

Figure 14: Collector Area installed in 2002-2007, *Source: ESTIF 2008*

In Poland the share of SDHWS for single family houses equals 99% (Source: Solar Heat Worldwide 2004, IEA). The active solar systems equipped with internal are dominant. The grants and soft loans offered by environmental protection funds cause the interest in bigger solar systems

(over 50 m^2). Such systems are being installed by public services sector (schools, hospitals) and mainly by housing cooperatives and social houses societies.
The collectors statistic in terms of installed capacity, collectors yield, corresponding oil equivalent and CO_2 reduction are presented in the Tab. 11 and 12.

Table 10: Installed capacity of solar collectors (Source: Solar Heat Worldwide 2008, IEA)

	Water Collectors			Air Collector		TOTAL [MW_{th}]
	unglazed	glazed	evacuated tube	unglazed	glazed	
Cumulative capacity installed at the end of 2006, [MW_{th}]	1,19	103,97	9,53	2,10	1,75	118,53
Installed capacity in 2006, [MW_{th}/a]	0,11	24,61	4,38	-	-	29,09
Installed capacity in 2005, [MW_{th}/a]	0,08	16,44	2,83	-	-	19,36
Total collector area in operation by the year 2006 [m^2]	1 700	148 522	13 608	3 000	2 500	169 330

Table 11: Calculated collector yield and corresponding oil equivalent as well as CO_2 reduction of solar thermal systems at the end of 2005 (Source: Solar Heat Worldwide 2008, IEA)

	Total collector area [m^2]	Total capacity [MW_{th}]	Number of systems	Collector yield [GWh/a]	Collector yield [TJ/a]	Energy savings oil equivalent [l/a]	CO_2 reduction [t/a]
All solar thermal systems	122 240	85,6	19 946	39,1	140,9	5 719 532	15 592
Hot water preparation and space heating with flat plate and evacuated tube collectors	120 690	84,5	19 938	38,8	139,7	5 665 406	15 444
Swimming pool heating with unglazed collectors	1 550	1,1	8	0,3	1,2	54 126	148

Table 12: Calculated collector yield and corresponding oil equivalent as well as CO_2 reduction of solar thermal systems at the end of 2006 (Source: Solar Heat Worldwide 2008, IEA)

	Total collector area [m^2]	Total capacity [MW_{th}]	Number of systems	Collector yield [GWh/a]	Collector yield [TJ/a]	Energy savings oil equivalent [l/a]	CO_2 reduction[t /a]
All solar thermal systems	163 830	114,7	26 792	52,5	189,0	7 670 038	20 909
Hot water preparation and space heating with flat plate and evacuated tube collectors	162 130	113,5	26 784	52,1	187,7	7 610 674	20 747

Swimming pool heating with unglazed collectors	1 700	1,2	9	0,4	1,3	59 364	162

Table 13: Solar thermal capacity per 1 000 inhabitant in 2004, 2005 and 2006 (Source: Solar Thermal Barometer 2005, 2006, 2007, 2008 EurObserv'ER)

Cumulative installed capacity of glazed flat and evacuated tube collectors in operation at the end of:	m^2 /1000 inhab.	kW_{th} /1000 inhab.
2004 per 1 000 inhabitants	2,5	1,7
2005 per 1 000 inhabitants	3,2	2,2
2006 per 1 000 inhabitants	4,3	3,0
2007 per 1 000 inhabitants	6,1	4,9

3. Solar collector production and sales

Solar thermal market in Poland increase dynamically. In 2006 we can observe an increase in installed area of 14 000 m^2 compared to 2005. According to data collected by EurObserv'ER, Poland is on the 12th place in cumulated capacity of solar thermal collectors installed in the European Union in 2006. Estimated installed solar collector area in Poland in 2006 was around 163 830 m^2. In 2007 number of installed solar collectors has been increasing significantly. Estimated total installed collector area in Poland in 2007 is almost equal to 235 000 m^2. It gave an increase of installed area more than 25 000 m^2 compared to previous year. Nevertheless it's important to emphasis that there is still a large imbalance between the national market and countries with the best developed solar thermal market in EU (Germany, Austria, Greece…). When we compare data concerning solar thermal capacity per inhabitant in 2006, Poland is located on the distant 19th place, with 4,3 m^2 per 1000 inhabitant, but in 2007 solar thermal capacity in operation per capita increase to 6,1 m^2. Nevertheless there is still a huge potential to develop a more balanced market.

In Poland the solar thermal market mainly consists of water flat plate solar collectors. Air collectors are not so popular because the utilization is very seldom in agriculture and passive buildings.

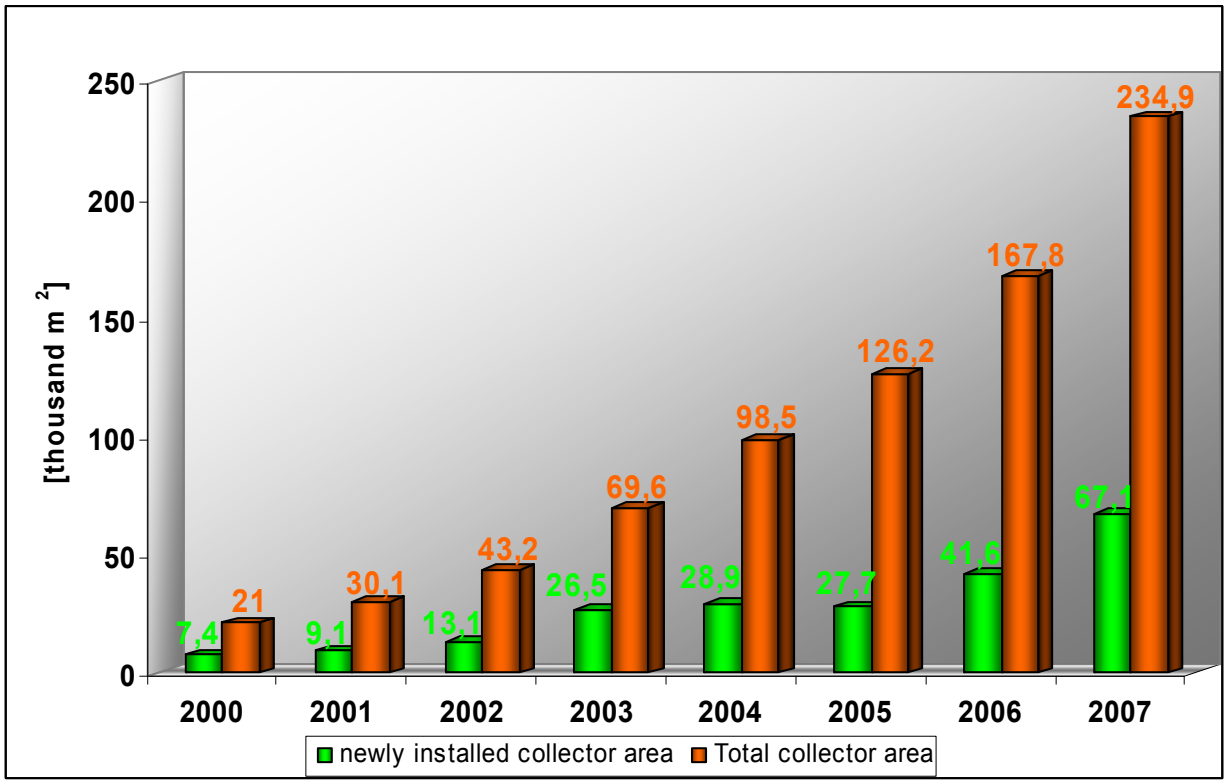

Figure 15: Total collectors sales in m^2 in 2000 – 2007

Table 14: Solar collectors production and sales in 2000 – 2007

Year	Flat Plate Collectors				Vacuum Collectors				Unglazed Collectors in m^2
	Production and sales in m^2				Production and sales in m^2				
	A	B	C	D = A-B+C	A	B	C	D = A-B+C	
	Total national production	Exports	Imports	Total home market sales	Total national production	Exports	Imports	Total home market sales	Total home market sales
2000				7 400					
2001				9 100					
2002				13 100					
2003				26 500					
2004				22 550				2 700	650
2005				23 485				4 048	120
2006				35 150				6 250	150
2007				46 000				20 800	300
Total				183 285				33 798	1220

On Poland's national market 57 types of solar collector are produced to prepare domestic hot water. 36 types are established water flat plate collectors, the rest are vacuum tube collectors. It is important to underline that only 30 % of Polish manufacturers on the market produce vacuum tube collectors.

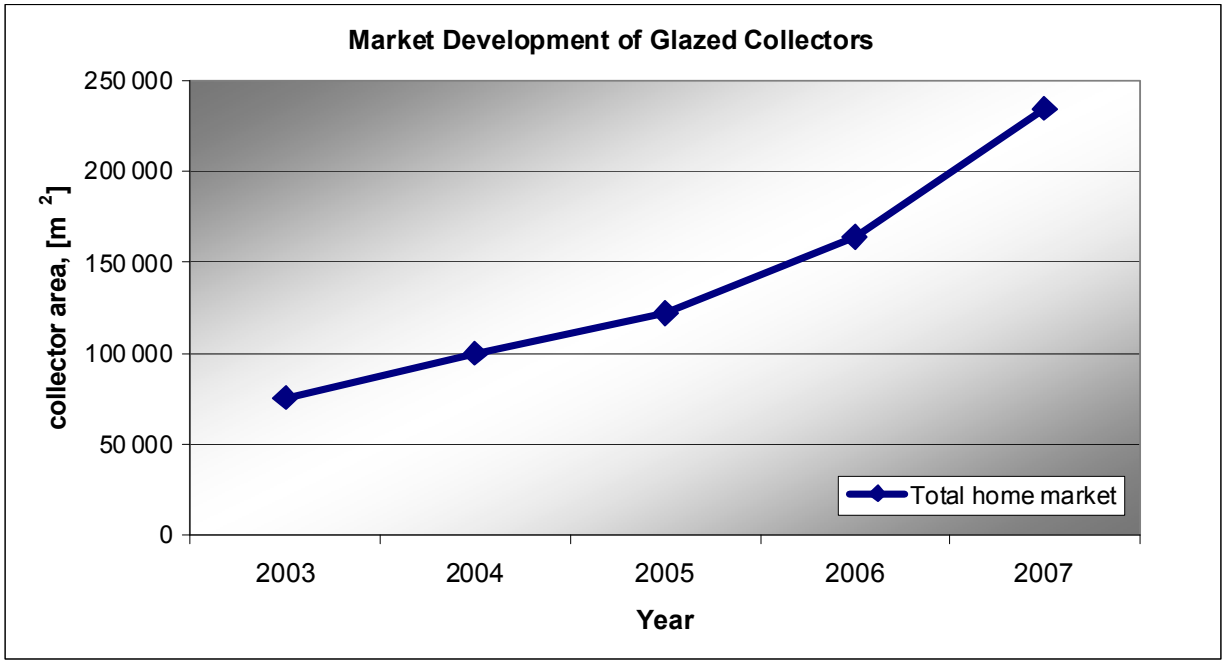

Figure 16: Market development of glazed collectors in 2003 – 2006

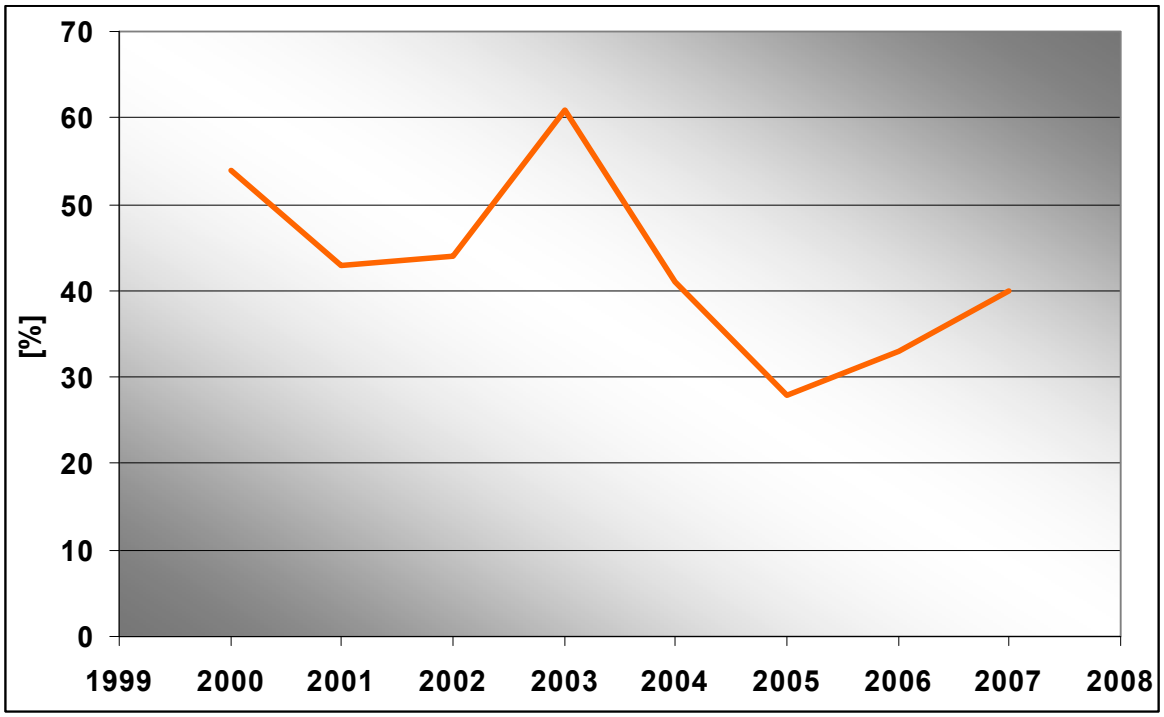

Figure 17: Development rate of installed collector area in 2000 – 2007

3.1. Estimated solar park in working order in 2006

Cumulated capacity of solar thermal	163 830	m^2
Flat plate collectors in m^2	35 150	m^2
Vacuum collectors in m^2	6 250	m^2
Unglazed collectors in m^2	150	m^2
Total in m^2	41 550	m^2

3.2. Estimated solar park in working order in 2007

Cumulated capacity of solar thermal	234 900	m^2
Flat plate collectors in m^2	46 000	m^2
Vacuum collectors in m^2	20 800	m^2
Unglazed collectors in m^2	300	m^2
Total in m^2	67 100	m^2

3.3. Estimated annual solar thermal energy production in 2006

Flat plate collectors =	m^2	x	kWh/m^2*year	=	19 800	
Vacuum collectors =	m^2	x	kWh/m^2*year	=	2 813	
Unglazed collectors =	m^2	x	kWh/m^2*year	=	0,069	
Total					18 700	MWh/year

If we take an average of 450 kWh/m^2*year for the different type of collectors than in total estimated annual solar thermal energy production in 2006 would be 41 550 m^2 x 450 kWh/m^2*year = 18 700 MWh

3.4. Estimated annual solar thermal energy production in 2007

Flat plate collectors =	m^2	x	kWh/m^2*year	=	20 700	
Vacuum collectors =	m^2	x	kWh/m^2*year	=	9 360	
Unglazed collectors =	m^2	x	kWh/m^2*year	=	135	
Total					30 195	MWh/year

If we take an average of 450 kWh/m^2*year for the different type of collectors than in total estimated annual solar thermal energy production in 2007 would be 67 100 m^2 x 450 kWh/m^2*year = 30 195 MWh

3.5. CO_2 emissions avoided in 2006 (on the basis of oil)

Flat plate collectors = MWh/year x tonnes/MWh = 20 747

Vacuum collectors	=	MWh/year	x	tonnes/MWh		
Unglazed collectors	=	MWh/year	x	tonnes/MWh	=	162
Total						20 909 tonnes/year

4. Product types and solar thermal applications

4.1. Product types

National producers offer complete solar instillations with solar tanks and controllers. In most cases solar installations include solar tanks and controllers produced by other manufacturers which they specialize in this type of devices. Solar tanks are offered by national companies as Elektromet, Termica or Biawar. However controllers are offered by Compit from Czestochowa and Frisko from Wroclaw.
Flat plate solar collector with copper absorber covered with black chrome or high selective absorber: ETA PLUS, TiNOX, Sunselect, in a casing made of welded, metal sheet of aluminum and with mineral wool insulation. The covering is made of tempered glass (thickness around 3 mm). This type of collectors can be used for supporting domestic hot water systems and central heating systems, as well as heating the water in swimming pools.
Vacuum tube solar collector consists of items, which can be easily put together just before installation. Collector consists of 10 vacuum tubes (made of glass pipe with antireflective coating) with absorbers inside; compact separator of heat medium; basic construction made of aluminum and connections made of stainless steel; top and bottom casings made of aluminum sheet. This type of collectors can be also used for supporting domestic hot water systems and central heating systems, as well as heating the water in swimming pools.

4.2. Applications

Installation figures according to the following application segments:

- Basic installation for warming up the water:

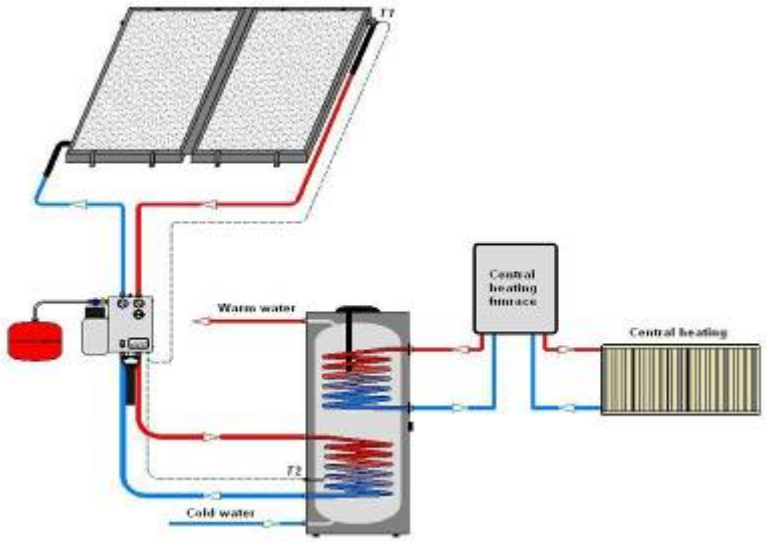

Figure 18: Draft of basic installation for warming up the water

- Installation for warming up the water with use of separate heater:

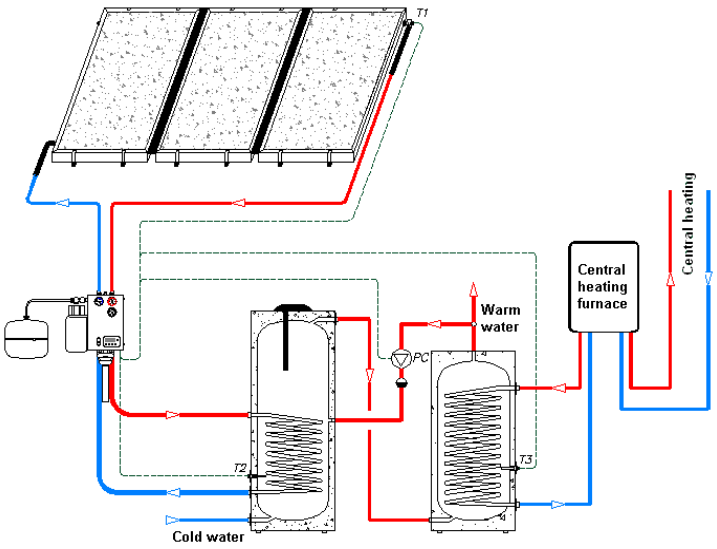

Figure 19: Draft of installation for warming up the water with use of separate heater

- Basic installation for a swimming pool:

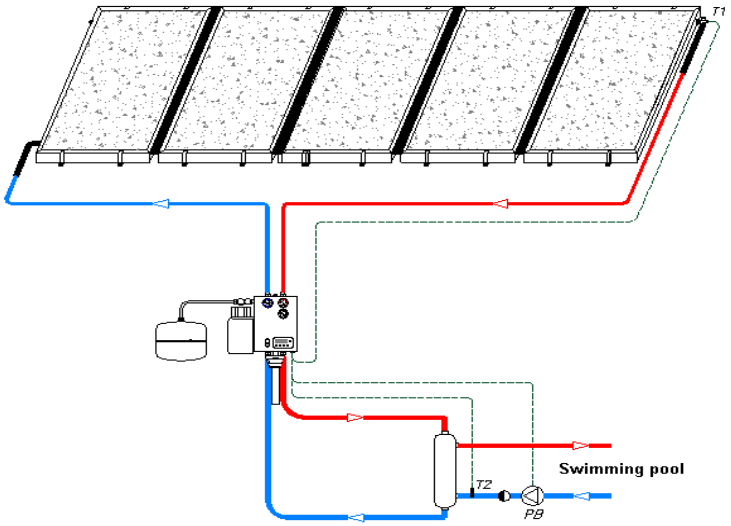

Figure 20: Draft of basic installation for a swimming pool

- Basic installation for warming up the water and supporting central heating:

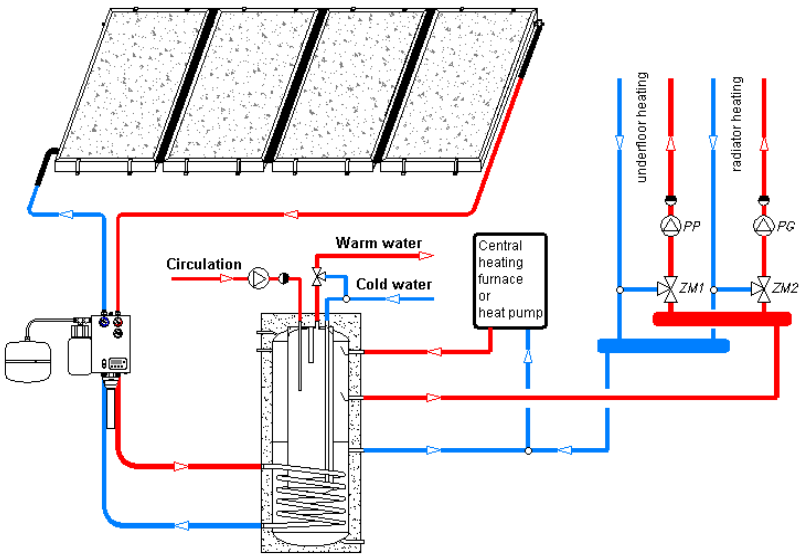

Figure 21: Draft of basic installation for warming up the water and supporting central heating

- Comprehensive installation for warming up the usable water, swimming pool and supporting building heating supplied by solar collectors, central heating and fireplace.

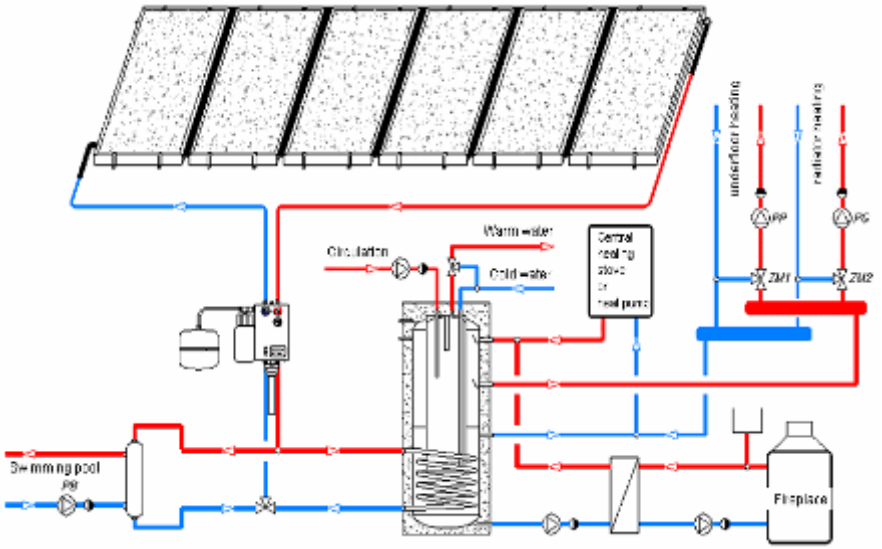

Figure 22: Draft of comprehensive installation for warming up the usable water, swimming pool and supporting building heating supplied by solar collectors, central heating and fireplace

5. Market share of major manufacturers

In Poland the solar collector market approximately consists of 20 manufacturers (i.e. HEWALEX, WATT) and 40 distributors. Fifteen manufacturers produce flat plate solar collectors and six manufacturers generate vacuum-tube collectors.
The first solar collectors in Poland was arisen at the beginning of 90'. Aparel company was the first manufacturer of solar collectors on polish market. In 1993 Aparel started production of absorber for companies from Germany and Austria. Then, a few years later the production of water flat plate solar collectors started. Also Hewalex was established at the beginning of 90'. At present Hewalex produce 8 types of flat plate solar collectors. Moreover SUNEX company also offer several types of flat plate solar collectors. Both company Hewalex and SUNEX are located in south part of Poland.

Year by year national manufacturers export more and more solar collectors, for example to Spain. The third biggest producer in Poland the WATT company, which was established in 1998, based on years of experience related to solar technology. During the production process, WATT use the newest materials and technologies provided by solar installation manufacturers established on the world market and cooperate with renowned sub-assembly suppliers. Most of national manufacturers are located in south part of Poland especially in provinces: Slaskie and Malopolskie. In other provinces predominate distributors of Polish and foreign producers.

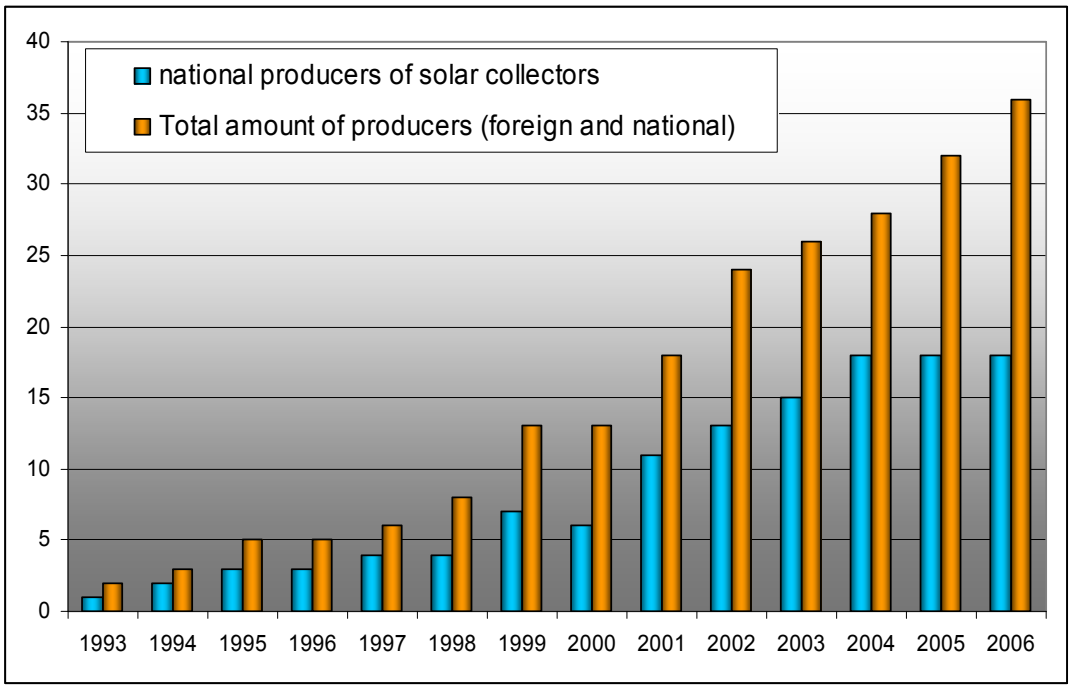

Figure 23: Development of Polish manufacturers and distributors of foreign companies on national solar thermal market.

Except the large producers of solar collectors in Poland, also small family companies which produce not more than 500 m^2 per year are existing. Unfortunately those companies can't afford the investment for new technologies. Besides Polish manufacturers, distributors of foreign companies which make up 47% of all producers on national market play an active part on the market. They produce 39% of all types of solar collectors on the Polish market.

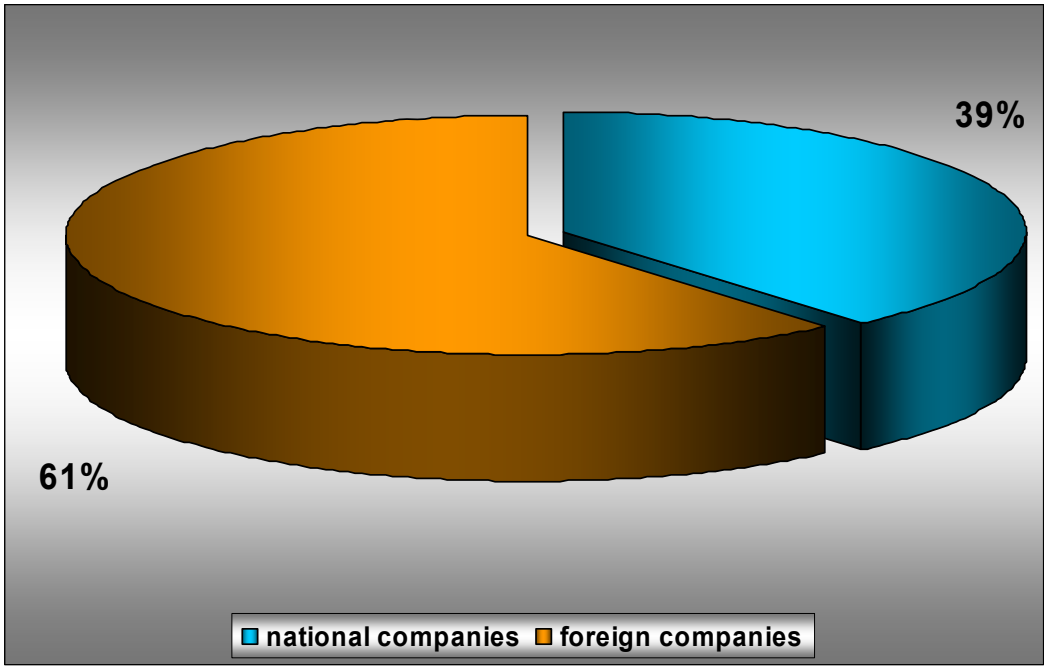

Figure 24: Amount of solar collectors offer by Polish manufacturers and foreign companies.

Below we can see estimated percentage of foreign producers offer solar collectors on Polish market. The biggest part of the import makes up solar collectors produce by Germany due to numerous distributors of German companies in Poland (Viessmann, Buderus, Vaillant, Wolf…). The second biggest part of imported solar collectors from foreign producers is produced by Austria (Sonnenkraft, Solektor…). Recently we can observe a notable increase of import of solar collectors or components (vacuum tube collectors) from China.

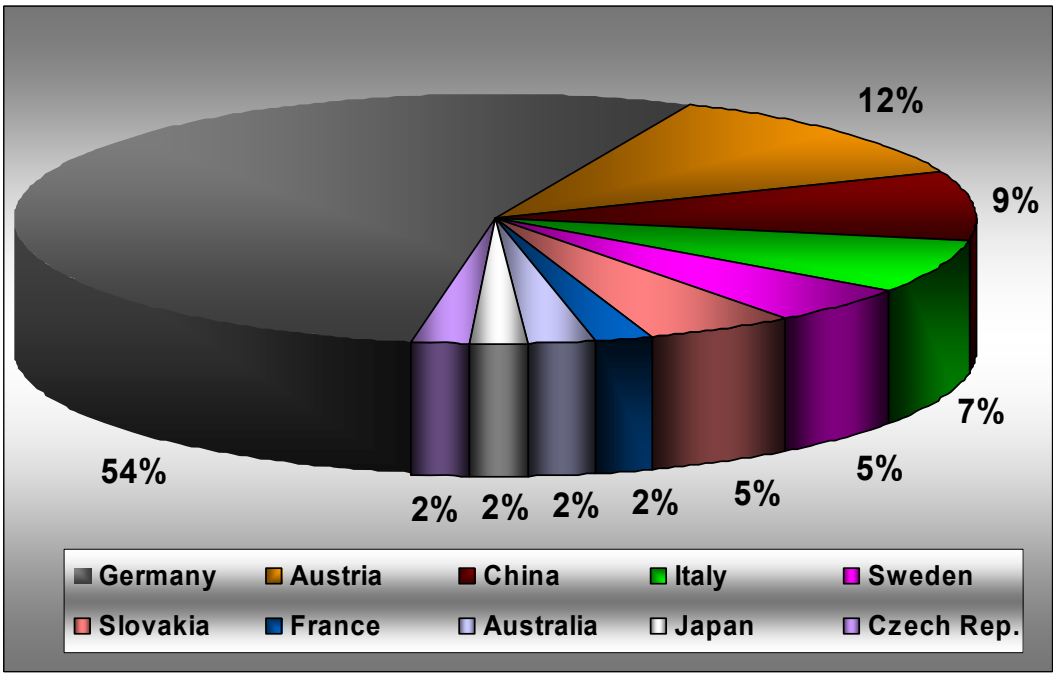

Figure 25: Percentage of foreign producers offer solar collectors on Polish market.

There are independent installers dealing with solar systems. The two companies biggest producers of flat plate solar collectors in Poland are HEWALEX and WATT which is shown below. In 2006 they covered nearly 73% of the market demand for solar collector.

Table 15: Total collectors areas produced by main producers in Poland

Producer	Total areas of sold collectors [m^2]	Total areas of sold collectors in Poland [m^2]	Total areas of export collectors [m^2]
	2005		
HEWALEX	12 664	11 048	1 616
	2006		
HEWALEX	15 602	14 372	1 230
WATT	9 900	8 415	1 485
∑	25 502	22 787	2 715
	2007		
WATT	13 500	10 125	3 375

The manufacturers and importers of solar collectors in Poland act as technical consultants and executor, i.e. they design the solar thermal systems, they provide the equipment and install it. For the installation of the solar thermal systems in some cases they have their own installers, and in other cases they use subcontractors. RAPID is one of the biggest company which install flat plate solar collectors in Poland. Between 2001 – 2007 this company installed more than 7 400 m^2 of solar collectors including 30 large installation (above 50 m^2). RAPID offering both types flat plate and vacuum tube collectors produced by national manufacturers (WATT, HEWALEX) and foreign companies (Viessmann, De Dietrich, Weishaupt).

Table 16: Total solar collectors areas installed by RAPID include only large installation

	2001	2002	2003	2004	2005	2006	2007
Total solar collectors areas installed by RAPID [m^2]	128	288	589	764	1 433,6	670	3 545,6

6. Employment

6.1. Manufacturing of components of solar thermal systems

On polish market 20 national and 10 foreign manufacturers of components of solar thermal systems are established. HEWALEX and WATT are the biggest producers of solar collectors and solar systems in Poland. In 2006 they covered nearly 73% of the market demand for solar collector. HEWALEX employs around 70 people.

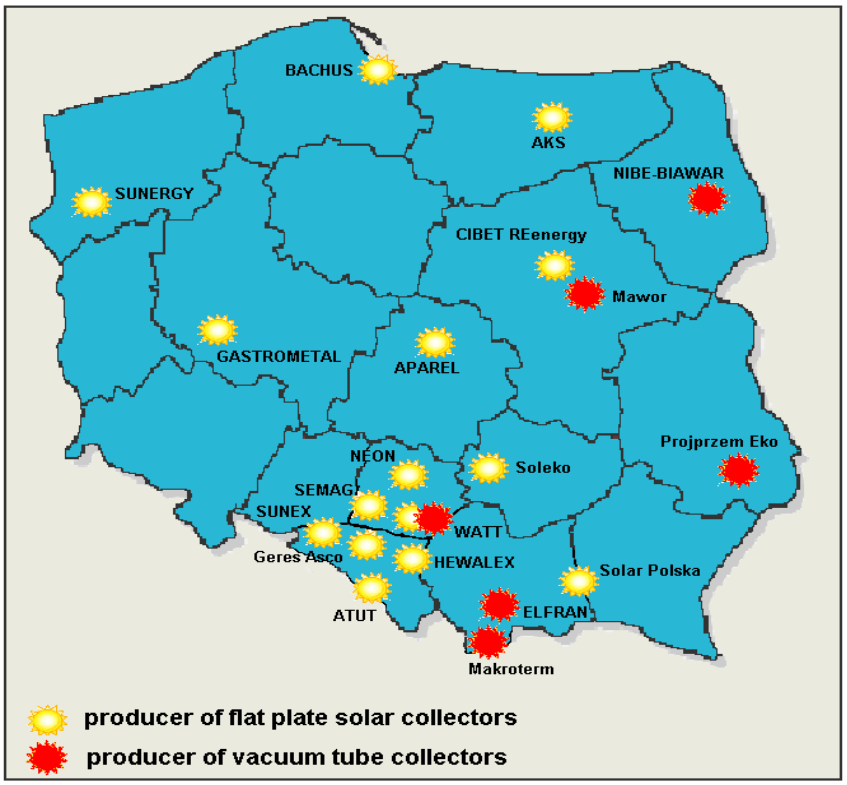

Figure 26: National manufacturers of solar collectors.

6.2. Installation and maintenance and distribution.

There are about 29 independent installers dealing with solar systems which offer delivery, installation and maintenance of solar thermal applications. A few of them are major firms which have distribution network around the country. Most of the other firms are small, which are dealing with heating systems in general and also offer solar collectors.

6.3. Sales and marketing.

There are about 40 companies which are dealing with sales of solar collectors. Most of them are rather small and don't have distribution network around the country.

Table 17: Results from questionnaire to producers/installers of solar thermal applications in Poland

Company	activity	the origin of the collectors	Sales in 2007 [m^2]	Prospects 2008/2009 [m^2]	Employment
Rapid	Installer, distributor	Poland, France, Germany	~ 10 000	~ 15 000	70
BMK Solar	distributor	China	~ 1 000	~ 610 (till June 2008)	12
ELHURT-KLIMA	distributor	China	~ 600	~ 800	10
SOLAR-THERM	distributor	Poland, Germany	~ 100	~ 600	< 10
SOLVER	distributor	Poland	~ 1 000	~ 10 000	10

PHU CZYSTA ENERGIA	distributor	Poland, Slovakia	-	-	< 10
TRADECO	distributor	Poland, Germany	-	~ 100	10
EKOEMITER	distributor	Poland, Germany	-	-	< 10
OZE Michal Gorski	distributor	Poland, Austria	-	~ 200	3
Mora Polska	distributor	Czech Rep.	-	-	30
PAM Zdzislaw Niedzialek	distributor	China	~ 600	~ 2 500	5

6.4. Testing, quality assurance and research.

There is one certified laboratory in Poland for testing solar collectors. Outdoor and indoor tests, accordingly EN standards, are being performed by Institute for Fuels and Renewable Energy, Jagiellońska street 55, 03-301 Warsaw.

6.5. Training and consultancy.

There is no association of the solar thermal companies in Poland, but there is the Polish Economic Chamber of Renewable Energy PIGEO, Gotarda street 9, 02-683 Warsaw. Trainings are mostly done by distributors, manufacturers, installers and in the framework of different projects funded through European Commission or other funds.

C. State of Production

7. Product technology and production methods

7.1. Product technology description

- Collectors (usual sizes in m^2) – installation consist of 3 collectors:
  - Gross surface of collector – 2,06 m^2 x 3 pcs. = 6,18 m^2
  - Absorber surface – 1,85 m2 x 3 pcs. = 5,55 m^2
- Absorber material – copper or aluminum.
- Surface treatment – black chrome or high selective absorber: ETA PLUS, TiNOX, Sunselect.
- Insulation – mineral wool.
- Transparent cover – tempered solar glass ~ 3 mm .
- Casing – welded, sheet metal of aluminum.
- Storage tank – capacity 300 dm^3.
- Cover – low iron glass.
- Pump – for a single installation, one pumping and control unit is used.
- Expansion tank – 18 l.
- Heat exchanger – single- and double-coil enamel heaters.
- Additional heating – central heating furnace.
- Application – domestic hot water preparation

Figure 27: Example of typical solar hot water systems.

7.2. Product technology description

7.2.1. Production methods and capacity

20 manufacturers in Poland are involved in collector production. Five of them produce vacuum-tube collectors. WATT generates both flat plate and vacuum tube collectors.

Most of the producer import the absorbers and the rest is produced and assembled in Poland.

Polish manufacturers of flat plate solar collectors had to adapted new technical and formal requirements. Most of high quality polish products confirm certificates: Total Quality Management ISO 9001:2000 (TUV Certificate - TUV 2008-07-11), Efficiency and energy performance SPF Nr

C824; C825 (certificates issued by independent The SPF Solartechnics Institute in Switzerland) and certificate SOLAR KEYMARK DIN EN 12975-1:2006-06.

8. Breakdown of solar systems costs

Table 18: Solar systems costs for typically sized systems

Solar Systems Costs for Typically Sized Systems		
	6m²	**9,1 m²**
Total costs (excl. VAT)	400 Euro / m^2	448 Euro / m^2
VAT (%)	110 Euro / m^2	112 Euro / m^2
Total cost (incl. VAT)	**510 Euro / m^2**	**560 Euro / m^2**

1 € = 3.3558 PLN (02.07.08)

Figure 28 below give the percentage cost breakdown of an average system ($6m^2$) produce in Poland for single family houses. The most expensive part of solar system is solar collector (38%). Average purchase price of 2 m^2 of flat plate solar collector equal 298 Euro. Of course in case of foreign producers or vacuum tube collectors purchase price is higher. Cost of storage and assembly amount to almost 50 % cost breakdown of an average solar system.

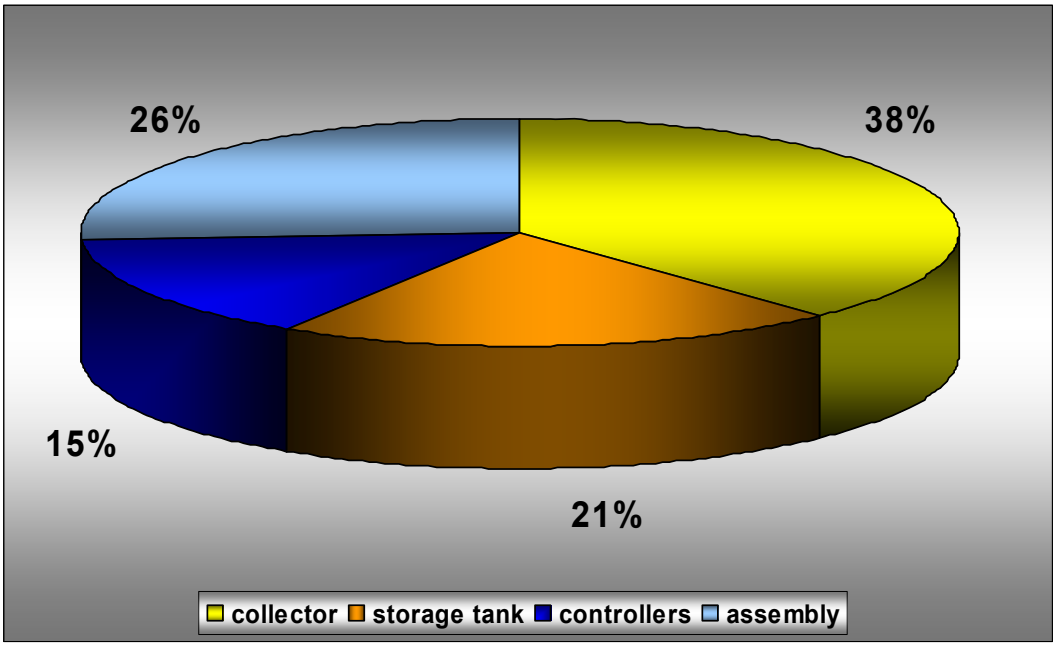

Figure 28: Percentage cost breakdown of an average solar system ($6m^2$) produce in Poland for single family houses.

Table 19: Prices comparison for solar systems of one of the major producers Hewalex which coverage nearly 73% market demand for solar collector in 2006

Solar system 2008	Elements	min.Price (Euro)	max.Price (Euro)
Solar set with 2 collectors and heater 250 l	2 flat plate selective collector 2,09 m2 or 2 vacuum-tube selective collector 1,82 m2, water storage 250 l, pump, management system, additional components	2 038,26	2 455,45
Solar set with 3 collectors and heater 300 l	3 flat plate selective collector 2,09 m2 or 3 vacuum-tube selective collector 1,82 m2, water storage 300 l, pump, management system, additional components	2 523,39	3 145,60
Solar set with 4 collectors and heater 400 l	4 flat plate selective collector 2,09 m2 or 4 vacuum-tube selective collector 1,82 m2, water storage 400 l, pump, management system, additional components	3 226,35	4 049,11
Solar set with 5 collectors and heater 500 l	5 flat plate selective collector 2,09 m2 or 5 vacuum-tube selective collector 1,82 m2, water storage 500 l, pump, management system, additional components	3 731,45	4 759,52
Solar set with 5 collectors and heater SIS S500/150l	5 flat plate selective collector 2,09 m2 or 5 vacuum-tube selective collector 1,82 m2, water storage 500 l, pump, management system, additional components	4 093,51	5 142,74

1 € = 3.3558 PLN (02.07.08)

9. Typical solar domestic hot water systems

9.1. Characteristics of a typical DHW system for a single family house

- System type – pumped system.
- Collector type – flat plate solar collector
- Collector area – 6 m^2 .
- Collector area per person – 1,5 m²/person
- Hot water storage – 300 liters.
- Hot water demand at 60°C – 150 l/d
- Price per m² system costs – 510 €
- Eventual subsides – not available.

Figure 29: General view of single-family house.

9.2. Characteristics of a typical DHW system for a dwelling

- System type – pumped system.
- Collector type – flat plate solar collector.
- Collector area – 128 m^2.
- Collector area per person – 0,26 m^2/person.
- Collector area per dwelling - 0,46 m^2/dwelling.
- Hot water storage – 4 800 liters.
- Eventual subsides – EcoFund (max. 40%) and National Fund of Environmental Protection and Water Management

Figure 30: General view of building – collectors field.

9.3. Characteristics of a typical DHW system for multi-family houses in Gdynia

- System type – pumped system.
- Collector type – flat plate solar collector
- Collector area – 50 m^2.
- Collector area per person (m^2/person)
- Hot water demand at 60°C
- Hot water storage – 2 500 liters.
- Hot water demand at 60°C – 2 000 l/d
- Eventual subsides – EcoFund (max. 40%) and National Fund of Environmental Protection and Water Management .

Figure 31: General view of multi-family houses.

9.4. Characteristics of a typical DHW system for a hospital in Warsaw

- System type – pumped system.
- Collector type – flat plate solar collector.
- Collector area – 163 m^2.
- Collector area per person – 0,2 m^2/person.
- Hot water demand at 50°C – 6 749 m^3/ year
- Hot water storage – 8 000 liters.
- Eventual subsides – EcoFund (max. 40%) and National Fund of Environmental Protection and Water Management.

Figure 32: general view of the roof of the hospital in Warsaw

9.5. Characteristics of a typical DHW system for a swimming pool in Gostynin

- System type – pumped system.
- Collector type – flat plate solar collector.
- Collector area – 153 m^2.
- Collector area per person (m²/person)
- Hot water demand at 60°C
- Hot water storage – 9 500 liters.
- Eventual subsides – EcoFund (max. 40%) and National Fund of Environmental Protection and Water Management.

Figure 33: General view of building of swimming pool.

9.6. Characteristics of a typical DHW system for district heating in Wolomin:

- System type – pumped system.
- Collector type – flat plate solar collector
- Collector area – 380 m^2.
- Hot water demand at 60°C – 12 000 liters/day.
- Eventual subsides
    - o EcoFund – 40%

Figure 34: General view of DHW system for district heating in Wolomin.

9.7. Characteristics of the biggest DHW system in Poland, located in Czestochowa:

- System type – pumped system.
- Collector type – flat plate solar collector.
- Collector area (absorber area) – 1 500 m^2.
- Collector area per person – m^2/person.
- Hot water demand at 60°C – 53 m^3/ day
- Hot water demand at 60°C – 19 500 m^3/ year
- Hot water storage – (liters).
- Total system cost – 1 285 876 €
- Price per m² system costs – 857 €/m^2
- Amortization based on the present energy price
- Eventual subsides:
    - EKOFUND – 41,92 %
    - National Fund for Environmental Protection and Water Management - 16,82%

Figure 35: General view of collectors field of the biggest DHW system in Poland.

9.8. Typical consumer motivation

- Single family house: pay-back period is diminished with rising energy prices; so solar collectors are fashionable for people with enough income, because without any co-financing the pay-back period is still to long

- Dwelling: motivation of investor in newly built dwellings based on the fact if they obtain co-financing from EcoFund or not.

- Hospital and public building sector: mostly projects co-financed through EcoFund and National Fund of Environmental Protection and Water Management

- Hotels and sport facilities: if solar installation is more than 50 m^2 of solar collectors, there is a chance for co-financing through EcoFund and National Fund of Environmental Protection and Water Management

10. Typical solar combi systems

10.1. Characteristics of a typical combi system in a single family house

- System type – pumped system.
- Collector type - Vacuum tube collector
- Collector area – 9,5 m^2.
- Heat storage 500 liters.
- 2 Pumps
- Expansion tank – 80 liters
- Heat exchanger – double-coil enamel heater
- Additional heating – central heating furnace
- Collector area per heating load (m^2/kW)
- Price per m^2 system costs – 560 €
- Amortization based on the present energy price
- Eventual subsides- not available.

10.2. Typical consumer motivation

- Single family house: pay-back period is diminished with rising energy prices; so solar collectors are fashionable for people with enough income, because without any co-financing the pay-back period of combi systems is higher than for typical solar systems

- Dwelling: motivation of investor in newly built dwellings based on the fact if they obtain co-financing from EcoFund or not.

- Hospital and public building sector: mostly projects co-financed through EcoFund and National Fund of Environmental Protection and Water Management

- Hotels and sport facilities: if solar installation is more than 50 m^2 of solar collectors, there is a chance for co-financing through EcoFund and National Fund of Environmental Protection and Water Management

11. Conventional water heating and energy prices

Table 20: Conventional water heating and energy prices

Conventional Energy Prices 2007		
Date: 2007	**Housing** (without taxes)	**Collective** (without taxes)
Electricity	0,0945 Euro/ kWh	0,0541 Euro/ kWh
Fuel - Oil	1122,13 Euro/ 1 000 l (VAT inl.)	
Natural gas	8,764 Euro/ GJ	7,5448 Euro/ GJ
District heating	11,17 Euro/ GJ	Euro/ kWh
Other (specify)	Euro/ kWh	Euro/ kWh

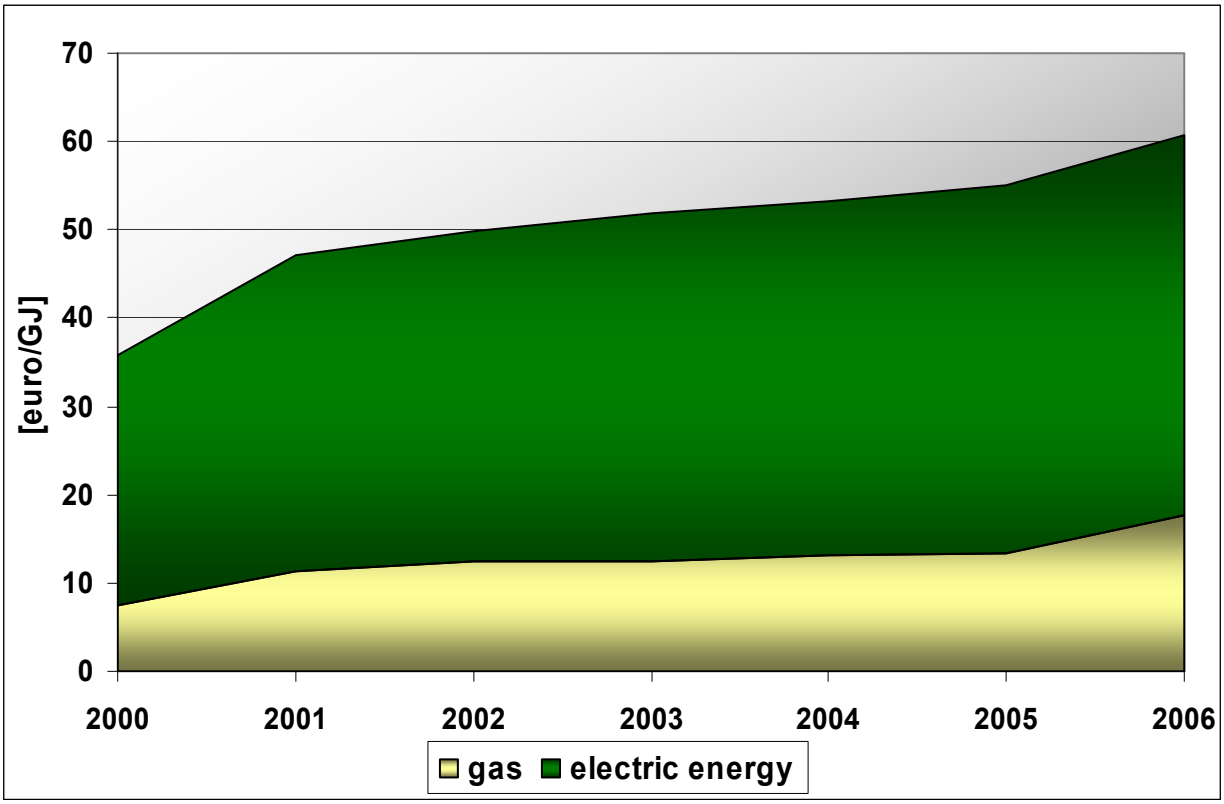

Figure 36: Growth of gas and electric energy prices in 2000 – 2006.

12. Standards and codes of practice

In Poland there is no obligation for certification of solar collectors, but there is one laboratory in Poland for testing solar collectors, which is authorized to give the needed certificates.

Producers of solar collectors in Poland usually perform tests and certify their products, but it isn't obligatory. So if they achieve good results for their products they advertise with the certificate, but if they don't, there is no need to publish the results of the measurement.

Table 21: List of standards concerning solar systems equipment

PN-76 B-02440	Protection of hot water system
PN EN 12975-1	The manufacturing of solar systems and their components
PN EN 12975-2	The testing and requirements of solar systems and their components, relevant to energy efficiency
PN EN 12975-2:2006	T he testing and requirements of solar systems and their components, relevant to their reliability (e.g. mechanical and electrical safety, weathering resistance etc)
PN EN 12976-1:2006	Thermal solar systems and components. Factory made systems. General requirements
PN EN 12976-2:2006	Thermal solar systems components. Factory made systems. Test methods

In Poland there is one certified laboratory for testing solar collectors. Institute for Fuels and Renewable Energy Jagiellońska street 55, 03-301 Warsaw perform outdoor tests accordingly EN standards.

13. Level of R & D

The best example of R & D activities on the solar thermal market in Poland is the company WATT. The Polish manufacturer WATT produces flat plate solar collectors with their own production technology of the absorber. The dynamic growth of WATT allowed company to become the first Polish company which produces vacuum collector based on glass tubes insulated with vacuum. In mid-year WATT plans to begin the production of the WATT 3000 S/SU+ collectors, whose absorbers will have structural surface.

D. State of Marketing

14. Distribution and marketing methods

In Poland 47 MW_{th} of solar thermal capacity were newly installed in 2007 (67 000 m^2). It gave 62% more than in the previous year. In the last years we can observe steady growth of solar thermal market in Poland. From the big UE countries, only Poland is not yet seen amongst the top solar thermal markets. In 2007, Polish share of the total EU market was estimate for 2% of European sales. But with increasing sales and a growth domestic industry, they are expected to increase this share. With 6,1 m^2 per 1 000 capita, Poland remains one of the most promising markets for strong growth in the coming years in the central part of Europe.
The solar collectors' market approximately consists of more than 90 companies involved in production, distribution and installing services. Some of them are in the heating business and additionally distribute solar collectors. HEWALEX and WATT are the biggest producers of flat plate solar collectors in Poland. In 2006 they coverage nearly 73% of the market demand for solar collector. Except the large producers of solar collectors in Poland, also small family companies which produce not more than 500 m^2 per year are existing. Unfortunately those companies can't afford the investment for new technologies. Besides Polish manufacturers, distributors of foreign companies which make up 47% of all producers on national market play an active part on the market. They produce 39% of all types of solar collectors on the Polish market.
The manufacturers and importers of solar collectors in Poland act as technical consultants and executor, i.e. they design the solar thermal systems, they provide the equipment and install it. For the installation of the solar thermal systems in some cases they have their own installers, and in other cases they use subcontractors. Majority of manufacturers of solar collectors in Poland execute direct sale, dimensioning and consulting or assembly thru distributors and installers network. Only a few producers execute direct sale and assembly by their own, mainly small family companies.
After analyses the data as above we can make conclusion that this two companies HEWALEX and WATT are the biggest producers and exporters of flat plate solar collectors in Poland. In 2006 they export together more than 2 715 m^2 of solar collectors. It means that average export rate in this companies equal almost 12%. In 2007 WATT company was increased export more than twofold and achieved number of 3 375 m^2 of exported solar collectors.
More than 50% imported solar collectors come from Germany due to numerous distributors of German companies in Poland (Viessmann, Buderus, Vaillant, Wolf…). 12% of imported solar collectors are produced in Austria (Sonnenkraft, Solektor…). Recently we can observe a notable increase number of imported solar collectors or components (vacuum tube collectors) from China. Share of collectors from China was estimated for 9% of foreign collectors on Polish market. Rest of the foreign producers play a minor rule on the polish market.

14.1. Brief historic overview of distribution and marketing methods used up to now

In Poland the solar collectors' market approximately consists of more than 90 companies involved in production, distribution and installing services. Some of them are in the heating business and additionally distribute solar collectors. HEWALEX and WATT are the biggest producers of flat plate solar collectors in Poland. In 2006 they coverage nearly 73% of the market demand for solar collector.

14.2. Role of manufacturers, of specialized installers and heating and ventilation equipment distributors in distribution and marketing

Majority of manufacturers of solar collectors in Poland execute direct sale, dimensioning and consulting or assembly thru distributors and installers network. Only a few producers execute direct sale and assembly by their own, mainly small family companies.

14.3. Use of solar collectors as standard facilities in housing projects

There is no practice of use of solar collectors as standard facilities in housing projects in Poland. Some investors in new housing buildings decide to install solar collectors with the construction of the building but there are no special incentives for this.

14.4. Guaranteed solar results contracts as marketing incentives for collective installations

There is no practice of guaranteed solar results contracts in Poland and they haven't been applied so far.

14.5. Percentage of distribution through wholesalers, installers and users

It is hard to estimate precisely percentage through wholesalers, installers and users in Poland, but for sure we can say that the distribution is mostly done by the installers which co-operate with national and foreign manufacturers and distributors of solar thermal systems.

14.6. After-sale methods

- Usual maintenance needs. Percentage of system retrofit market.

14.7. Promotion activities

In Poland exist several fairs specialized for RES, but there are two the biggest international fairs: POLEKO in Poznan and ENEX – New Energy in Kielce.

- This year's POLEKO, held under the auspices of the Minister of the Environment, was larger than its previous very successful edition and attracted almost 1,000 exhibitors and represented companies from 21 countries - Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Italy, the Netherlands, Japan, Liechtenstein, Lithuania, Norway, Poland, Russia, Slovakia, Spain, Sweden, Switzerland and the United States.

- As a result of ENEX – New Energy, in the exhibition halls of Kielce Trade Fairs there were stands prepared by almost 120 exhibitors from Poland, Germany and Sweden. ENEX – New Energy featured equipment used in the power industry, state-of-the-art technological systems, network equipment, solar collectors, wood fueled furnaces, radiators, biomass boiler rooms, and biofuel-powered vehicles.

14.8. Usual guarantees

The guarantee for the solar collectors in Poland is varied but usually is between 5 and 15 years.

15. Incentives and financing methods

15.1. What kind of financial incentives have been used in the past and are used presently and at what level?

The system of financial support for environmentally clean technologies is based on environmental protection funds, i.e. on the National Fund for Environmental Protection and Water Management and funds of particular provinces (voivodships). Such funds are managing the environmental fees and penalties, of which some part is fed back to RES investments as low - interest loans or subsidies.

The system was created at the beginning of nineteen's to realise Ecological Policy of Poland including the fulfilment of international obligations concerning environmental issues.

The RES development was not initially defined as a separate task of the system. The awareness of the RES role in the realisation of the sustainable energy policy has been systematically increased in Poland during the last decade. *The Development Strategy of Renewable Energy Sector* was just passed by the Parliament in 2001. The strategic objective is the increase of the share of energy from renewable sources in Poland's primary energy balance to 7.5% in 2010 and to 14% in 2020.

The development of renewable energy projects is facing financial problems. These problems are related to the high investment costs although operational costs are relatively low. Given the current level of prices of fossil fuels, the above cost structure is the reason why the payback time of renewable energy projects is long. The lack of necessary know-how and experience in the formulation and financing of projects are yet further problems.

Currently, systems utilising renewable energy sources are often not economically viable in Poland. Financial mechanisms addressed directly to the independent producers of energy from renewable sources are insufficient.

The system of financial support for environmentally clean technologies operation is characterised by well-established and effective structure as presented below.

EUROPEAN COMMISSION	MINISTRY OF ENVIRONMENT	MINISTRY OF FINANCE

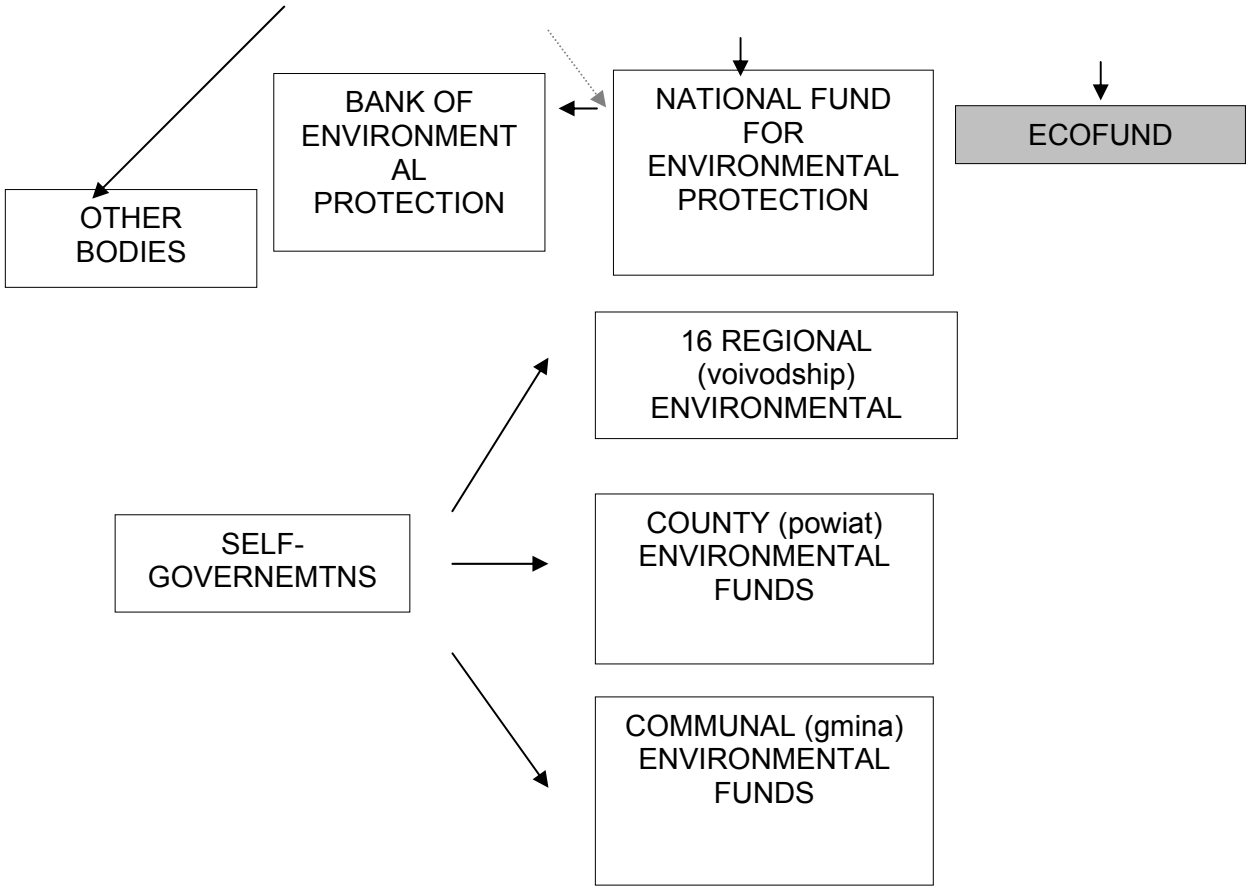

Figure 37: The financial RES scheme

The system of environmental funds in Poland consists of four levels. National Fund for Environmental Protection and Water Management (NFOŚiGW) is the central one. Sixteen Regional Funds for Environmental Protection and Water Management constitute the regional level. Both the national and the regional funds are legal entities and they take independent decisions in the field of choosing investments to be financed, the way the investors will be supported and conditions on which the support will take place. County (powiat) and communal (gmina) environmental funds support the environmental funds system. They are neither legal entities nor independent from the organisational structures of local authorities. They are not allowed to grant loans, neither. Environmental funds gather financial means from fees for using the environment, fines for exceeding limits and mineral rights. They also redistribute the money along with the national ecological policy.

The National Fund for Environmental Protection and Water Management exists to protect the natural environment of Poland. Through subsidies and preferential loans the National Fund supports initiatives serving the improvement of the state of nature and ecology. Special attention is given to ecological activities adapting Poland to the European Union Standards.

NFOSiGW was established on the basis of the amended Act of April 27th 1989 concerning shaping and protection of nature. It began operating on July 1st of the same year.

The main objective of the National Fund is financing projects, which serve the protection of the environment. These projects have been described in the "National Environmental Policy" adopted by the Polish Parliament in 1991 and specified in the "Implementation Programme for the National Environmental Policy by the year 2000". The Minister of Environment supervises the implementation of the principles defined in these documents.

A priority list of programs planned for the National Environmental Protection and Water Management Fund for financing in 2003 comprises of e.g.:

- Air protection from contamination through the prevention and reduction of pollution emissions and conservation of raw materials and energy,
- Using alternative and environmentally friendly energy sources.

The National Fund for Environmental Protection and Water Management is the largest institution financing environmental protection projects in Poland. The mission of the Fund is to provide financial support for undertakings of national or interregional scale. The financial resources of the National Fund constitute of the funds designated for investments serving environmental protection and for the improvement of the state of natural environment in our country. The primary aim of the environmental protection funds is pollution control.
Special loans with an ecological focus are provided by the fund. The loans from the National Fund are soft loans from 0.2 to 1.0 times the Polish base rate, for up to 50% of total project costs (gminas can be supported up to 70%). Loans are available for 20 years, however usually they are granted for 5 years. Every year around 800 projects receive support from the National Fund. Usually 200 projects receive loans and the rest grants.

The National Fund for Environmental Protection and Water Management is utilising services of Environmental Protection Bank (BOŚ) to realise its goals. The Environmental Protection Bank is a universal, commercial Bank specialised in financing activities connected with environmental protection and water management. The main objective of the Bank's activities is to strengthen its position within the banking sector and to maintain a leading role in the banking services for the environmental protection in Poland.
In the rapidly developing Polish market, a competitive and comprehensive range of services is offered by BOS SA to companies, institutions involved in production, distribution and to local government units, regardless of their nature or specific kind of business.
This Bank has both the infrastructure and experience to undertake the responsible task according to its ecological mission, expert lending team operating in the field of environmental protection projects. The BOS SA Environment Bank is owned by the National Fund (NFOSiGW) and the commercial bank. BOS acts as a banking partner providing commercial finance to invest with money from the National Found. On the base of agreement between NFOŚIGW and BOS special credit lines have been established to support RES investments (the interest rate of 0.5 of the rediscount rate). The soft loans are provided to geothermal plants, small hydro, biomass boilers of less than 5 MW installed power, biofuels production, heat pumps and solar collectors.

15.2. Public supports for investments

15.2.1. ECOFUND

EcoFund is a foundation created in 1992 by the Ministry of Finance to efficiently administer the money derived from the conversion of a part of the foreign debt of Poland into a fund intended to support environmental protection projects (within a mechanism usually referred to as "debt-for-environment swap"). To date, decisions to join the Polish-debt-for-environment-swap scheme were taken by the USA, France, Switzerland, Italy, Sweden (to expire at the end of 2003), and Norway.
The EcoFund's task is to subsidize environmental protection projects that are not only important for the region or the whole country but also help to attain ecological goals recognized by the international community as all-European or even global priorities.
Five environmental protection sectors have been declared in the EcoFund's Statutes as priority areas. One of the priorities is the reduction of emissions of gases that cause global changes (climate protection). Inside this priority the projects promoting the use of solar energy (solar collectors and photovoltaic panels) can be financed.
EcoFund may financially support both the projects having just been started and those where the project implementation process is more advanced, unless the degree of financial engagement

exceeds 60% on the day of submission of the Application to EcoFund. Any departure from this rule may only be allowed as an exception and requires justification.
In consideration of the administrative costs incurred by the Foundation, an EcoFund grant awarded for a single project may not be lower than € 12 908.

Examples

Solar collector system supporting district heating network in WOŁOMIN
District heating plant being the subject of consideration is located in small town Wołomin north-east of Warsaw. It is operated by Wołomin District Heating Company. The central heating plant supplying heating network uses fine coal as a primary fuel that is exceptionally supplemented by oil or natural gas. The hot district water temperature at the network inlet is changed between 70^{o}C during the summer months to 120^{o}C in winter. Every day of operation about 12 m^3 of heat carrier is lost from the heat distribution line as a result of network pipes leaking.
The main task of planned installation is preheating of 12 m^3 water per day for supplementing uncontrolled network leakage. Solar system has to satisfy several restrictions including limited space for collector location and necessity of using the typical small size commercially available solar collectors. As a result of our considerations the 349 m^2 installation with 196 flat plate solar collectors arranged in 3 independent loops connected to single 17.5 m^3 storage tank has been designed. Analysis of the system operation shows that during summer months presented installation should supply up to 70% of essential energy required for supplementary water heating up to 70^{o}C, which is the summer network inlet temperature.

Economics and environment protection of planned solar installation
The total estimated investment cost is € 144 572 (413 € per collector square meter). The assumption was made that subsidy of 40% is available from public means. That reduces the the cost to 86 743 €. For such volume the investment economic indicators are determined. The economic indicators are highly dependent on the fuel that is being replaced by solar energy. The comparison was performed for the cases when solar system reduced the fine coal, natural gas or oil.

15.3. Third party financing

ESCO companies in Poland mainly realize projects relevant energy efficiency. ESCO financing is used for many sectors of economy, especially in companies which have a large potential for saving energy due to lighting, heating or waste management. Some times it is used to realize solar projects and installation but not so often.

15.4. Other incentives

E. Future Prospects

16. National energy policy

Although a new attitude toward renewables is being under development, a very strong coal energy lobby still exists in Poland. There are many obstacles to involve renewables in Polish energy consumption balance. However, historically the use of renewables in Poland was considerable. This was mainly due to hydropower and burning of biomass, i.e. wood and peat. Especially hydroenergy had good tradition in Poland. After the Second World War about 30 % of primary energy demand was provided by hydroenergy.
The potential of renewables in Poland is high. Renewable energy in Poland, due to the location of the country, geographical and climatic conditions, can have following forms:

⇒ direct forms of solar energy, which includes:
- decentralised methods of utilisation of solar energy and its photo-thermal conversion in low temperature systems, i.e.:
  - active solar heating systems with flat plate solar collectors, so called solar space and water heating;
  - passive solar heating systems - solar architecture.
- decentralised methods of utilisation of solar energy and its photo-electric conversion in photovoltaics systems.

⇒ indirect forms of solar energy - secondary effects of solar radiation:
- hydroenergy;
- wind energy,
- biomass;
- environmental heat (used by heat pumps)

⇒ other sources of renewable energy:
- geothermal energy.

The rational use of renewable energy sources is one of the important elements of the country's sustainable development. The degree of use of renewable energy sources depends on their availability and the technologies of their processing.

Fundamentals of regulation concerning renewable energy are included in the Energy Law. Passed by the Parliament on 10 April 1997, this act covers principles of development of the state energy policy, principles and terms of supply and use of fuels and energy, including heat and of operation of energy enterprises, and also determines organs appropriate in issues of the fuels and energy economy. Therefore, the Act defines the basic legal framework for utilization of renewable energy sources as a part of the energy sector.

16.1. Targets

Poland has set several targets for Renewable Energy:
- 2010: In *Energy Policy of Poland until 2025* and *the Renewable Energy Sector Development Strategy*, the Polish government formulates its intent to increase the share of renewable energy in the primary energy balance to 7.5%.
- 2010: 7.5% Renewable Electricity production of the national electricity gross consumption as the indicative target in the Directive 2001/77/EC.
- 2010: 10.4% Renewable Electricity sold to final consumers as an obligation to the power utilities (suppliers) in the Decree of the Minister of Economy of November 3rd, 2006.

The production of RES-E in 2005 was 3.8 TWh, which equals the 3.5% of the power sold to the final consumer.

16.2. Green certificates and quota obligation system

In 2005 the amendment to the Energy Law established a supporting mechanism for RES which can be classified as "green certificates", which is accompanied by quota obligation mechanism. The Decree of the Minister of Economy of 19 December 2005 (Journal of Law 05.261.2187) and its amendment of November 3rd, 2006 define the detailed scope of "green certificate" system.
Energy undertaking involved in generation of or trading in electricity and selling this energy to final consumers connected to the system within the boundaries of the Republic of Poland is obliged, to the extent specified in the secondary regulations, to:

1) acquire the certificate of origin and present it to the President of the Energy Regulatory Authority (URE) for cancellation, or
2) pay the compensation fee, calculated in accordance with the method presented below:

The compensation fee is calculated in accordance with the following formula:

$$Oz = Ozj \times (Eo - Eu)$$

where the symbols are:

- Oz – the compensation fee expressed in PLN,
- Ozj – the compensation fee unit amounting to 240 PLN per MWh,
- Eo – the amount of electricity, expressed in MWh, stemming from the obligation to acquire certificates of origin and to present them for cancellation, in the particular year,
- Eu – the amount of electricity, expressed in MWh, stemming from the certificates of origin, which the energy undertaking presented for cancellation in the particular year.

The compensation fee unit indicated by symbol Ozj, is subject to annual valorisation by the mean-annual consumer price index from the calendar year preceding the year for which the compensation fee is calculated, determined in the communication of the President of the Central Statistical Office and announced in the Official Journal of the Republic of Poland 'Monitor Polski'.
The President of ERA announces the compensation fee unit after its valorisation in the Bulletin of the Energy Regulatory Authority not later than on 31 March of every year.
The compensation fee constitutes the income of the National Fund for Environment Protection and Water Management, and is paid into a designated account of this fund until 31 March of each year, for the previous calendar year.
The supplier of last resort is obliged, insofar as specified in the regulations issued, to purchase electricity generated in renewable energy sources connected to networks located within the area of operation of the supplier of last resort, offered by energy undertakings which acquired licenses for its generation; such purchase is made at average electricity sales price for the previous calendar year.
Energy undertaking involved in trading of heat and selling this heat is obliged, insofar as specified in the regulations issued, to purchase offered heat generated in renewable energy sources connected to the network located on the territory of the Republic of Poland, in the amount not exceeding the demand of this undertaking's consumers connected to the network, to which the renewable energy sources are connected.
Energy undertaking involved in generation of or trading in electricity and selling this energy to final consumers, connected to the network on the territory of the Republic of Poland, is obliged, insofar as specified in the regulations issued, to purchase offered electricity co-generated with heat in energy sources connected to the network located on the territory of the Republic of Poland.
The Decree of the Minister of Economy of November 3rd, 2006 (Journal of Law 06.205.1510) states minimal values eligible as levels of fulfilling the imposed obligation, in terms of particular years up to 2014. The share of RES-E refers to the electricity sold by energy enterprises to final consumers. Every 5 years Minister of Economy presents a report describing targets for the share of energy from renewable sources in national electric energy consumption. Current document describes targets until year 2014.

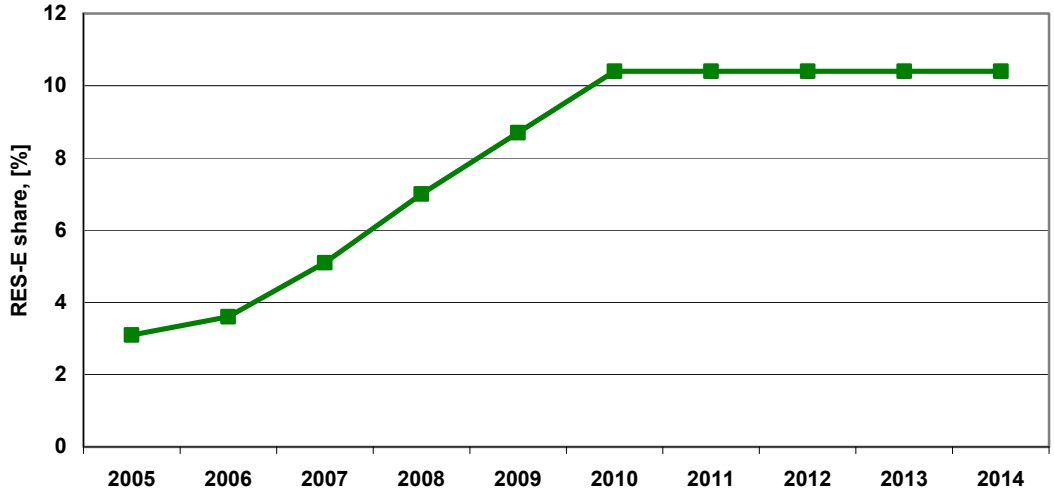

Figure 38: Minimal values of RES-E share in electricity sold by energy enterprises to final consumers, accordingly the Decree on November 3rd, 2006.

Table 22: National targets for renewable energy - Electric energy from RES – the share RES-E in electricity sold to final consumers

	Current plan consistent with the target for 2010 accordingly Directive 2001/77/EC
	%
2007	5,1
2008	7,0
2009	8,7
2010	10,4
2011	10,4
2012	10,4
2013	10,4
2014	10,4

The green certificate system, introduced in 2005, caused the growth of green electricity generation. The RES-E share increased up to 2.9% (2005) compared to the 2.1% in 2004. The co-firing was the main component of the RES-E share growth. In Fig. 30 the RES-E shares, accordingly EUROSTAT data is provided.
In general, it can be said that biomass (agricultural, industrial, and forest wastes and biogas) and wind energy realistically offer the largest potential to be used in Poland, with the current energy prices and terms of state aid. Next in line are water energy and geothermal energy resources. Solar technologies, in turn, (despite the enormous technical potential), due to low cost-effectiveness in relation to electricity generation, may in practice play a role only in heat generation.

The sources representing the biggest potential in Poland (with their predicted share in national electric energy consumption – totally 7.5%) are:

- Biomass 4%;
- Wind 2.3%;
- Hydro 1.2%.

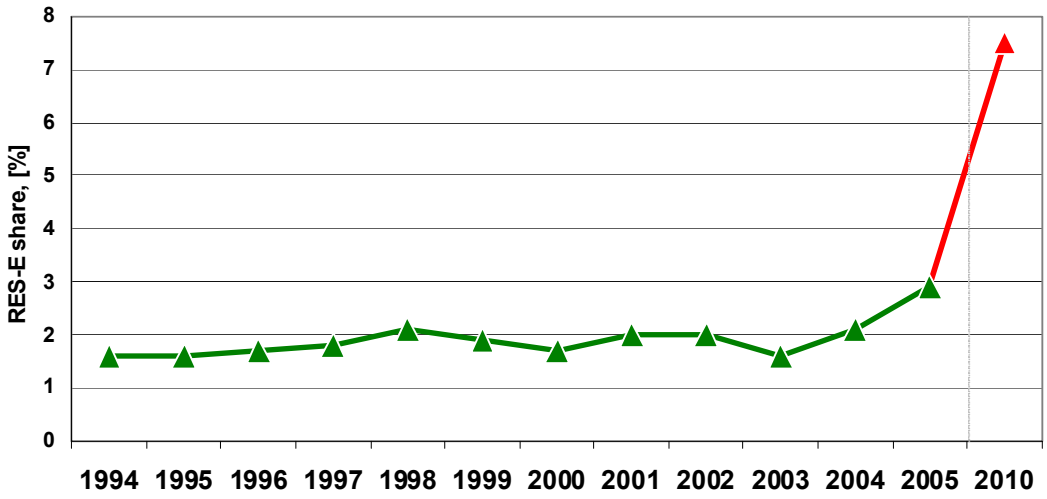

Figure 39: Share of electricity generated from renewable in total national consumption – historical data and indicative target for 2010

16.3. Development of renewable energy sources in the light of Energy Policy of Poland until 2025

The rational use of renewable energy sources is one of the important elements of the country's sustainable development. The degree of use of renewable energy sources depends on their availability and the technologies of their processing. In general, it can be said that biomass (agricultural, industrial, and forest wastes and biogas) and wind energy realistically offer the largest potential to be used in Poland, with the current energy prices and terms of state aid. Next in line are water energy and geothermal energy resources. Solar technologies, in turn, (despite the enormous technical potential), due to low cost-effectiveness in relation to electricity generation, may in practice play a role only in heat generation.
The strategic objective of the State's policy regarding renewable energy sources is the promotion of this energy's development to reach the 7.5% share of renewable energy in the primary energy balance. This should be carried out in such a way as to ensure the utilization of different kinds of renewable energy sources. The competition will promote the most economically-effective sources, which will prevent excessive increase of energy cost for consumers. This should be the fundamental principle for development of use of renewable energy sources.
The share of electricity from RES in the total gross consumption of electricity in the country should attain 7.5% in 2010. This is in line with the indicative quantitative objective stipulated for Poland in Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources.
The question of further increase of RES share in the country's fuel and energy balance after 2010 will be determined in the course of government work on amending the renewable energies development strategy. Nevertheless, the projected dynamic increase of total electricity consumption until 2025 will anyhow bring about the need to increase electricity production from renewable energy sources.

Achievement of targets designated by the energy policy doctrine in the perspective of 2025 requires cooperation of state bodies in the individual areas of this policy, especially in those, which are connected with covering the increments of demand for fuels and energy, improvement of competitiveness and energy efficiency of the economy, and with the limitation of energy sector's impact on the natural environment.

For long-term action directions until 2025 concerning:
1) generation capacities of domestic fuels and energy sources,
2) volume and types of stocks of fuels,
3) transport capacities, including cross-border connections,
4) energy efficiency of the economy,
5) protection of the environment,
6) development of use of renewable energy sources,
7) restructuring and ownership changes of the fuels and energy sector,
8) research and development work,
9) international cooperation,

a package of executive tasks until 2008 has been prepared, and persons responsible for accomplishment of these tasks have been appointed.

In order to ensure the proper position of renewable energy sources within the power industry, actions should be executed in the following directions:

1. Maintaining the stable support mechanisms for the use of renewable energy sources - It is planned that until 2025 support mechanisms for the development of energy from RES will be used. It is particularly important to ensure the stability of these mechanisms, i.e. to create conditions for safe investing into RES. Continued monitoring of support mechanisms is planned, as well as their enhancement, if needed. Any substantial amendments to these mechanisms will be implemented with appropriate notice, so as to guarantee stable conditions for investment.
   Support of the development of Renewable Energy Sources (RES) and of cogenerating sources, including local generation with the use of market mechanisms is indicated as the 5th key principle of the energy policy doctrine formulated in Energy policy of Poland until 2025.
2. The use of biomass in electricity and heat generation **-** In Polish conditions the technologies using biomass will remain the fundamental line of development of RES, but use of biomass for energy purposes should not lead to shortages of timber in wood, cellulose, paper and wood-using industries. The use of biomass will have a substantial influence on the improvement of agricultural and forest management, and should be an important element of agricultural policy. It is assumed that biomass obtained for energy generation will come largely from energy crops. It is also planned to use a wide range of biomass contained in various types of industrial and communal waste, not only from plant and animal production, to create new opportunities for dynamic development of local enterprise. However, intensive cultivation of energy crops must guarantee that the necessary intensive fertilization will not lead to deterioration of environmental conditions (water, land)
3. Intensification of use of small-scale water power - Activities will be undertaken with the view to increasing by 2025 the capacity installed in small-scale water power plants. Conditions will be determined for location and construction of new small-scale hydro-electricity generation facilities, including facilities taking maximum advantage of the existing stages of fall on water courses for energy generation. It is also assumed that the installed capacities of the existing small-scale water power plants will be increased through modernisation and extension, taking account of conditions concerning fish restitution planned by agriculture.
4. Increased use of wind power - Significant progress in technologies for the use of wind power observed in recent years among technologies using RES makes wind power one of the fastest-developing branches of industry. Activities are planned to facilitate investment conditions also in this field of renewable energy sources. The necessary solutions are foreseen aiming at the enhancement of co-operation between wind power plants and the national power system. Actions to this end must not clash with environmental protection requirements (NATURA 2000). Possibilities of establishing offshore wind farms in the Baltic Sea coastal area should be evaluated from the network point of view.
5. Increase of share of bio-components in the liquid fuel market – successive increase in bio-components share in the overall volume of liquid fuels brought into the Polish market is

assumed. Actions in this respect will concentrate first of all on implementation of the Community regulations.

6. Development of industry for renewable energy generation - Development of use of renewable energy sources brings positive effects linked first of all with professional activation in the areas with high unemployment, thus stimulating the development of agricultural production, increase of employment, and development of industry and services for renewable energy. The growing use of renewable energy sources will be accompanied by the growth of industry operating for renewable energy. Particular activities are foreseen for the development of manufacturing of equipment for wind power facilities. The degree of development of this branch of industry should go beyond domestic demand and create opportunities for profitable export of these devices.

In order to implement the above mentioned directions the following executive actions are planned for realization until 2008:

Ad. 1. A system analysis of types of support mechanisms for development of use of renewable energy sources in order to possibly modify the solution adopted in Poland – realized under the leadership of the minister responsible for economy in cooperation with the minister responsible for public finances and the minister responsible for environment.

Ad. 2. a) Elaboration of biomass balance with regards to its availability for energy purposes and as regards the distance from combustion sources –realized under the leadership of the minister responsible for agriculture in cooperation with the minister responsible for environment and the minister responsible for economy.
b) Initiative for the inclusion of new EU Member States in the EU system of direct payments to all energy crops – realized under the leadership of the minister responsible for agriculture.

Ad. 3. Elaboration of the concept of combining the development of wind power with pumped-storage power stations – realized under the leadership of the minister responsible for economy.

Ad. 4. Conducting analysis indicating optimal locations for wind power generation – realized under the leadership of the minister responsible for environment in cooperation with the minister responsible for construction, spatial development and housing.

Ad. 5. Preparation of a proposal of a regulation ensuring implementation of Directive 2003/30/EC *on promotion of the use of bio-fuels and other renewable fuels for transport* – realized under the leadership of the minister responsible for agriculture in cooperation with the minister responsible for economy, the minister responsible for transportation, the minister responsible for environment and the minister responsible for education.

16.4. Strategy for solar energy

The Renewable Energy Sector Development Strategy, adopted by Parliament in 2001, refers to solar energy directly. In annex 4 of above document, scenarios of renewable energy technologies development for the year 2010 are included. No specific action plan, in particular relevant to solar energy, followed the *Renewable Energy Sector Development Strategy.*

It is important to note that the percentage of energy produced from solar collectors won't be higher than 1% of total energy production from RES in 2010.

Air collectors are most frequently used at farms for crop drying. They are operated for 300-600 hours per year on average. Liquid collectors are mainly used for heating water in homes, camping and summer cottages, sports and recreation facilities, livestock buildings and fodder stores. Also, liquid solar collectors heat up water in tanks and swimming pools as well as process water in small industrial plants.

17. Local bodies, prescribers, certification

In our country exist the Polish Centre for Accreditation. This is the national accreditation body authorized to accreditation of certification and inspection bodies, testing and calibration laboratories and other entities conducting conformity assessments and verifications on the basis of the Act of Parliament of 30 August 2002 on conformity assessment system (Off. J. No 166, item 1360 with further changes).

Polish Centre for Accreditation was established on 1 January 2001 on the basis of the Accreditation Office of the Polish Centre for Testing and Certification (PCBC) and the Calibration Laboratories' Accreditation Department of the Central Office of Measures (GUM), taking over employees, liabilities and commitments of the above institutions within the accreditation activities, including:

- over 430 granted accreditations
- experienced and highly qualified personnel
- proved procedures
- a wide database of auditors
- international relations

Both, Polish Centre for Testing and Certification (continuing activity of its predecessor - the Central Office for Product Quality) and the Central Office of Measures have previously carried out, for a long time, appropriately:

- assessment and authorization of testing laboratories for certification purposes according to ISO/IEC Guide 25 and ISO/IEC Guide 45
- assessment and authorization of calibration laboratories for the purpose of the national metrological infrastructure.

The first certificate of accreditation, issued as a result of accreditation process carried out in accordance with the requirements of European Standards of 45000 series, was issued: for testing laboratory in 1992, for certification body in 1993, for calibration laboratory in 1997 and for inspection body in the mid of 2000.

17.1. Solar energy laboratories, tests centres: existing organisations

- Institute for Buildings Mechanization and Electrification of Agriculture in Warsaw, 02-532 Warsaw, Rakowiecka street 32; http://www.ibmer.waw.pl

Figure 40: Station in Institute for Buildings Mechanization and Electrification of Agriculture in Warsaw performing outdoor tests of solar collectors

- Institute of Fundamental Technological Research of Polish Academy of Sciences, division Solar Energy Engineering, 00-049 Warsaw, Świetokrzyska Street 21; http://www.ippt.gov.pl
  This laboratory perform scientific researches for solar devices and solar domestic hot water systems. Investigation are made for manufacturers and consumers according to the following standards: ISO 9806-1:1944 and ASHREA 93-77.

17.2. Solar energy certification

- In Poland there is one certified laboratory for testing solar collectors. Institute for Fuels and Renewable Energy Jagiellońska street 55, 03-301 Warsaw perform indoor tests accordingly EN standards. http://www.ecbrec.pl
  The scope of Institute for Fuels and Renewable Energy is performing scientific research & development as well as service and technical assistance for polish fuel sector and Renewable Energy Sector. The main subject of Institute for Fuels and Renewable Energy activity are alternative energy sources for transport and heating.

Figure 41: Station in Institute for Fuels and Renewable Energy in Warsaw performing indoor tests of solar collectors accordingly EN standards.

17.3. List of main technical offices/consultants specialized in solar projects and prescribers

Main technical offices/consultants are a part of companies deal with distribution, production and assembly of solar collectors.

17.4. List of existing training organizations and specialized professional schools

Trainings are mostly done by distributors, manufacturers, installers and in the framework of different projects funded through European or other funds.

17.5. Companies, organizations and manufacturers

See Annex A.

17.6. Institutions totally or partially concerned by solar energy

- Polish Solar Energy Society PTES-ISES; Świętokrzyska street 21, 00-049 Warsaw, phone: (+48 22) 660-52-27 website: www.ippt.gov.pl
- EC Baltic Renewable Energy Centre EC BREC, Warsaw Office - Jagiellońska steet 55, 03-301 Warsaw, phone: (+48 22) 510-02-00, fax: (+48 22) 510-02-45, e-mail: warszawa@ecbrec.pl, website: www.ecbrec.pl
- Renewable Energy Association, Ogrodowa street 59a, 00-876 Warsaw, phone: (+48 22) 433-12-38, fax: (+48 22) 433-12-39, e-mail: biuro@seo.org.pl, website: www.seo.org.pl
- Polish Economic Chamber of Renewable Energy PIGEO, Gotarda street 9, 02-683 Warsaw, phone: (+48 22) 548-49-99, fax: (+48 22) 548-49-98, email: pigeo@pigeo.org.pl, website: www.pigwo.pl
- Polish Association for Energy Certification, Wołyńska street 22, 60-637 Poznań, phone: (+48 61) 846-02-35, fax: (+48 61) 846-02-09, e-mail: ptce@ptce.pl, website: www.ptce.pl
- Economic Chamber of Polish Heat Engineering Elegijna street 59, 02-787 Warszawa, phone: (+48 22) 644-70-19, fax: (+48 22) 644-70-99, e-mail: igcpwaw@pro.onet.pl, website: bi.warszawa@igcp.org.pl

18. Objectives for the solar industry / market

There isn't any objectives for the solar industry / market in polish law. According to national forecast for 2030, the energy potential of solar collectors only in agriculture can equal 60 PJ, including 34,4 PJ for domestic hot water. This forecast seems hard to be achieved, because the implementation of the solar collector systems in agriculture is not fast enough

18.1. Prospects for market development by sector

18.1.1. Public services sector

Hospitals, Health care centers

The Central Statistic Office estimated that in Poland in 2005 exist 861 hospitals with total number of beds 222 735 and more than 4 000 Health care centers. Most of them require thermo modernization, so it is good opportunity to install flat plate solar collectors. Assuming that every 4th hospital in Poland will make thermo modernization, including installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 10 000 m^2 collectors areas.

Schools

The Central Statistic Office estimated total number of schools in 2005 and it is equal more than 39 000. Most of school buildings have been constructed in '70. The energy was delivered from district heating systems, individual boilers and coal fired stoves. Most of this buildings require thermo modernization, so it is good opportunity to install flat plate solar collectors. Assuming that every 10th school buildings which is occupied during the summer period in Poland will make thermo modernization, including installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 200 000 m^2 collectors areas.

Social Welfare Facilities

According the Central Statistic Office the number of Social Welfare Facilities in 2004 was 1 154. Assuming that every 10th Social Welfare Facilities in Poland will make thermo modernization, including installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 5 500 m^2 collectors areas.

Fire Stations

The Central Statistic Office estimated total number of Fire Stations in 2004 and it is equal more than 17 268. Assuming that every 10th Fire Stations in Poland will make thermo modernization, including installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 86 000 m^2 collectors areas.

18.1.2. Hotels, hostel, holiday houses

Generally, hotels sector in Poland including many types of facilities, for example: five stars hotels and camping sites. The Central Statistic Office estimated total number of hotel facilities in 2004 and it is equal nearly 7 000. In 2004 the number of hotel facilities decline nearly by 613 compared with 1995. But the number of hotels and motels increased. In 2004 in Poland exist 1 202 hotels with different standards, 116 motels and 241 holiday houses. The biggest hotels facilities have nearly 71 000 rooms, where can accommodate nearly 140 000 people. Assuming that every third hotel, motel or holiday house in Poland will make installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 26 000 m^2 collectors areas.

18.1.3. Multi – family buildings

According to official statistical data from 2005, Poland has approximately 12.8 million dwellings. The total usable area is about 885 million m^2. Almost 59% of the housing units are privately owned, 27% are owned by housing co-operatives and 10% by municipalities. The Central Statistic Office estimated the total number of dwellings owned by the housing co-operatives in 2005 and it is equal nearly 3 429 000. According to Population and Housing Census (2002) 23.1% of buildings have been constructed before 1945, 26.9% between 1945 and 1970 and 50% between 1971 and 2002. Most of this buildings require thermo modernization, so it is good opportunity to install flat plate solar collectors.

18.1.4. Church units

The Central Statistic Office estimated that in Poland in 2004 exist 10 066 Church Units. Assuming that every 10th Church Units in Poland will make thermo modernization, including installation of the large scale solar collectors systems (more than 50 m^2), this will give the result of more than 50 000 m^2 collectors areas.

19. Strategy to overcome the barriers to market development

19.1. Description of major barriers by category

19.1.1. Technical

- insufficient number of domestic economic entities involved in the manufacturing of solar collectors equipment on a larger scale;
- the lack of tax preferences for import/export of equipment and components for the systems utilising solar energy,
- knowledge about planning, installing and maintaining large solar thermal systems is poor,

19.1.2. Institutional

- the lack of regulations clearly defining a programme and policy concerning the utilisation of solar thermal
- lack of associations focus manufacturers, distributors, installers of solar collectors, which will promote and lobby solar systems and renewable energy sources generally
- lack of regional cell of innovation centres connecting with solar enterprises
- lack of legal and regulatory frameworks, limited institutional capacity, and excessive bureaucratic procedures
- No clear policy for promoting energy-saving technologies and RES
- the lack of objectives for the solar industry / market

19.1.3. Economic

- insufficient economic mechanisms in the state budget, including particularly tax mechanisms permitting adequate benefits from relatively high capital-intensive investments in facilities, installations and plants for the generation of energy from solar thermal systems,
- The subsidies are mostly available for large solar systems, but small investors don't have possibilities to have financial support,
- The solar installations are still very expensive with long playback period,
- The credits for RES investment do not cover the expectations of the consumers,
- Lack of tax reduction for investment concern with RES,
- The relatively high initial investment; especially high investment without any financial support due to too high VAT tax for solar thermal devices,
- Not enough preferences for using RES and complicated procedures for obtaining co-financing from The National Fund for Environmental Protection and Water Management.

19.1.4. Cultural

- the lack of easy access to information on the distribution of the usable energy potential of individual solar thermal systems;
- insufficient information on consulting, design and manufacturing companies involved in issues relating to solar collectors systems;
- the lack of easy access to information on procedures concerning the preparation and execution of investments in solar thermal systems and standard costs of an investment cycle on the one hand, the lack of information on economic, social and environmental benefits relating to the utilisation of renewable energy sources on the other;

19.1.5. Educative

- Low level of marketing and promotion,
- an inadequate primary and post-primary school syllabus which does not recognise renewable energy sources,
- Lack of scientific bodies and institutes for application of new technologies and their mass use,
- the lack of education and training programmes concerning solar thermal systems and targeted at engineers, design engineers, architects, representatives of the energy sector, banks and decision makers,
- Lack of regional (municipality or government organization) for proper dissemination and promotion of RES (especially solar thermal technology).

19.1.6. Quality

- some difficulties concerning quality, especially the maintenance of solar systems i.e. misty (steam) collectors, worn out isolation.

19.2. Description of main measures needed to extend the solar thermal market by category

19.2.1. Institutional

- the establishment of Association for solar thermal systems, which will protect both the interests of stakeholders and end-users;
- the establishment of solar legislation obligatory for all new buildings or completely renovated to cover some share of hot water needs from solar thermal energy;
- the changes in Energy Law to favor RES installations;
- Create regional bodies responsible for development RES investment.
- Adoption of certain rules and norms for the encouragement of the installation of solar systems;
- Simplify building law in order to encourage to investment of RES.
- Simplifying the application documents for application to tenders and other schemes.

19.2.2. Economic

- New National Fund for supporting RES utilization should be established instead of EcoFund because EcoFund association finishes activity at 2010,
- To apply economic preferences for installing thermal collectors and systems (e.g. reduced VAT),
- Many more state incentives for using solar thermal,
- Reduction of the price of solar collectors and high quality local production.

19.2.3. Educative

- Large scale campaign for presenting the economic and environmental benefits from solar thermal applications,
- More media articles and TV and radio spots for information on solar thermal applications,
- Pro-ecological education in primary and secondary school,
- Regional campaigns for promoting the economic and environmental benefits from solar thermal applications.

19.2.4. Technical

- Training technically of installers,
- Promoting and dissemination of innovative energy savings technologies,
- Not to allow on the market collectors and systems which do not fulfill the European quality standards.

19.2.5. Quality

- Application of guaranteed solar results contracts.

19.3. Suggestions from key actors for contribution of the TRANS SOLAR project

Most companies involved in solar thermal in Poland consider that helpful would be to organize business missions for development of partnerships between Polish and other European organizations.

- transfer of experience regarding marketing and advertisement of solar thermal applications as well as technologies and technological aspects,
- transfer of experience regarding incentives in Europe for encouraging the market of solar thermal applications.

20. Concluding remarks

From above analysis of national solar thermal market we can conclude that Polish market appear now as dynamic evolving market. Year by year the national market develops more and more, also national companies involved in solar thermal (manufacturers, distributors, installers and consulting companies). The biggest manufacturers develop faster than other due to certain position on the market and export to European Union countries. Moreover the amount of distributors of foreign manufacturers systematically increase. According this fact we can say that there is a strong competition between solar producers on the national market. In order to stimulate the polish market, the government should subsidize solar thermal investments (even for single family houses) and develop a support system for national manufacturers.
In coming years a change will happen for support mechanism of RES investments due to fact that on 7 December, the European Commission approved the operational programme provided with the biggest European funds ever in the framework of the Cohesion Policy 2007-2013. It is a Polish project for the environment and infrastructures, provided with 27.9 billion. Essentially, the money comes from the Cohesion Fund.

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- "Efficiency and quality tests according to SPF Institute" Ireneusz Jelen, Myslowice 2002.
- Watt solar systems www.watt.pl
- Hewalex solar systems www.hewalex.com.pl
- Prerequisites of the RES development are included into the Guidelines for Energy Policy of Poland until 2020, verified by the Governmental document Assessment of Implementation and Amendment to the 'Guidelines for Energy Policy of Poland until 2020".
- *POLAND 2025 - Long-term Strategy for Sustainable Development* – assumes an increase of the share of renewable energy in the primary energy balance of Poland to minimum 14% in the year 2020.

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Annex A: Solar Thermal Directory

List of firms producers, suppliers and installers of solar thermal systems in Poland

No	Name	Address	Telephone/Fax	E-mail	website	Services
1	ATUT Spółka z o.o.	ul. Korfantego 37 43-400 Cieszyn	33 857 90 32 33 857 90 33	biuro@atut.cieszyn.pl	www.atut.cieszyn.pl	National manufacturers of Air collectors
2	Bachus P.P.H.U.	ul. Nowiny 40 80-020 Gdańsk	58 306 65 90 58 301 21 21	bachus@op.pl	www.bachus.com.pl	National manufacturers of flat plate water collectors
3	ELFRAN	ul. Krasińskiego 10 34-400 Nowy Targ	18 2662210 018 2641490	elfran@ceti.pl	www.elfran.com.pl	National manufacturers of vacuum tube collectors
4	Aparel Sp. z o.o.	ul. Nowe Sady 10 94-102 Łódź	42 689 33 78 42 689 33 78	aparel@aparel.com.pl	www.aparel.com.pl	National manufacturers of flat plate water collectors
5	Gastrometal Alvo Grupa	ul. Południowa 21a 64-030 Śmigiel		office@gastrometal.pl	www.alvo.pl	National manufacturers of flat plate water collectors
6	HEWALEX	ul. Witosa 14 a 43-512 Bestwinka	32 214 17 10 32 214 17 10	hewalex@hewalex.com.pl	www.hewalex.com.pl	National manufacturers of flat plate water collectors a vacuum tube collectors
7	Mawor s.c.	ul. Kasprzykiewicza 45 05-200 Wołomin Leśniakowizna	22 374 44 99 22 787 80 08	mawor@mawor.pl	www.mawor.pl	National manufacturers of vacuum tube collectors
8	NEON	ul. Przemysłowa 3 42-262 Poczesna	34 324 51 61 34 324 51 61	neon@neon.new.pl	www.neon.new.pl	National manufacturers of flat plate water collectors
9	Polska Ekologia	ul. Spokojna 14 62-025 Kostrzyn Wielkopolski Siekierki	61 897 82 42 61 897 82 42	robert.debicki@polskaekologia.com.pl	www.polskaekologia.pl	National manufacturers of flat plate water collectors
10	Projprzem EKO Sp. z o.o.	ul. Osiedlowa 1 89-203 Zamość k. Bydgoszczy	52 384 00 25 52 384 00 26	peko@projprzemeko.pl	www.projprzemeko.pl	National manufacturers of vacuum tube collectors
11	Solar Polska Grzegorz i Eugeniusz Byczek	ul. Migowska 54d 80-287 Gdańsk	58 340 66 00 58 340 66 06	kt@solar-polska.pl	www.solar-polska.pl	National manufacturers of flat plate water collectors
12	Sunenergy Solar Technik	ul. Jęczydół 16 73-108 Kobylanka	91 561 10 80 91 561 10 81	sunenergy@neostrada.pl	www.sunenergy.pl	National manufacturers of flat plate water collectors a vacuum tube collectors
13	WATT Sp. z o.o.	ul. Narutowicza 15 41-503 CHORZÓW	32 736 20 81 32 736 20 81	info@watt.pl	www.watt.pl	National manufacturers of flat plate water collectors a vacuum tube collectors
14	SEMAG	Ul. Janika 4 41 - 800 Zabrze	32 271 64 51 32 277 52 31	info@semag.com.pl	www.semag.pl	National manufacturers of flat plate water collectors

15	SUNEX	ul. Piaskowa 7 47-400 Racibórz	32 414 92 12 32 414 92 13	info@sunex.pl	www.sunex.pl	National manufacturers of flat plate water collectors
16	Makroterm	ul. Sienkiewicza 22 34 - 500 Zakopane	18 202 07 42 18 202 07 41	zakopane@makroterm.com.pl	www.makroterm.pl	National manufacturers of flat plate water collectors
17	Geres Asco Sp. z o. o.	Powstańców Warszawskich 33a 42-680 Tarnowskie Góry	601 87 30 54	geres_asco@interia.pl	www.geresasco.com	National manufacturers of flat plate water collectors
18	AKS Sp. z o.o.	Bikupiec 11-300 ul. Chrobrego 28	089 715 44 96	budownictwo@aks.ibc.pl	aks.ibc.pl	National manufacturers of flat plate water collectors
19	CIBET REenergy Sp. z o.o.	al. Krakowska 197 02-180 Warszawa	22 573 97 33 22 573 97 57	info@cibeteenergy.pl	www.cibetreenergy.pl	National manufacturers of flat plate water collectors
20	NIBE-BIAWAR Sp. z o.o.	Al. Jana Pawła II 57 15-703 Białystok	85 662 84 90 85 662 84 09	kolektory@biawar.com.pl	www.biawar.com.pl	National manufacturers of vacuum tube collectors
21	De Dietrich	ul. Mydlana 1 51-502 Wrocław	71 345 00 51 71 345 00 64		www.dedietrich.com.pl	Foreign manufacturers of flat plate water collectors a vacuum tube collectors
22	Paradigma	ul. Kruczkowskiego 27 41-300 Dąbrowa Górnicza	32 261 01 00 32 261 01 01		www.paradigma.pl	Foreign manufacturers of vacuum tube collectors
23	Schott Poland Sp. z o.o.	ul. Migdałowa 4/70 02-796 Warszawa	22 645 12 06 22 645 12 09		www.schott.pl	Foreign manufacturers of vacuum tube collectors
24	Schuco International Sp. z o.o.	al.Jerozolimskie 181 02-222 Warszawa	22 608 50 00 22 608 50 06		www.schueco.pl	Foreign manufacturers of flat plate water collectors r collectors
25	Sonnen-Kraft	ul. Lipowa 2 44-100 Gliwice	32 330 15 00 32 330 15 00		www.technikagrzewcza.pl	Foreign manufacturers of flat plate water collectors a vacuum tube collectors
26	STIEBEL ELTRON Polska	ul. Instalatorów 9 02-237 Warszawa	22 846 69 08	techniczny@stiebel-eltron.com.pl	www.stiebel-eltron.pl	Foreign manufacturers of flat plate water collectors
27	Vaillant	al. Krakowska 106 02-256 Warszawa	22 323 01 00 22 323 01 13		www.vaillant.pl	Foreign manufacturers of flat plate water collectors a vacuum tube collectors

28	Velux Polska Sp. z o.o.	ul. Dzika 2 00-194 Warszawa	22 33 77 000 22 33 77 090		www.velux.pl	Foreign manufacturers of flat plate water collectors
29	Viessmann Sp. z o.o.	ul. Puławska 41 05-500 Piaseczno	22 71 14 400 22 7114 401		www.viessmann.pl	Foreign manufacturers of flat plate water collectors a vacuum tube collectors
30	Wolf	al.Stanów Zjednoczonych 61A 04-028 Warszawa	22 516 20 60 22 516 20 61		www.wolf-polska.pl	Foreign manufacturers of vacuum tube collectors
31	BMK Solar Sp. z o.o.	ul. Azotowa 21 41-503 Chorzów	32 245 90 74 32 245 91 74	biuro@bmksolar.pl	www.bmksolar.pl	Distributors of flat plate water collectors vacuum collectors
32	Capito Polska Sp. z o.o.	ul. Sielska 10 60-129 Poznań		info@capito.pl	www.capito.pl	Distributors of flat plate water collectors vacuum collectors
33	CIBET Sp. z o.o.	ul.Krakowska197 02-180 Warszawa	22 57 39 733 22 57 39 721	cybet@cibet.com.pl	www.cibet.com.pl	Distributors of flat plate water collectors
34	Czysta Energia PHU	ul. Kościuszki 3 43-330 Wilamowice	606 92 55 47	biuro@czystaenergia.bielsko.pl	www.czystaenergia.bielsko.pl	Distributors of flat plate water collectors vacuum collectors
35	Diaterm	ul. Gen. Stanisława Maczka 33 52-201 Wrocław	71 789 98 50	biuro@diaterm.wroclaw.pl	www.diaterm.wroclaw.pl	Distributors of flat plate water collectors
36	DOZAL & Solar System	ul. Spokojna 1 32-082 Bolechowice	12 641 19 33	dozal@kolektory-sloneczne.biz	www.dozal-solarsystem.pl	Distributors of flat plate water collectors vacuum collectors
37	ECOMARK P.P.U.H.	ul. Rzeszowska 2 60-468 Poznań	61 822 17 35	ecomark@poczta.onet.pl	www.ecomark.pl	Distributors of flat plate water collectors
38	Ekoemiter	ul Gen. Sosnkowskiego 17/12 02-249 Warszawa	22 8676603	ekoemiter@ekoemiter.com.pl	www.ekoemiter.com.pl	Distributors of flat plate water collectors vacuum collectors
39	Ekoszok	ul. Obotrycka 14c 71-684 Szczecin	91 422 73 49 91 422 16 21	info@ekoszok.pl	www.ekoszok.pl	Distributors of vacuum tube collectors
40	ELAR PHU	ul.Przemysłowa 1a 83-000 Pruszcz Gdański	58 773 00 90	info@elar.com.pl	www.elar.com.pl	Distributors of flat plate water collectors vacuum collectors
41	Elhurt-Klima	ul. Gąsocińska 12 00-711 Warszawa	22 651 06 67 22 642 06 06	elhurt@optimus.waw.pl	www.elhurtklima.com.pl	Distributors of vacuum tube collectors
42	Energia Odnawialna	ul. Bluszczowa 1 85-361 Bydgoszcz	52 379 79 21	info@energia-odnawialna.pl	www.energia-odnawialna.pl	Distributors of flat plate water collectors vacuum collectors
43	Euronom-Partners Sp. z o.o	ul. Słoneczna 28 66-200 Świebodzin	68 475 72 52 68 475 33 99	info@euronom.pl	www.euronom.pl	Distributors of vacuum tube collectors
44	Eurosolar	Ul. Wańkowicza 192 31-752 Kraków	12 644 10 67	eurosolar@neostrada.pl	www.eurosolar.pl	Distributors of flat plate water collectors vacuum collectors

45	Faba F.H.	ul. Rynek 25 44-300 Wodzisław Śląski	32 455 53 10 32 455 28 85	poczta@faba.com.pl	www.faba.com.pl	Distributors of flat plate water collectors
46	Hartmann Solar	ul. Radzionkowska 34 Świerklaniec	32 384 31 10 32 284 16 42		www.elco.pl	Distributors of flat plate water collectors vacuum collectors
47	IMPET FHU	ul. Kalwaryjska 25 30-504 Kraków	12 656 59 51 12 656 42 56	biuro@impet.net.pl	www.impet.net.pl	Distributors of flat plate water collectors vacuum collectors
48	Innotech Gdynia	ul. Bednarska 3 81-175 Gdynia	58 625 20 56 58 665 98 33	innotech@innotech.com.pl	www.innotech.com.pl	Distributors of flat plate water collectors vacuum collectors
49	Juma	ul. Dobra 24 60-595 Poznań	51 765 89 12	info@juma-energy.com	www.juma-energy.com	Distributors of flat plate water collectors vacuum collectors
50	Mora Polska Sp. z o.o.	ul. Wilczak 45/47 61-623 Poznań	61 855 23 50 61 855 27 47	marketing@mora.com.pl	www.mora.com.pl	Distributors of flat plate water collectors vacuum collectors
51	TERMALCO	Ul. Wilczak 45/47 61-623 Poznań	61 843 50 28	termalco@wp.pl	www.termalco.pl	Distributors of flat plate water collectors vacuum collectors
52	PAM – Zdzisław iedziałek	ul Rozkoszna 6 04-883 Warszawa	22 615 24 30 22 398 74 81	niedzialekz@poczta.onet.pl	www.pompyciepla.info	Distributors of vacuum tube collectors
53	PGK System Sp. z o.o.	ul. Szosa Gdańska 12 86-031 Osielsko	52 326 76 76 52 326 76 77	pgksystem@pgksystem.pl	www.pgksystem.pl	
54	piTERN – ekologiczna energia	ul. Ożarowska 42 61-332 Poznań	61 8710 938 61 8710 939	info@pitern.pl	www.pitern.pl	Distributors of flat plate water collectors vacuum collectors
55	RAPID PPUH Sp. z o.o.	ul. Prosta 7 21-500 Biała Podlaska	83 343 26 91 83 343 25 38	biuro@rapid.org.pl	www.rapid.org.pl	Distributors of flat plate water collectors vacuum collectors
56	ROTEX - Polska	ul. Sandomierska 326 25-330 Kielce	41 344 88 77 41 344 77 18		www.rotex.com.pl	Distributors of flat plate water collectors
57	Roth – Polska Sp. z o.o.	ul. Dekoracyjna 1c 65-722 Zielona Góra	68 320 20 72 68 453 91 02	service@roth-polska.com	www.roth-polska.com	Distributors of flat plate water collectors vacuum collectors
58	Roto-Frank Okna Dachowe Sp. z o.o.	ul. Lubelska 104 21-100 Lubartów	081 855 05 22 081 855 05 28	biuro.pl@roto-frank.com	www.roto.pl	Distributors of flat plate water collectors
59	MM Solar sp. z o.o.	ul. Siewna 15 Łódź	42 25 32 859	techniczny@heliosin.pl	www.heliosin.pl	Distributors of vacuum tube collectors
60	Solar-Bin	ul. T.Boya-Żeleńskiego 27 35-959 Rzeszów	17 850 40 40 17 850 40 50	doradcy@solar-bin.pl	www.solar-bin.pl	Distributors of flat plate water collectors
61	Solar-Pro Artur Radomski	ul. Faradaya 53 lok. 12 42-200 Częstochowa	34 363 43 25 34 360 18 09	biuro@solar-pro.pl	www.solar-pro.pl	Distributors of flat plate water collectors
62	Solar Shop	ul. Dr Putka 5/11 34-100 Wadowice	800 88 99 22	biuro@solarshop.pl	www.solarshop.pl	Distributors of flat plate water collectors vacuum collectors

63	Solektor Polska	ul.Baranowskiego 85 Bydgoszcz	52 581 66 11 52 581 67 10	sonergo@interia.pl		
64	Soltec s.c.	ul. Junkiewicz 4/93 03-543 Warszawa	22 679 77 04	biuro@soltec.pl	www.soltec.pl	Distributors of vacuum tube collectors
65	SOL-TERM (SOTIS PLUS)	ul. Jagiellońska 22 58-560 Jelenia Góra	75 64204 90 75 64204 90	info@eko-technika.pl	www.eko-technika.pl	Distributors of flat plate water collectors
66	Solver Sp. z o.o.	ul. Kossutha 6 40-844 KATOWICE	32 782 26 96 32 254 47 24	biuro@solver.katowice.pl	www.solver.katowice.pl	Distributors of flat plate water collectors
67	Sosiński Tadeusz PUH	Poznań	61 868 45 25	tsosinski@go2.pl	www.sosinski.com.pl	Distributors of flat plate water collectors flat plate va collectors
68	Stiebel Eltron Polska Sp. z o.o.	ul. Instalatorów 9 02-237 Warszawa	22 846 48 20 22 846 67 03	stiebel@stiebel-eltron.com.pl	www.stiebel-eltron.com.pl	Distributors of flat plate water collectors
69	Thermo-Solar Polska Energia Słoneczna	ul. Słonecznikowa 12 58-200 Dzierżoniów	74 831 90 58	biuro@energiasloneczna.com	www.energiasloneczna.com	Distributors of flat plate water collectors vacuum collectors
70	Urlich Sp. z o.o.	ul. Modlińska 248 03-152, Warszawa	91 422 73 49 91 422 16 21	info@ekoszok.pl	www.ekoszok.pl	Distributors of vacuum tube collectors
71	P.H.U. ALBA Marek i Irena Bosy Sp.j.	ul. Krzemieniecka 60a 54-613 Wrocław	71 374 40 60 71 357 71 02	biuro@alba.wroc.pl		Installers
72	Instalsystem s.j.	ul. Bielicka 82 85-135 Bydgoszcz	52 371 70 01 52 375 29 66	instalsystem@t-g.pl		Installers
73	NSG Nowoczesne Systemy Grzewcze	ul. Osmolińska 13 98-200 Zduńska Wola	43 823 81 97 43 823 81 97	NSG@onet.pl		Installers
74	P.P.H.U "KAMA" Mirosław Walczak	ul. Szczęśliwa 2 91-493 Łódź	42 659 41 11 42 659 41 11	info@kolektory.biz		Installers
75	PPHU AWEX WOŹNIAK ANDRZEJ	91-49 Gontyny 523 Łódź	42 678 78 98	awex@poczta.onet.pl		Installers
76	THERMOPLUS	ul. Łęczyńska 51 20-313 Lublin	81 746 30 31 81 746 29 39	thermoplus@neostrada.pl		Installers
77	ENERGO-TERM Greczkowski Krzysztof	ul. Ojcowska 9 31-344 Kraków	12 626 43 33 12 626 43 42	biuro@energo-term.com.pl		Installers

78	F.H.U. RAFEX Niemiec Rafał	ul. Glinik 43 31-990 Kraków	12 695 400 931 12 685 05 55	niemiecrafal@gazeta.pl		Installers
79	Firma Handlowa MPBP Eugeniusz Poręba	ul. Racławicka 24 32-200 Miechów	41 383 19 60	mpbp@miechow.com		Installers
80	P.P.U.H SZOT	Jurków 270 32-860 Czchów	14 684 22 03 14 684 22 03	szot@b-net.pl		Installers
81	Solarem	al. Pokoju 81 31-564 Kraków	600 099 888 12 378 33 32	biuro@solarem.eu		Installers
82	TISIN	ul. Sulisława 4 31-990 Kraków	663 800 830 294 33 33	robert@gp-grup.com.pl		Installers
83	EKOEMITER	ul. Sosnkowskiego 17/12 02-495 Warszawa	22 867 66 03 22 867 66 03	ekoemiter@ekoemiter.com.pl		Installers
84	F.H.U. JAND	ul. Ryżowa 97 05-816 Warszawa – Opacz	22 723 01 86 22 723 01 86	jand@jand.pl		Installers
85	MAWOR S.C.	ul. Kasprzykiewicza 45 05-200 Wołomin, Leśniakowizna	22 423 68 32 22 787 80 08	mawor@mawor.pl		Installers
86	TRADECO Odnawialne Źródła Energii	ul. Pajdaka 8/1 03-199 Warszawa	22 244 21 50 22 814 06 12	office@tradeco-oze.pl		Installers
87	UNITECH-LECH S.J.	al. Gen. L. Okulickiego 35-206 RZESZÓW	17 861 28 67	Biuro@unitech-lech.pl		Installers
88	UNITHERM sp.j.	ul. Kartuska 391 80-171 Gdańsk	58 323 75 00 58 732 23 69	unitherm@unitherm.pl		Installers
89	"TERMO-PERFEKT" Jan i Urszula Zembok	ul. Konstytucji 3 Maja 32 41-940 Piekary Śląskie	32 380 25 07	biuro@termo-perfekt.com.pl		Installers
90	F.H.U."Wod-Kan" Szymon Sapeta	ul .Stanowa 1310 34-381 Radziechowy	501 545 918	wod-kan10@wp.pl		Installers
91	MARWENT S.C.Szmidt Marian, Bomba Elwira	ul. Główna 63 42-622 Świerklaniec	32 390 26 46 32 390 26 26	biuro@marwent.pl		Installers

92	NAPRAWA SPRZĘTU AGD	ul. M. Skłodowskiej-Curie 7 44-200 Rybnik	32 422 52 97 32 422 35 44	biuro@agd-serwis.rybnik.pl		Installers
93	P.P.H.U Warmexll s.c B. Warmińska J. Warmiński	ul. Nankera 103 41-947 Piekary Śląskie	32 287 98 26 32 287 98 26	warmex2@o2.pl		Installers
94	RAD-INSTAL F.H.U.	ul. Gdańska 1 41-800 Zabrze	32 370 13 04 32 370 13 04	info@radinstal.pl		Installers
95	WIBTRONIC Spółka Jawna	ul. Wojska Polskiego 54B 25-389 Kielce	41 366 28 49 41 368 44 07	biuro@wibtronic.pl		Installers
96	Eko Systemy	Plac 23 Stycznia 4 i 63-400 Ostrów Wielkopolski	62 738 34 93 62 738 34 93	biuro@ekosystemy.com.pl		Installers
97	PITERN - Ekologiczna Energia	ul. Ożarowska 42 61-332 Poznań	61 8710 938 618 710 939	info@pitern.pl		Installers
98	P. H. U. EKOTERMBUD Majchrzak Moch Sp. Jawna	ul. Okrężna 2 75-736 Koszalin	94 341 03 83 94 341 03 83	ekotermbud@op.pl		Installers
99	RAPID PPUH Sp. z o.o.	ul. Prosta 7 21-500 Biała Podlaska	71 374 40 60 71 357 71 02	www.rapid.org.pl		Installers

Annex B: List of major legislative documents

Basic political documents concerning the RES are as follows:

- Resolution of the Parliament of Poland of July 8, 1999, on the Increase in Use of Energy from Renewable Sources.

- *The Renewable Energy Sector Development Strategy* (fulfilment of an obligation following the Resolution as above) - adopted by the Parliament on August 23rd 2001. The document formulates a strategic objective, which is the increase of share of energy from renewable sources in the Polish primary energy balance to 7.5% in 2010 and to 14% in 2020. As a phase of the Strategy's execution, an action plan will be worked out by the Government, covering all kinds of renewable energy sources and including assumptions and optimisation criteria common for hydro energy, utilisation of biomass energy, as well as wind, solar and geothermal energies.

- Prerequisites of the RES development are included into the *Guidelines for Energy Policy of Poland until 2020*, verified by the Governmental document *Assessment of Implementation and Amendment to the 'Guidelines for Energy Policy of Poland until 2020*".

- *POLAND 2025 - Long-term Strategy for Sustainable Development* – assumes an increase of the share of renewable energy in the primary energy balance of Poland to minimum 14% in the year 2020 and the utilisation of energy generated from waste to minimum 1%.

- *The Second Ecological Policy*.

Basic legislation relevant to RES

The issues relating to Renewable Energy Sources are regulated in Poland by basic acts as follows:

- the Energy Law,
- the Environmental Protection Law,
- the Act on Geological and Mining Law,
- the Water Law,
- the Act on Waste.