Intelligent Energy Europe

TRANS-SOLAR

SLOVENIAN NATIONAL REPORT

University of Ljubljana – Faculty of Mechanical Engineering

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A. Introduction

1. Overview of the country

1.1. Meteorology: temperatures, global daily radiation

Slovenia lies at the intersection of four major European geographic regions: the Alps, the Dinarides, the Pannonian plain, and the Mediterranean. Its climate is Sub-Mediterranean on the coast, Alpine in the mountains and continental with mild to hot summers and cold winters in the plateaus and valleys to the east. The average temperature is -2°C in January and 21°C in July. The average rainfall is 1,000 mm at the coast, up to 3,500 mm at the Alps, 800 mm at south east and 1,400 mm at central Slovenia. Yearly degree-day value ranges from 2400 Kday to 4000 Kday. The yearly solar radiation on horizontal plane is between 1000 and 1300 kWh/m². Daily solar radiation on horizontal surface for four months is presented on picture bellow.

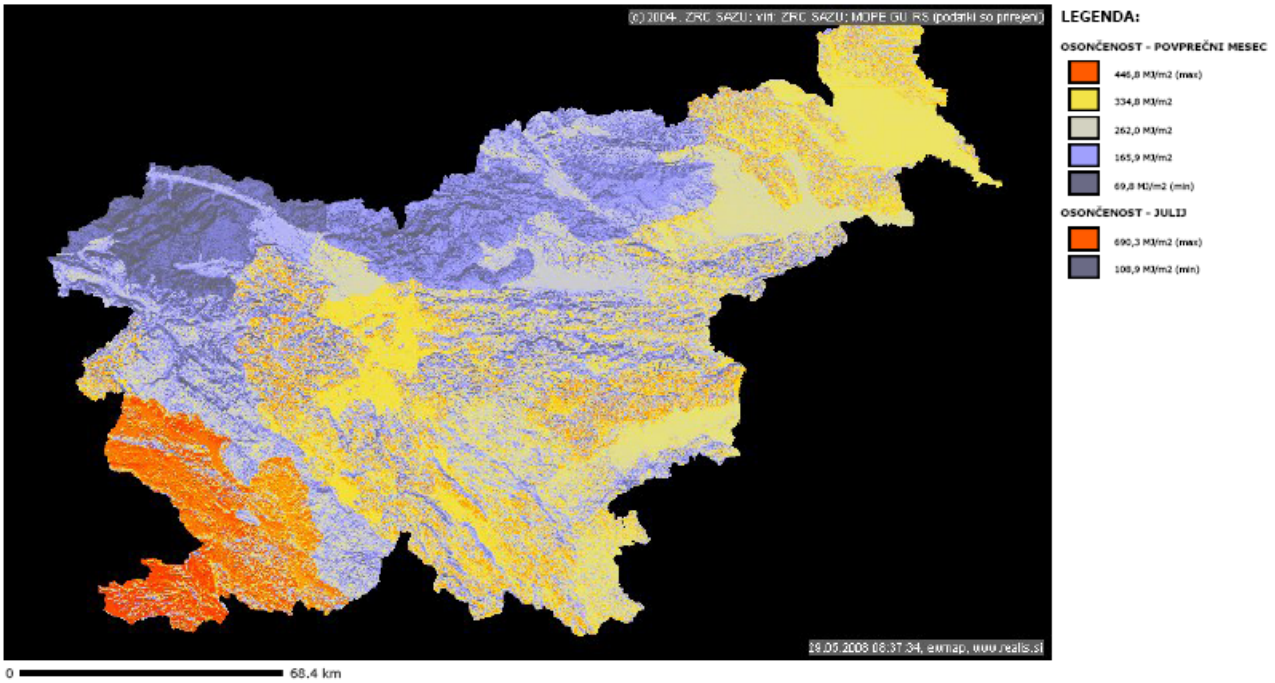


Figure 1: Average monthly solar radiation on the territory of Slovenia (Source: ZRC SAZU)

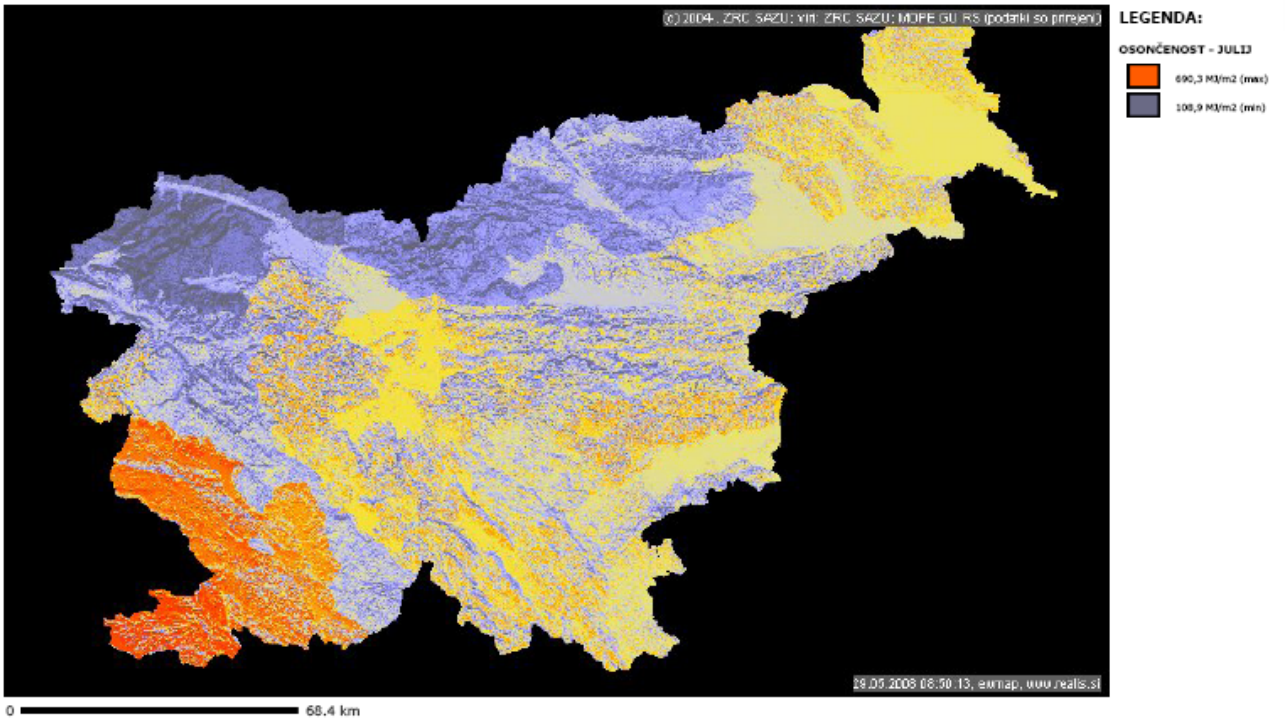


Figure 2: Monthly solar radiation on the territory of Slovenia - July (Source: ZRC SAZU)

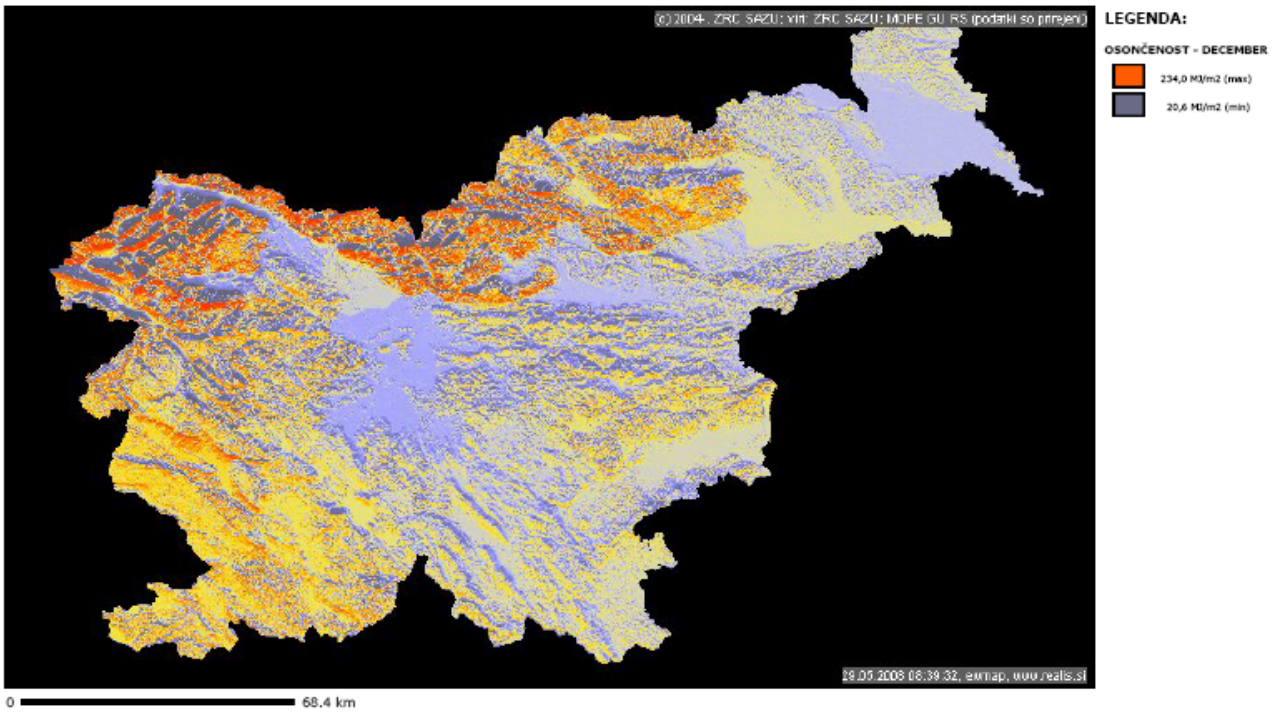


Figure 3: Monthly solar radiation on the territory of Slovenia – December (Source: ZRC SAZU)

1.2. Relief

Approximately one half of the country (10,124 km²) is covered by forests. This makes Slovenia the third most forested country in Europe, after Finland and Sweden. Remnants of primeval forests are still to be found, the largest in the Kočevje area. Grassland covers 5,593 km² of the country and fields and gardens 2,471 km². There are also 363 km² of orchards and 216 km² of vineyards.

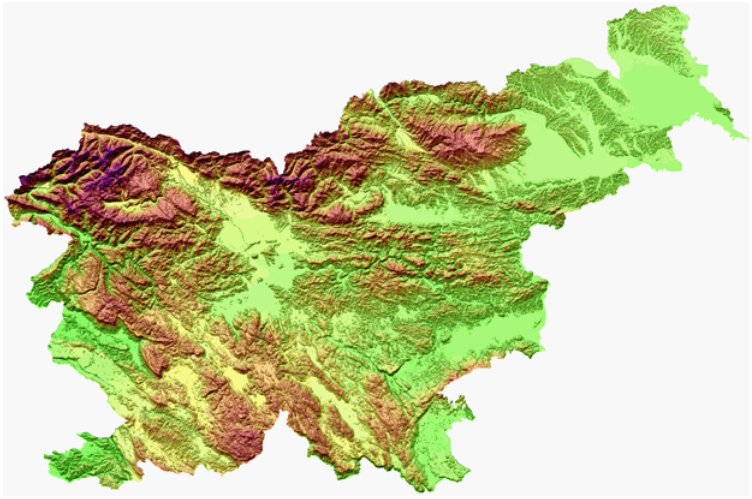


Figure 4: Relief of Slovenian territory [Source: Geografski inštitut Antona Melika (Source: ZRC SAZU)

1.3. Population: evolution for the last 10 years, actual situation and forecast

The population of Slovenia was increasing until the year 1993 when a natural decrease was registered for the first time since World War II. The number of births has been decreasing ever since and the number of deaths remained the same. For the last ten years Slovenia has been recording a natural decrease. In 2002, 1,200 people more died than were born. A slow population growth after 1998 is the result of a positive migration of foreign populations into Slovenia. In 2002, 1,865 people more immigrated than emigrated, which gives the rate of 0.9 per 1000 population. In year 2006 the number of births exceeded the number of deaths for the first time after 1993.

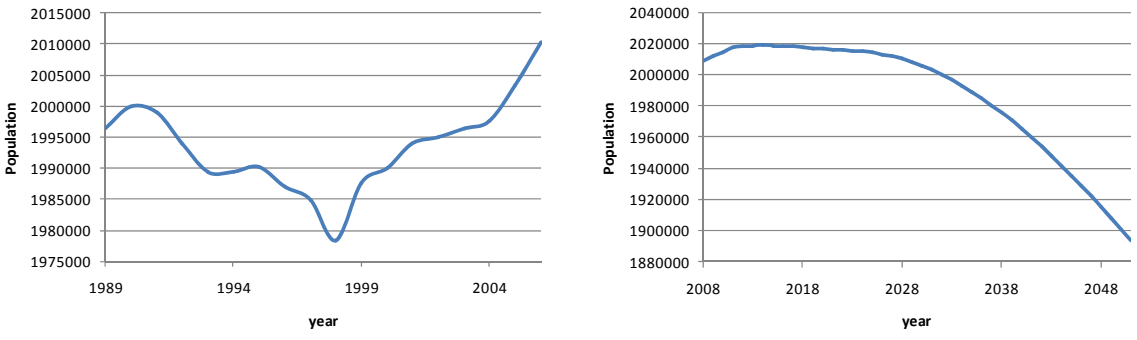


Figure 5: Population in Slovenia from 1989 on left, and the estimations for the future on right (Source: SURS, EUROSTAT)

1.4. Additional available statistics

In 2006 the Slovenian GDP per capita in PPS was 12% below the EU-27 average and 20% below the Euro area average. GDP per capita in PPS in Slovenia amounted to 85% of the EU-27 average in 2004, 87% in 2005 and 88% in 2006. Despite quite high economic growth, the consumer prices increase in 2007 was on average 5.6%. Goods prices grew by 6% and service prices by 4.8%. The large difference between the inflation rate in 2007 and the inflation rate in 2006, which was 2.8%, was mostly the result of higher prices of food and petroleum products.

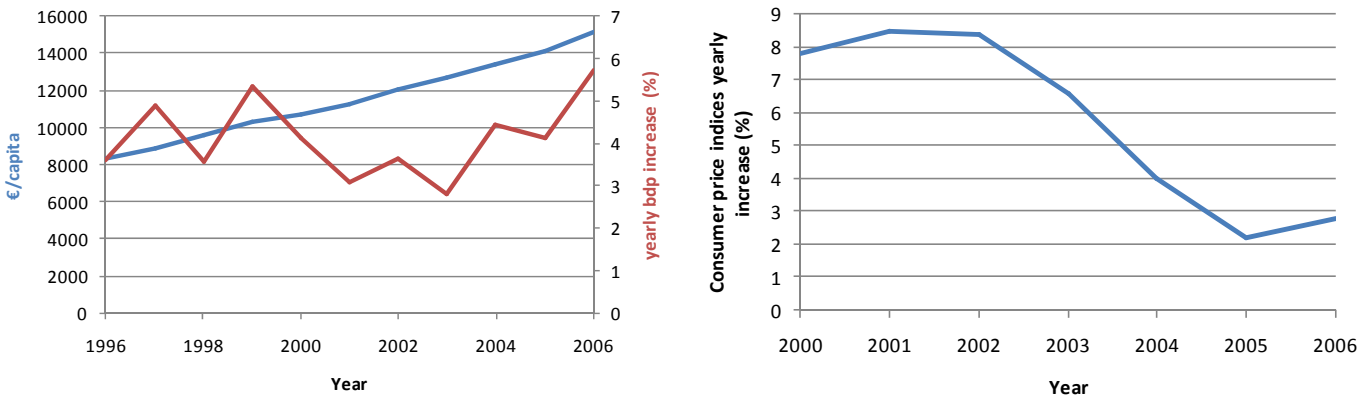


Figure 6: GDP per capita on figure on left and customer price indices on right (Source: SURS)

1.5. Statistic data of energy consumption, dependency energy imports, price evolution, forecast energy consumption, CO_2 emissions

The yearly primary energy consumption in Slovenia has been increasing constantly during the last years. In last six years the consumption grew approximately 15% and in year 2006 we can notice a minor settle.

Table 1: Primary energy consumption between 2000 and 2005 (1toe = 41,868 PJ) (Source: SURS)

	2000	2001	2002	2003	2004	2005	2006
Primary energy consumption (1000 toe)	6358	6526	6755	6961	7188	7341	7253

According to the number of inhabitants (2.010.377 in year 2006) this represents a yearly final energy consumption of 151 GJ per inhabitant. The structure of primary energy is presented on the picture bellow. Half of primary energy is imported from abroad (the nuclear primary energy is treated as domestic). The share of renewable energy sources in primary energy supply has increased from 8,8% in 2000 to 9,5% in 2004 on account of biomass heating and small hydro power plants.

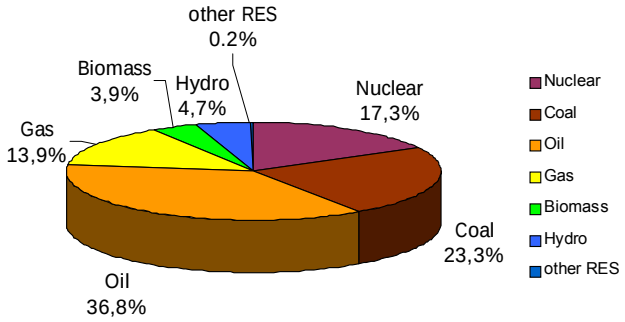


Figure 7: Structure of primary energy supply in Slovenia (Source: SURS)

The total emissions of green house gasses in 2005, sinks not considered, were 20,264.17 kt CO2 eq., which represents a 0.5% increase of emissions compared to 1986 base year. In the period 1986-1991, a reduction of emissions was recorded due to the economic conditions at that time and Slovenian independence in year 1991. In the period 1992-1997, a strong increase of emissions was noticed, which was a consequence of increasing economic growth and increase of industrial production. In the second half of that period, the increased emissions were a consequence of "gasoline tourism" (25% of the total sale of motor fuels in Slovenia), since the prices of motor fuels in the Republic of Slovenia were quite lower than in the neighbouring countries. In the period 1998-1999, emissions decreased due to the measures undertaken by the neighbouring countries to decrease the "gasoline tourism" and due to the increased supply of electrical energy from the Krško Nuclear Power Plant. In the 2000-2002 period, emission kept increasing again due to the increased obligatory export of electrical energy from the Krško Nuclear Power Plant to Croatia. Simultaneously, due to very dry and hot summers the consumption of electrical energy increased and the production of electrical energy in hydroelectric power stations in Slovenia decreased. Consequently, the thermal power plants had to make up for both the deficit in the production of electrical energy in hydroelectric power plants as well as the increased consumption of electrical energy.

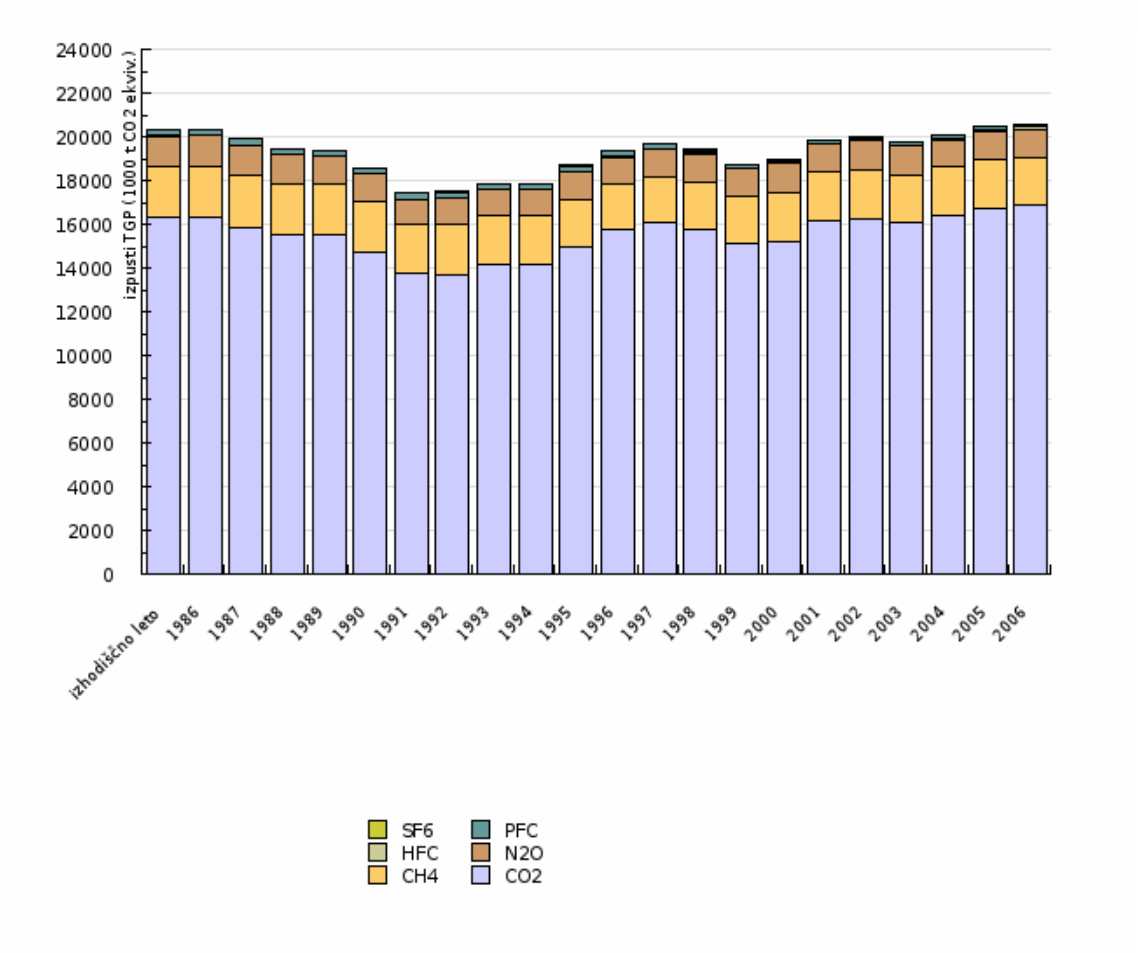


Figure 8: The amount of green house gasses emissions in Slovenia (Source: ReNEP)

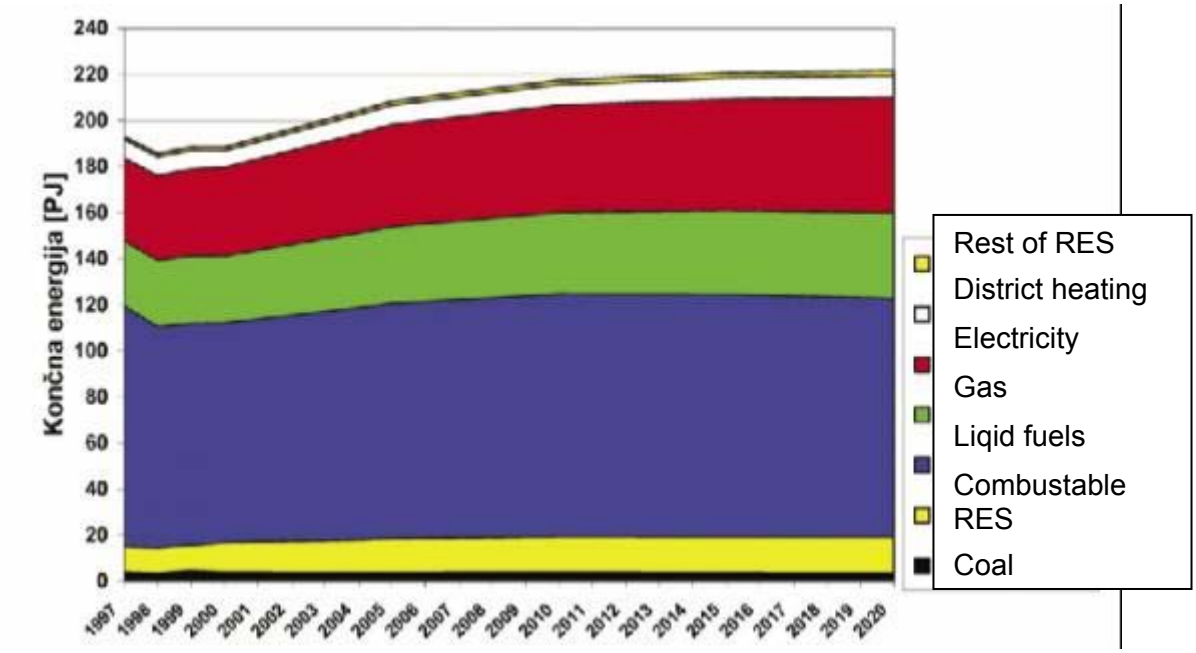


Figure 9: Final energy consumption predictions for Slovenia (Source: ReNEP)

B. State of the Market

2. Overview of the market situation

The period between 1980 and 1986 is in Slovenia often called the “golden age of the solar systems”. The Slovenian solar industry was dominant in former Yugoslavia, and therefore benefited most from the “tourist boom”, high inflation and low loans of that time. In that period a lot of small and large solar systems were installed and thanks to that period, the average installed solar collector area per inhabitant in Slovenia is still quite high (35 m² per 1000 inhabitants). A system in Budva (in Montenegro), build in 1985 with 2500 m² of SC, was the largest European solar system at that time.

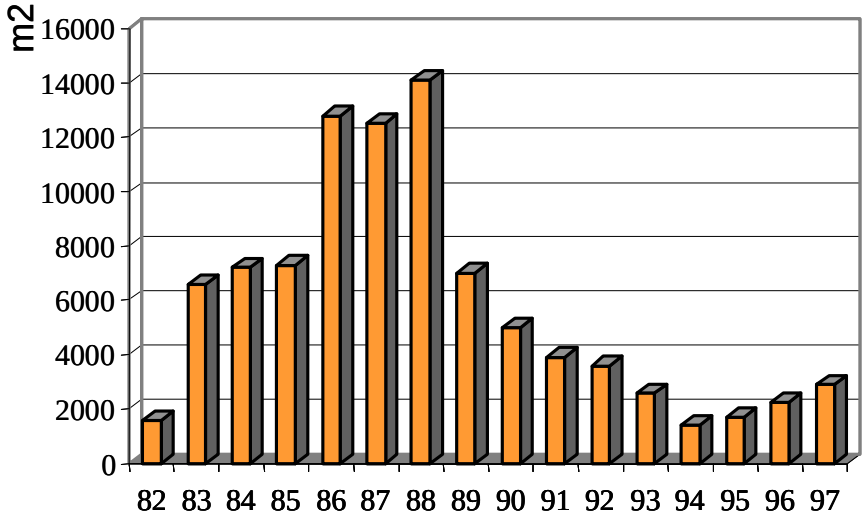
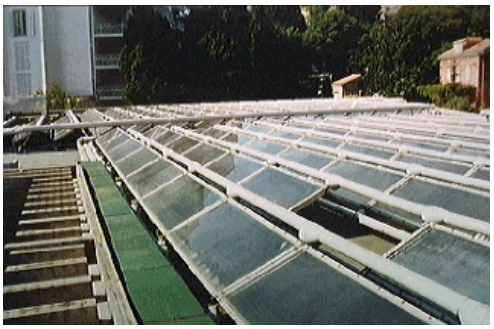


Figure 10: Area of solar collectors installed between 1982 and 1997 in Slovenia. (Source: UNI LJ)

The different economic conditions, as well as bad experience especially with durability of SC were reasons why large solar systems were not so popular during the next 15 years.



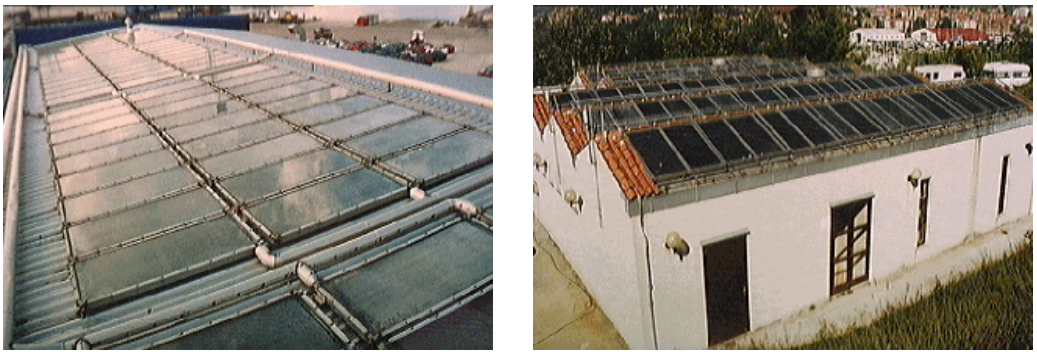


Figure 11: Some of the solar systems build between 1980 and 1990 (top left in Hotel in Portorož, top right on hotel in Izola, bottom left in Port Koper, bottom right in camp Sečovlje); in several cases during the reconstruction of the buildings, the solar system was removed (as in case presented in top left picture); (Source: UNI LJ)

In 1980's and early 1990's several domestic producers of solar collectors and heat storage existed. Today only two producers are still present on the market and only one of them produces all the solar thermal system components by itself.
Exponential growth of installed solar systems just began 5 years ago. A national subsidies scheme has great influence on this, but only in the sector of domestic solar systems for tap water heating.
Currently the solar market depends mostly on private investors. But there are few new large solar systems built in last 5 years, mainly on hotels and in spas, elderly homes, on two industrial buildings and one for the heating of a church. All of the investors are private companies (elderly homes operate in principle as private companies). No system on multifamily houses operates until now, no system on public buildings either (except that one on the church).
A domestic solar industry exists, but is not well developed and not integrated. Two of the three domestic producers of solar collectors (IMP Klimat and Lentharm Invest) import the selective absorbers, because no domestic producers of selective coatings exist. The other one produce self-developed double glazed, black painted solar collectors (STROJ d.o.o.). Among all of them, a "do-it-yourself" group, organized by Gradbeni institur ZRMK is the most successful. In contrast to the solar collector producers, there are several producers of heat storage and they trade their products with producers of solar collectors from abroad. Lack of domestic producers is the reason why many of the important European solar collector producers are present on the Slovenian market. According to data from subsidy applications, two domestic "producers" - the "do it yourself" groups (with 24% market share) and STROJ company (with 18 % market share) - have the biggest market share. All together the share of domestic solar collectors (and solar systems) suppliers is 70% (2005).

Figure 12: The private investors associate within the "Do it yourself" campaign have produced in the year 2005 145 solar system for tap hot water heating in households; this corresponds to 24% market share. (Source: GI ZRMK)

The solar market is recovering quite rapidly. In 2004 MOP approved subsidies for solar thermal systems to 222 applicants, in year 2005 to 584 applicants, in year 2006 to 664 applicants and in year 2007 to 1207 applicants. Currently there are 120.000 m² of solar collectors installed in Slovenia.

Table 2: Number of new solar thermal collectors installed (Source: AURE)

Year	2004	2005	2006	2007
Newly installed solar collectors (m²)	1.800	4.800	6.900	12.000

The flat plate solar collectors with selective absorber coatings prevail. Close loop systems with pump, heat exchanger integrated in heat storage and antifreeze protection are most common. Typical system is presented on the picture bellow.

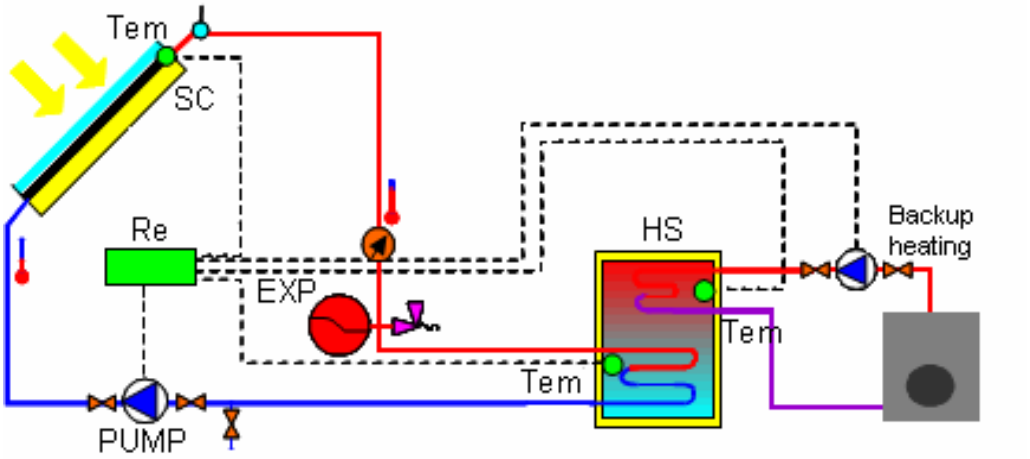


Figure 13: Typical hydraulic scheme of small solar systems for tap water heating installed in Slovenia

In year 2002 there was 1,1% of dwellings equipped with solar system for domestic hot water heating and 0,4% with solar heating of dwellings.

3. Solar collector production and sales

Table 3: Types of new solar thermal collector installed

Year	Flat Plate Collectors				Vacuum Collectors				Unglazed Collectors in m²
	Production and sales in m²				Production and sales in m²				
	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
2002					0		40	40	680
2003					0		75	75	
2004	693+400	400	957	1650	0		150	150	
2005	1890+400	400		4500	0		300	300	
2006	2646+400	400		6300	0		600	600	
2007	5445+400	400		10300	0		1700	1700	200
Total									

There are approximately 50 m² of solar collectors per 1000 capita installed in Slovenia, which is the sixth most dense in Europe. There were approximately 6 m² of solar collectors per 1000 capita installed in Slovenia in year 2007.

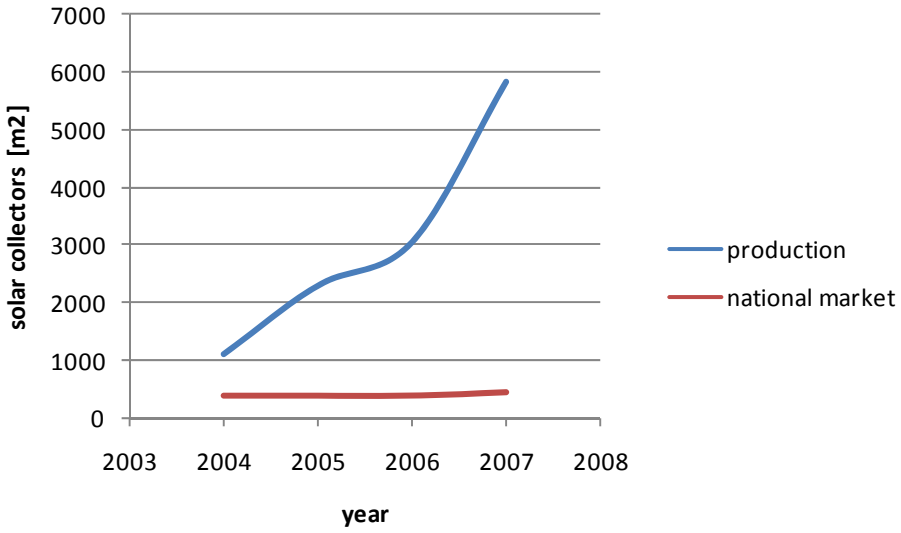


Figure 14: The amount of produced and installed solar collectors (Source: UNI LJ)

There is no statistical information about solar collectors installed in Slovenia on previous years. It can be estimated that because of the relatively closed Yugoslavian market, most of them were produced in Slovenia, which also exported quite a lot of solar collectors to other Yougoslavian republics.

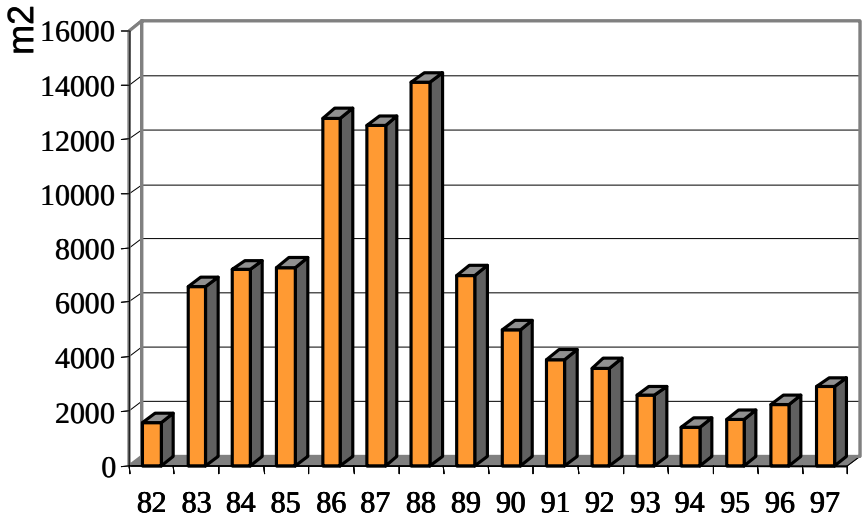


Figure 15: Area of solar collectors installed between 1982 and 1997 in Slovenia, mainly produced in Slovenia (Source: UNI LJ)

3.1. Estimated solar park in working order in 2007/2006

Flat plate collectors in m²:	121300
Vacuum collectors in m²:	3000
Unglazed collectors in m²:	1000
Total in m²:	125300

3.2. Estimated annual solar thermal energy production in 2007/2006

Flat plate collectors= 121300 m² x 1200 kWh/m²*year x 0,45 = 65502 MWh

Vacuum collectors = 3000 m² x 1200 kWh/m²*year x 0,6 = 2160 MWh

Unglazed collectors= 1000 m² x 500kWh/m²*year x0,3 = 150MWh

Total 67812 MWh/year

3.3. CO_2 emissions avoided in 2007/2006 (on the basis of oil)

Flat plate collectors = 65502 MWh/year x 0,34 tonnes/MWh = 22270 t

Vacuum collectors = 2160 MWh/year x 0,34 tonnes/MWh = 734 t

Unglazed collectors = 150 MWh/year x 0,34 tonnes/MWh = 51 t

Total 23055 tones/year

4. Product types and solar thermal applications

4.1. Product types

4.1.1 Unglazed collectors

- used in solar systems designed for seasonal applications (summer resort):
  - solar pool water heating system
  - domestic hot water (DHW) systems
- plastic materials are usually used for absorbers

Figure 16: Unglazed solar collectors at Hotel Žusterna

4.1.2 Flat plate collector

- most used collectors in Slovenia:
  - DHW systems
  - Solar Combi systems
  - Solar systems for space heating
  - Combination of DHW and solar pool water heating system
- usual absorber area per collector is 2 m²
- absorbers are made of copper or aluminum
- absorbers are coated with selective coating

Figure 17: Flat plate collectors at Dom Tisje

4.1.3 Vacuum tube solar collectors

- used in 15 % of new installations
- wider appliance of this collector is limited by higher price
  - DHW systems
  - Solar Combi systems
  - Solar systems for space heating
  - Combination of DHW and solar pool water heating system
  - Solar process heat systems
- absorbers are usually made of copper or aluminum
- some collectors have a concentration parabolic plate behind tubes

Figure 18: Vacuum tube collectors

4.1.4 Air collector

- not used very often in Slovenia

Figure 19: Air collector in Tehnopolis Celje (Source Eges)

4.2. Applications

Solar thermal systems in Slovenia are mainly used for hot water heating. There are no solar district heating systems, solar air conditioning or solar industrial process heating applications available (except car washing).
There is no statistical information about the number of solar thermal systems installed used also for support of space heating. The number can be estimated according to size of solar collector installed. Approximately 8% of solar thermal systems have solar collectors larger than 10 m².

5. Market share of major manufacturers

Domestic producers in Slovenia have a quite large (70%) market share of newly installed solar collector. Almost one fourth of solar thermal systems in year 2005 were installed by self-producers under instructions of trained personnel at ZRMK. During the last three years the self production is decreasing and today only a minor share of newly installed solar collectors are installed by self-producers.

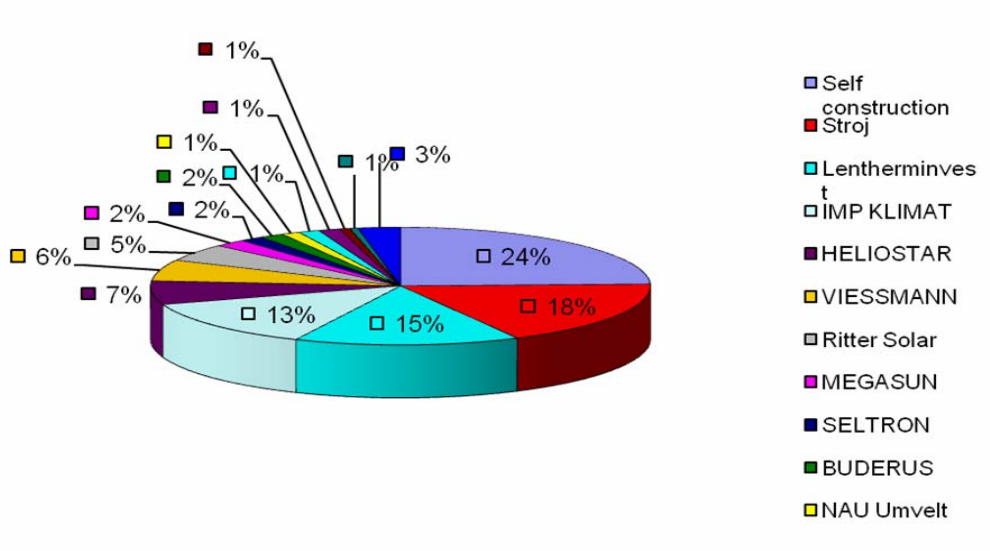


Figure 20: Market share of producers of solar collectors in year 2005 (Source: UNI LJ)

6. Employment

There are 3 manufacturers of solar thermal systems in Slovenia, Stroj d.o.o. (produces all parts of solar system), Hidria IMP Klima d.o.o. (produces heat storages and imports solar absorbers and assembles flat plate collectors), Lentherm Invest (produces heat storages and flat plate collectors) and self producers under supervision of trained personnel. There are approximately 200 people (not counting the self producers) working on sector of manufacturing of solar components and systems.
There are approximately 40 different supplier companies of solar thermal systems, who are importing, marketing and designing solar thermal systems with an employee working on each of distribution, marketing and consulting – together 120. There are approximately 300 installers of solar thermal systems. For installation of approximately 10.000 m² of solar collectors every year, approximately 60 people with full time jobs are required. Since there is no accredited testing laboratory in Slovenia, there is no one working on testing and quality assurance. There are 5 people working on training and 3 people working on research.

C. State of Production

7. Product technology and production methods

7.1. Product technology description

7.1.1. Typical solar hot water system

- Collectors (usual sizes in m²): 6,5 m² (average size of installed collectors)
- Absorber material: cooper, stainless steal
- Surface treatment: selective coating
- Insulation: rock wool,
- Transparent cover: glass
- Casing: aluminum
- Storage tank: steal
- Cover: pvc
- Pump: electric centrifugal pump, power 50 W
- Expansion tank: 8 – 50l
- Heat exchanger: internal coil heat exchanger
- Additional heating: conventional heating, most often oil fired boilers

Typical hydraulic schemes is shown on figures below:

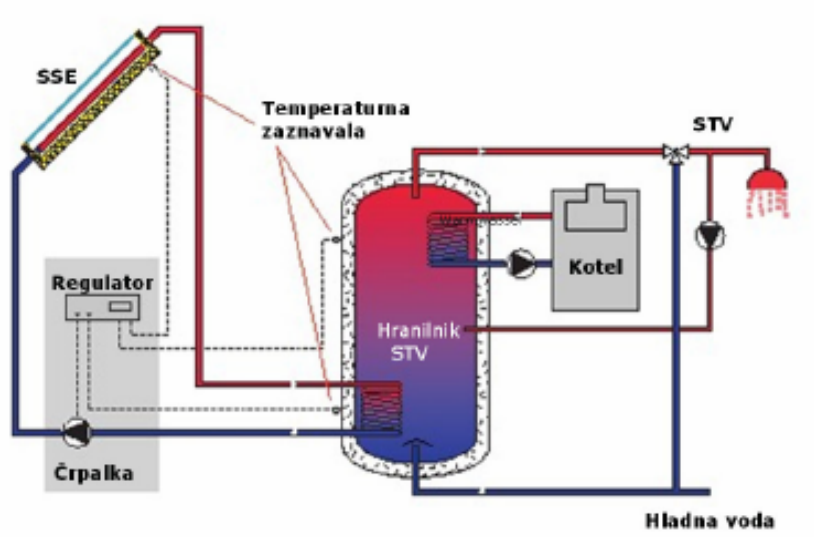


Figure 21: Hydraulic schemes of typical solar thermal system in Slovenia (Source: FME-Diploma work)

7.1.2. Typical solar hot water combined system

- Collectors (usual sizes in m²): 12 m² (average size of installed collectors)
- Absorber material: cooper, stainless steal
- Surface treatment: selective coating
- Insulation: rock wool,
- Transparent cover: glass
- Casing: aluminum
- Storage tank: steal
- Cover: pvc

- Pump: electric centrifugal pump, power 50 W
- Expansion tank: 8 – 50l
- Heat exchanger: internal coil heat exchanger
- Additional heating: conventional heating, most often oil fired boilers

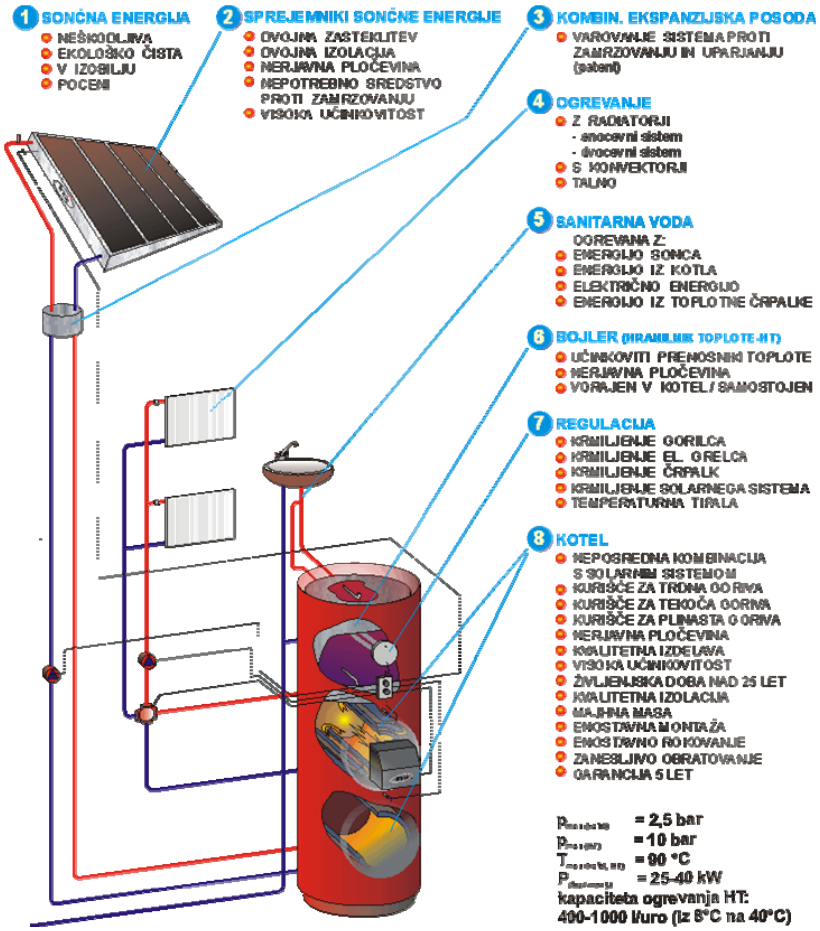


Figure 22: One of typical hydraulic scheme of solar thermal system in Slovenia with drain down operation. (Source: Stroj)

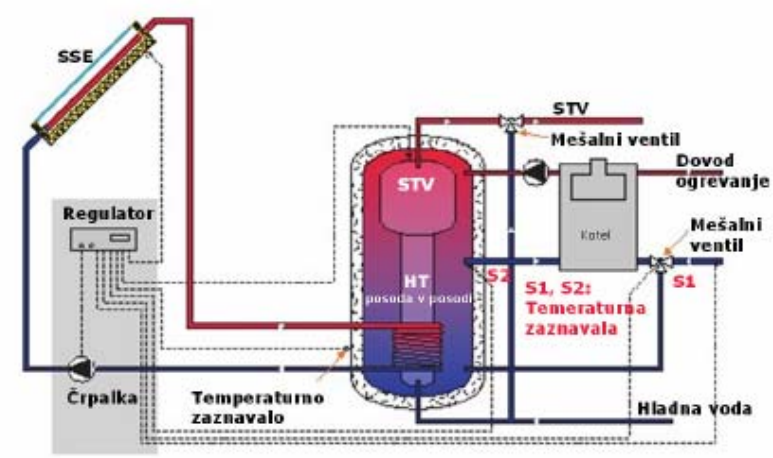


Figure 23: Typical efficiency of solar collectors and systems depends on use of hot water and ranges from 350 to 550 kWh/m²/year. (Source: FME-Diploma work)

7.2. Product technology description

There are 3 companies involved in solar collector production; Stroj d.o.o. who produce all parts of solar collectors and IMP Klimat and Lentherm Invest who import solar absorber and assembles the rest. The biggest share of solar collectors is produced by self construction, lead by ZRMK. Stroj d.o.o., IMP Klimat, and Lentherm Invest produce collectors on a partly automated production line; the self producers produce collectors manually. The production capacity of producers can be easily increased by employing more manpower. The capacity of production is adapted to the needs of the market (shown on chapter 3 and 5). The share of self produced collectors in 2007 was 7%, the rest 93% of solar collectors were produced in partly automated assembly production and assembly line. Stroj d.o.o. tested solar collectors at Faculty of mechanical engineering, Lentherm Invest and Hidria IMP Klima tested their solar collectors at foreign accredited laboratories. The collector production lines could be further automated and some new technologies of metal joining could be introduced.

8. Breakdown of solar systems costs

Table 4: Solar system costs

Solar Systems Costs for Typically Sized Systems		
	6m²	**15m²**
Total costs (excl. VAT)	520 Euro / m²	450 Euro / m²
VAT (%)	104 Euro / m²	90 Euro / m²
Total cost (incl. VAT)	**624 Euro / m²**	**540 Euro / m²**

8.1. Cost breakdown of an average 6m² solar thermal system (VAT not included):

- Raw material supply: 50 €/system
- Hot water storage manufacturer: 640 € for 300l heat storage
- Fixtures and fittings for solar set: 120 €
- Collector manufacturer: 200 €/m² for collectors, 20 €/m² for holder/support
- Wholesalers:
- Installers: app 1000 € /system

8.2. .Cost breakdown of an average 15m² solar thermal system (VAT not included):

- Raw material supply: 150 €/system
- Hot water storage manufacturer: 1000 € for 500l heat storage
- Fixtures and fittings for solar set: 300 €
- Collector manufacturer: 200 €/m² for collectors, 20 €/m² for holder/support
- Wholesalers:
- Installers: app 2000 €/system

Possibly differentiate according to system type.
There are differences in price between flat plate collectors and vacuum tube collators 620 €/m² + VAT.

9. Typical solar domestic hot water systems

9.1. Typical DHW system for a single family house

- System type: SDHW
- Collector type: flat plate collectors
- Collector area (m²): 6 m²
- Collector area per person (m²/person): 1-2 m² per person
- Hot water storage (liters): 50l/m² of solar collector surface
- Price per m² system costs: 600 Eur/m²
- Amortization based on the present energy price: 10 years
- Eventual subsides: 25% of investment cost, but not more than 150€/m² of solar collector area for flat plate collectors and not more than 200€/m² of solar collector area for vacuum tube collectors. 75€/m² for self constructed solar collectors (for year 2008).

The most common hydraulic scheme of solar thermal system in single house building is shown on figure below. The systems usually consist of flat plate solar collectors in size of 1 to 2 m² per person and with the heat storage with a size of approximately 50 L per every m² of solar collectors. The payback period depends on size and type of solar collectors and ranges from 10 to 15 years.

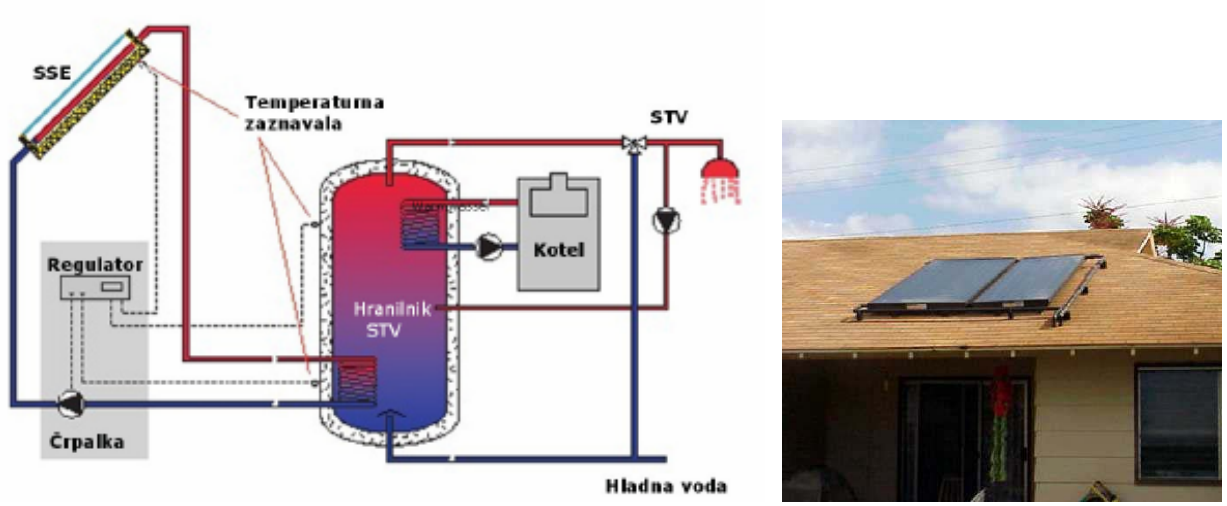


Figure 24: Typical DHW system for a single family house (Source: FME-Diploma work)

9.2. Typical DHW system for a dwelling

- System type: SDHW
- Collector type: flat plate collector
- Collector area (m²): 6 m²
- Collector area per person (m²/person): approximately 1 m² per person
- Collector area per dwelling (m²/dwelling): 6 m²
- Hot water storage (liters): 50l/m² of solar collector surface
- Price per m² system costs: 600 Eur/m²
- Amortization based on the present energy price: 10 to 15 years
- Eventual subsides: 25% of investment cost, but not more than 150€/m² of solar collector area for flat plate collectors and not more than 200€/m² of solar collector area for vacuum tube collectors. 75€/m² for self constructed solar collectors (for year 2008).

Domestic hot water systems in multifamily houses are very rare and can be hardly found. The hydraulic scheme of a pilot project is shown on the figure below. The systems consist of flat plate solar collectors in size of 1 m² per person and with the heat storage with a size of approximately 50 L per every m² of solar collectors. The payback period of system depends on size and type of solar collectors and ranges from 10 to 15 years.

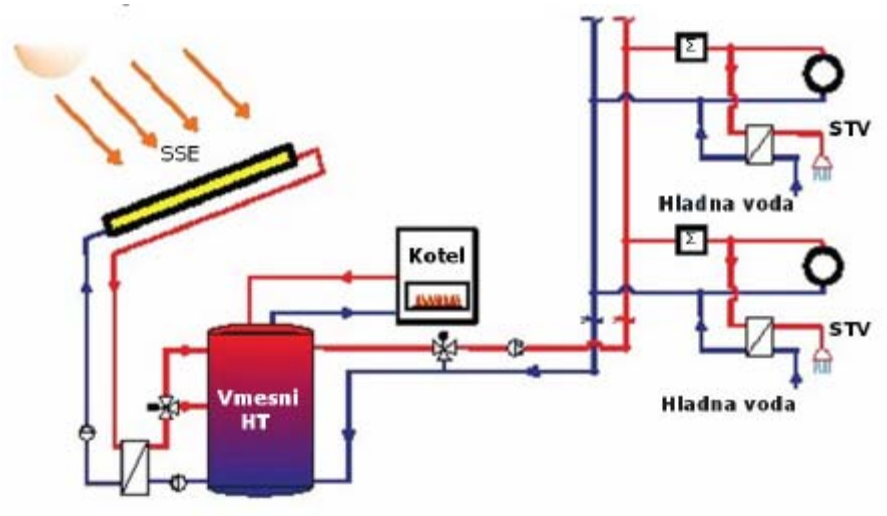


Figure 25: Typical DHW system for a dwelling (Source: FME-Diploma work)

9.3. Typical DHW system for a hospital

- System type: n.a.
- Collector type: flat plate collector
- Collector area (m²): 70 – 200 m²
- Collector area per person (m²/person)
- Hot water demand at 60°C
- Hot water storage (liters).
- Price per m² system costs
- Amortization based on the present energy price
- Eventual subsides: no subsidies available

There are only a few hospitals equipped with solar thermal system. Since there is no need for separate expense charging (like in multifamily houses), the system can be designed similar to the one used in single-family houses. The systems usually consist of flat plate solar collectors. The heat storage is sized to approximately 50 L per every m² of solar collectors. The payback period of system depends on size and type of solar collectors and can be less than 10 years.

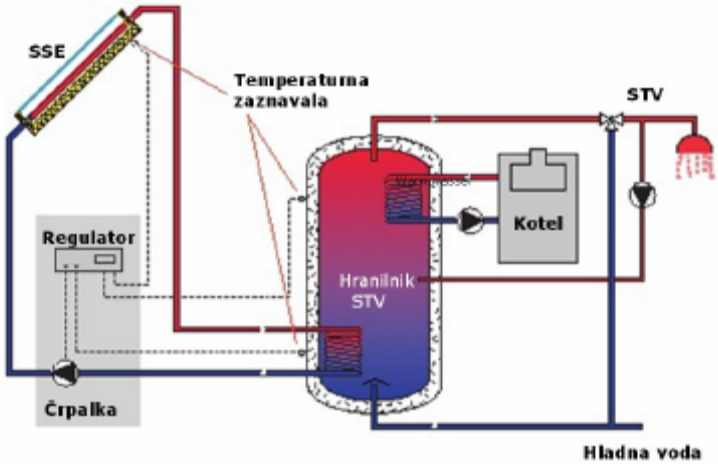


Figure 26: Typical DHW system for a hospital (Source: FME-Diploma work)

There are some elderly homes equipped with solar thermal solar system, like in case of Preddvor. The elderly home in Preddvor takes care of 190 pensioners and disabled people. There are two residential buildings heated by a biomass district heating plant. The boiler house is 1.5 km away. Except LG for drying and ironing, all heat demands are covered with "green heat". Specific energy consumption for heating is 165 kWh/m² per year. Energy demand for tap water heating is 290 MWh per year, the solar fraction of CSTS is 25 %.

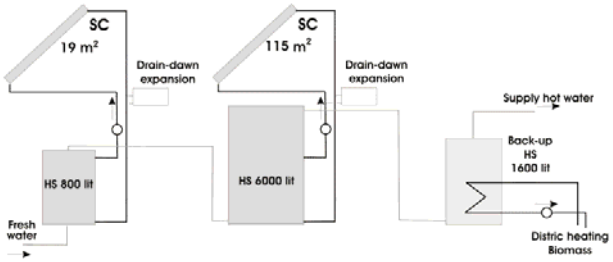


Figure 27: The hydraulic scheme of system installed in elderly home in Preddvor

9.4. Typical DHW system for a hotel

- System type: n.a.
- Collector type: flat plate collector
- Collector area (m²): 80-140 m²
- Collector area per person (m²/person)
- Hot water demand at 60°C: not known
- Hot water storage (liters): 15.000
- Price per m² system costs: n.a.
- Amortization based on the present energy price
- Eventual subsides: no subsidies available

In Hotel Delfin in Izola, there are 128 m² of flat roof collectors installed. The roof supports four fields of solar collectors, which are designed exclusively for heating of salt water in indoor (250 m², 355 m3, 24–25 °C, all year long) and outdoor swimming pool (555 m², 722 m3, 26–27 °C, Apr.–Oct.). The solar system has three horizontal heat storages (5 m3 each) with integrated tube heat exchangers. They are connected to the compensation pool where fresh sea water is added and disinfected. They use oil burners for heating of building and tap water. They installed buffer storage with a total size of 15 m^3.
The payback period is less than 10 years. There are no subsidies available for companies.

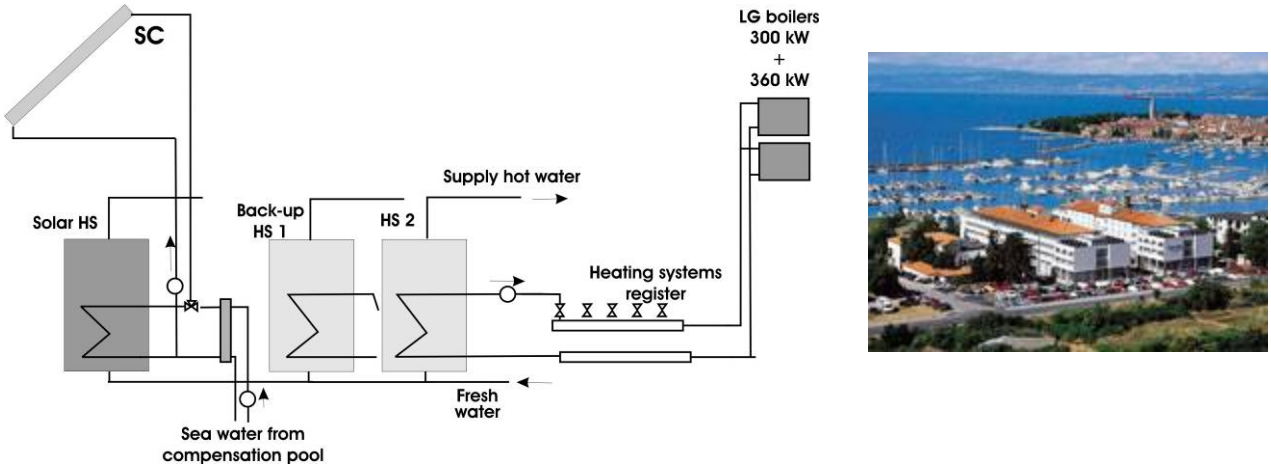


Figure 28: The hydraulic scheme and photo of typical solar thermal systems installed at hotels

9.5. Typical consumer motivation

Consumers are mostly motivated by government subsidies, high oil prices, self-production of solar collectors and the “green” image.
The number of installed solar thermal systems is rapidly increasing since 2002 when AURE offered the first government subsidies for RES.
There was quite successful action of so-called “do it yourself” collector production launched by Gradbeni institur ZRMK. They produced almost one fourth of all installed solar collectors in Slovenia in the last few years. They are targeted mainly on atprivate houses. The share of self-produced solar collectors is decreasing every year. In 2007 the share of self-produced solar thermal system was only 7%.
Third, in the last few years increasing fuel prices are decreasing the payback period of installed solar thermal system and therefore becoming a much more significant factor.
Some hotels and companies are also developing an overall environmental protection image, which can also be a reason for solar thermal system investments.

10. Typical solar combined systems

10.1. Typical combined system in a single family house

- System type: n.a.
- Collector type: Flat plate
- Collector area (m²): 10-20 m²
- Heat storage (liters): 1000 – 1500 L
- Pump: centrifugal pump
- Expansion tank: drain back system

- Heat exchanger: coil heat exchanger
- Additional heating: oil fired boiler
- Collector area per heating load (m²/kW)
- Price per m² system costs:
- Amortization based on the present energy price
- Eventual subsides: 25% of investment cost, but not more than 150€/m² of solar collector area for flat plate collectors and not more than 200€/m² of solar collector area for vacuum tube collectors. 75€/m² for self constructed solar collectors.

In well-insulated buildings the solar thermal system can be also used to support of conventional heating system. Hydraulic schemes for typical solar thermal combined system are shown below. Typically solar thermal combined systems in single-family houses usually use flat plate collector with a size of 10-20 m². Typically there is 1000 – 1500 L heat storage. The system is additionally heated by conventional heating system, usually by an oil-fired boiler. There is a coil heat exchanger typically installed inside the heat storage.

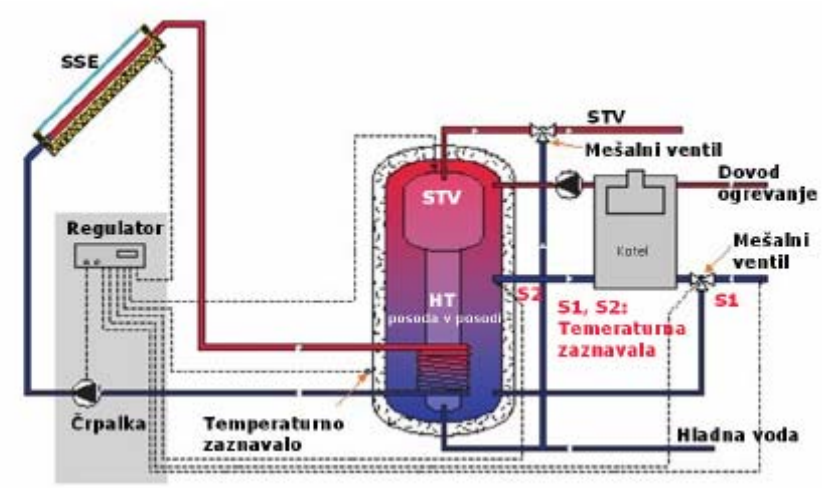


Figure 29: Typical combined system in a single-family house (Source: FME-Diploma work)

10.2. Typical combined system in a dwelling

- System type. SDHW
- Collector type: flat plate
- Collector area (m²): 10-12 m²
- Heat storage (liters). 800-1000 l
- Pump: n.a.
- Expansion tank: n.a.
- Heat exchanger: n.a.
- Additional heating: oil burner
- Collector area per heating load (m²/kW):
- Energy demand for hot water/heating
- Price per m² system costs
- Amortization based on the present energy price
- Eventual subsides.

Domestic hot water systems in multifamily houses are very rare and can be hardly found. The hydraulic scheme is shown on figure below. The systems consist of flat plate solar collectors in size of 1 m² per person and with the heat storage of size of approximately 50 L per every m² of solar collectors. The payback period of system depends on size and type of solar collectors and ranges from 10 to 15 years. Separate heat sub station units with heat meters for separate billing are installed in each dwelling. The hydraulic scheme for typical system is shown below.

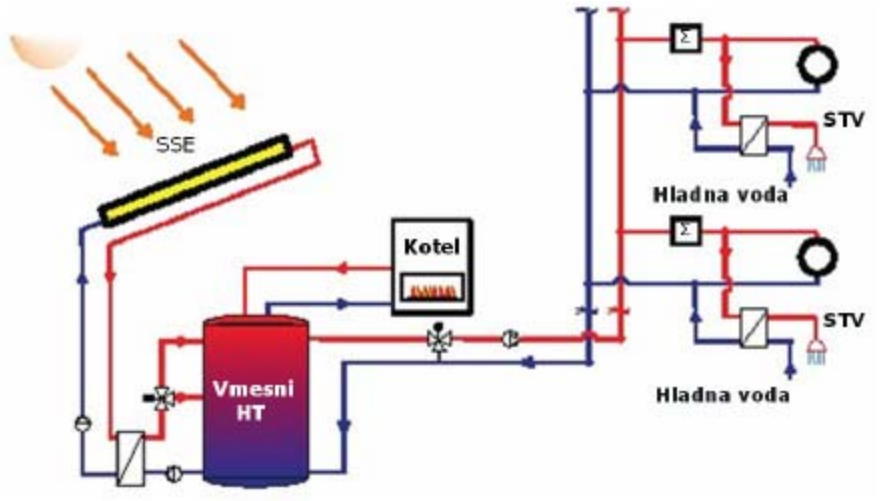


Figure 30: Typical combined system in a dwelling (Source: FME-Diploma work)

10.3. Typical combined system in a hospital

There are no solar thermal systems in hospitals with support for heating installed in Slovenia.

10.4. Typical combined system in a hotel:

There are no solar thermal systems in hotels with support for heating installed in Slovenia.

10.5. Typical combined system for other purposes

- System type: n.a.
- Collector type: vacuum tube collector
- Collector area (m²). 44 m²
- Heat storage (liters): 1000 l + 1500 l buffer storage
- Pump: n.a.
- Expansion tank: n.a.
- Heat exchanger: n.a.
- Additional heating: liquid gas fired boiler
- Collector area per heating load (m²/kW): n.a.
- Energy demand for hot water/heating: 3.000 l/day
- Price per m² system costs: 1040 m²
- Amortization based on the present energy price
- Eventual subsides: no subsidies available for companies

There is only one solar thermal system installed for other purposes. At Špan d.o.o., a family company working in the vulcanizing business, in 2005 expanded their business to car washing.

Great emphases were put into environmental friendly technologies: they use only LG, electrical transportation vehicles and highly effectively (75%) recycling of wastewater from carwash devices. For that reason they have also added solar system with vacuum solar collectors, which are placed on the flat roof of office building. The solar system is used for preparing hot water, floor heating in a coffeehouse and heating the process water in the carwash department.

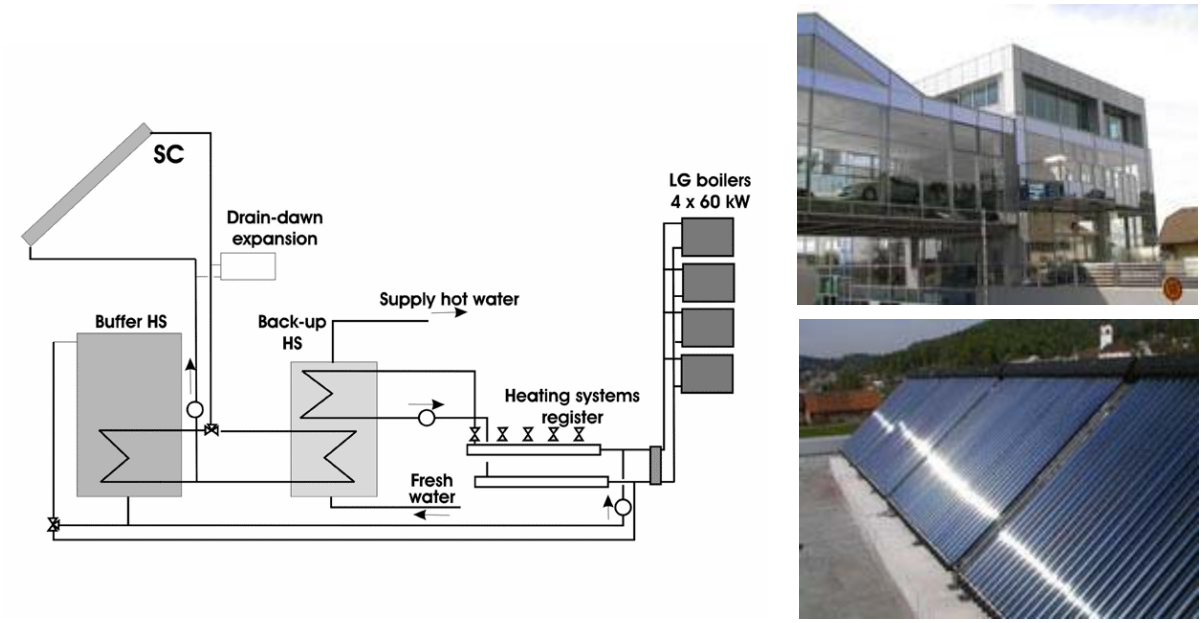


Figure 31: The hydraulic scheme and photo of solar system installed for other purpose.

The aperture area of vacuum tube solar collectors installed is 28 m². The nominal power of solar thermal system is 20 kW. There is also a 60 kW liquid gas-fired backup system installed for support of solar thermal system. The system has a 1,5 m² buffer storage and 1 m^3 hot tap water storage installed. Daily hot tap water consumption is 1,5 m^3.

10.6. Typical consumer motivation

Consumers of combined systems are motivated by the same reasons as users of solar hot water systems: government subsidies, option of self production of solar collectors (for private houses), high oil prices and in the case of hotels also the image.

11. Conventional water heating and energy prices

Table 5:

Conventional Energy Prices		
Date: 2007	**Single family** VAT incl.	**Multifamily** VAT incl.
Electricity - normal Electricity - low rate	0,11422 Euro/ kWh 0,07068 Euro/ kWh	0,11422 Euro/ kWh 0,11422 Euro/ kWh
Fuel - Oil	0,0758 Euro/ kWh	0,0758 Euro/ kWh
Bottled gas Natural gas	0,097 Euro/ kWh 0,0894 Euro/ kWh	0,097 Euro/ kWh 0,0894 Euro/ kWh
District heating	0,0363 Euro/ kWh	0,0363 Euro/ kWh
Other (specify)	Euro/ kWh	Euro/ kWh

12. Standards and codes of practice

There is no obligation or legislation requirement about certification and testing of solar collectors. There is also no institution in Slovenia certificated for carrying out the testing and certifying. In general hot water preparation is covered by sanitary regulations. International standards were adopted as national standards for solar collectors, solar systems and factory made solar systems. No control scheme has been established until now. The national standards for nomenclature and water and air solar collectors testing were accepted under Yugoslav office for standardization in 1987. After Slovenia become independent, international standards in field of solar systems were adopted as national standards.
The lack of domestic products is also the reason why no certification laboratory (office) exist in Slovenia at the moment. The expenses for creating such lab, maintaining the equipment and high stuff costs are too big for the current solar thermal market.
All Slovenian companies that export solar thermal systems have their product tested in European laboratories.
List of major legislative documents and standards are listed in Annex B.

13. Level of R & D

Research and Development activities are funded from three main sources – EU funding, governmental funding and private funding. The main programs for European funding are the 6th framework programme for research and technological development and The Intelligent Energy - Europe Programme. Governmental funding support Research and Development mainly by financing research at universities and specific project of solar development partnerships between private companies and University. Financial subsidies support different types of Research and development activities, including development of new product, testing new materials, promotion of solar technologies, etc.
There is only one company that is strongly dependant on the solar market – STROJ d.o.o. The firm has their own R&D and produces and installs the solar systems. They have experience in solar thermal system production, installation and maintenance. There are solar system R&D units also at Hidria IMP Klima, Lentherm Invest and Trimo d.d.
There is also R&D activity at the Faculty of Mechanical Engineering which works on many R&D projects to support the industry of solar thermal systems and develops solar products as partner of private companies from industry. They work also on basic research in the field of solar systems in form of pilot projects, under graduate and postgraduate studies.

D. State of Marketing

14. Distribution and marketing methods

Solar thermal systems are directly marketed via specific fairs, Internet sites, magazine advertisements and also in technical articles. Manufacturers and suppliers (especially Lentherm Invest) advertise their solar thermal products on national and local radio stations. The advertisements are focused mainly on specific commercial brands.
There are some professional magazines (EGES) and newspapers additions (Varčujmo z energijo) targeted at renewable energy sources which often publish news and advertisements about solar thermal systems.
There is a Sejem energetike fair organized every two year at the Celjski sejem venue.
There is governmental financial support schemes for private investors offered by Eko Sklad who offers subsidies and loans under favorable conditions.
Imp Klimat also adopted some new marketing concepts. They offer 10% for tt first system installed in a municipality.
Guaranteed solar results contracts are not used as marketing incentives for collector installations.
Some companies, like Sonnenkraft, distribute their product mainly through installers but their share is not known.
The usual guarantee for solar collectors is 10 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

There are two main incentives for solar thermal system offered by Eko Sklad - Environmental Fund public fund: subsidies and loans under favourable conditions.
The national strategy for promoting solar thermal application is orientated mainly on promoting solar heating systems for tap water heating in single family buildings. A quite successful scheme was established decade ago. In the last four years the subsidies for solar systems for domestic hot water heating were:

- • 104 €/m² solar collector (SC) to a maximum of 628 € (in 2002 – 2004)
- • 125 €/m² SC to a maximum of 750 € (in 2005)
- • 125 €/m² SC to a maximum of 2085 € for the solar system (in 2006, 2007)

For the larger solar thermal systems, subsidies (for the legal investors and enterprises) were available only between the years 2002 to 2004. It represented 30% of eligible costs or 40% if the solar system was used for cooling too.

The current subsidies (2008-2010) for solar thermal systems which can be applied for are presented below:

- For households: (subsidies for solar systems for domestic hot water heating)
  - 25% of investment to a maximum of 150 €/m² of solar collector for flat plate collectors
  - 25% of investment to a maximum of 200 €/m² for vacuum tube collectors
  - 25% of investment to a maximum of 75 €/ m² for self produced solar collectors

SolarKeymark-approved collectors are subsidized with an additional 10 €/m².
There are only few companies that offer third party financing which are subject to individual agreements.

15.2. Public supports for investments

Eko Sklad offers loans under favourable conditions for all investments in renewable energy sources. They offer a maximum amount of 20.000 euro for a maximum period of 10 years at a constant 3.9% interest rate.

15.3. Third party financing

There are not many ESCOs who would offer third party financing incentives.

E. Future Prospects

16. National energy policy

16.1. Brief description of the present and past energy policy and the role of solar thermal energy

The national target regarding RES can be found in two national strategic documents: Resolution about National Environment Protection Program 2005-2012 from 2005 and National Energy Program from 2003. Currently biomass is, in national energy policy, a much more favoured RES compared to solar energy; however, large demand of energy for tap water heating (6,4 PJ per year, 2,1 PJ alone in multifamily buildings) and a big share of electricity boilers ensure a bright future for solar heating systems. In reference to the floor area of dwellings in Slovenia, the average specific end use of energy for tap water heating is 32 kWh per square meter per year.

16.2. Priorities of the current general energy policy

The priority of general energy policy is to increase the use of renewable energy sources and efficient use of energy and consequently to become more energy independent and sustainable. The priority in current energy policy is to increase energy efficiency in all fields of energy use. The activities are targeted to individuals, private companies and public subjects. The goal will be achieved by the introduction of energy taxes, emissions taxes, excises, CO_2 emissions taxes, new standards and loans and also by awareness campaigns and demonstration projects. For fulfilling these tasks several plans were developed. Among them, the government is also developing a national network of energy consultants and subsidies scheme for rational energy use and use of renewable energy sources (subsidies for PV, solar thermal, biomass, etc).

16.3. Energy mix of the country - share of renewable, share of solar thermal energy

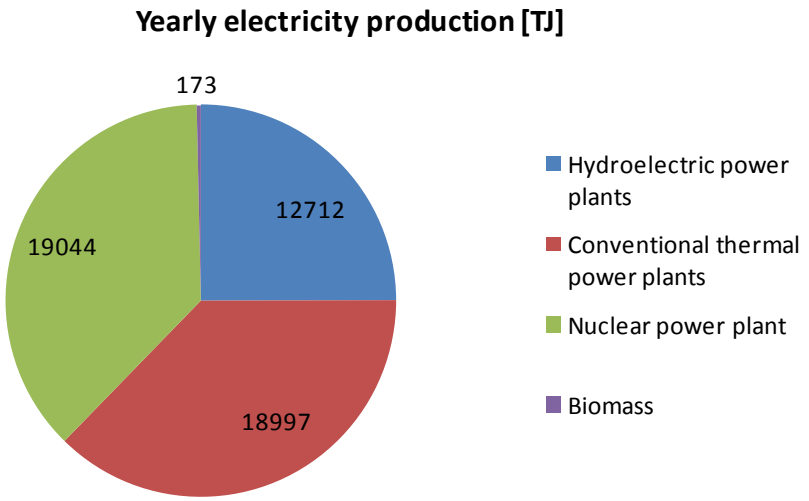


Figure 32: Yearly electricity production, year 2006 (Source:SURS)

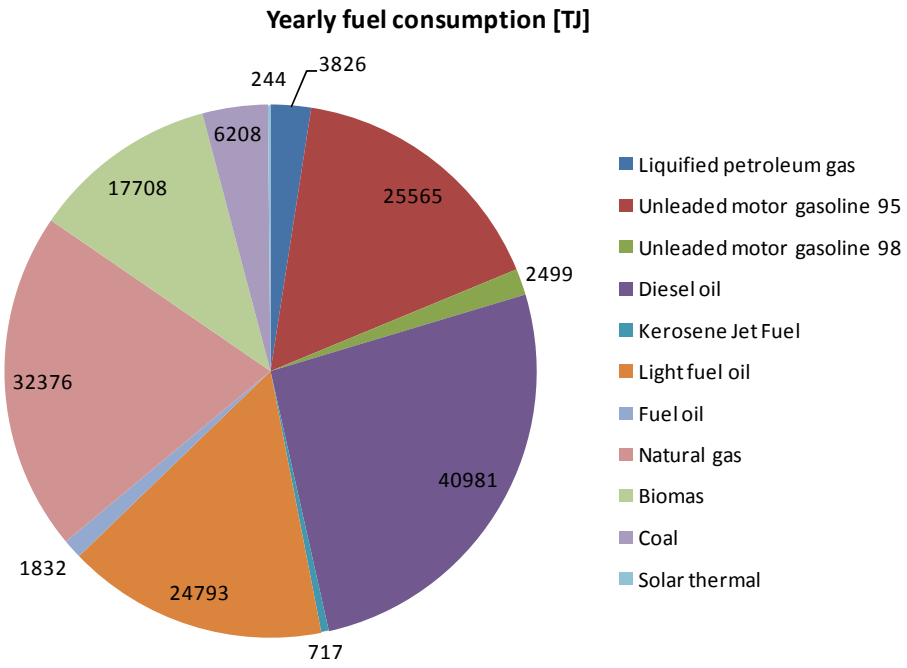


Figure 33: Yearly fuels consumption, year 2006 (Source:SURS)

16.4. Are there any targets to meet?

Share of RES in primary energy should increase to 12% by the year 2010. According to the plan an additional 4 PJ per year must be provided by 2010 through the additional use of biomass (3,1 PJ per year), biogas (0,4 PJ per year), geothermal energy (0,4 PJ per year) and 0,1 PJ per year from other RES. This should be fulfilled:
- by enlarging RES thermal from 22% in 2002 to 25% by 2010
- by enlarging the RES electricity from 32% in 2002 to 33,6 % by 2010
- by implementing a directive of biofuels - 5,75% of volume by 2010

16.5. Driving forces of energy policy

The driving force of energy policy is European and national legislation.

17. Local bodies, prescribers, certification

There is one laboratory in Slovenia equipped for testing solar collectors, solar heat storage as well as for testing solar systems in-situ. It was established in 1984 at the Faculty of Mechanical Engineering, University of Ljubljana. Despite a long tradition, they are not recognized as a certification body but their report is recognized as a national authority.

- University of Ljubljana, Faculty of Mechanical Engineering, Laboratory for Heating, sanitary and solar technology, Contact: assoc. prof. Sašo Medved; saso.medved@fs.uni-lj.si

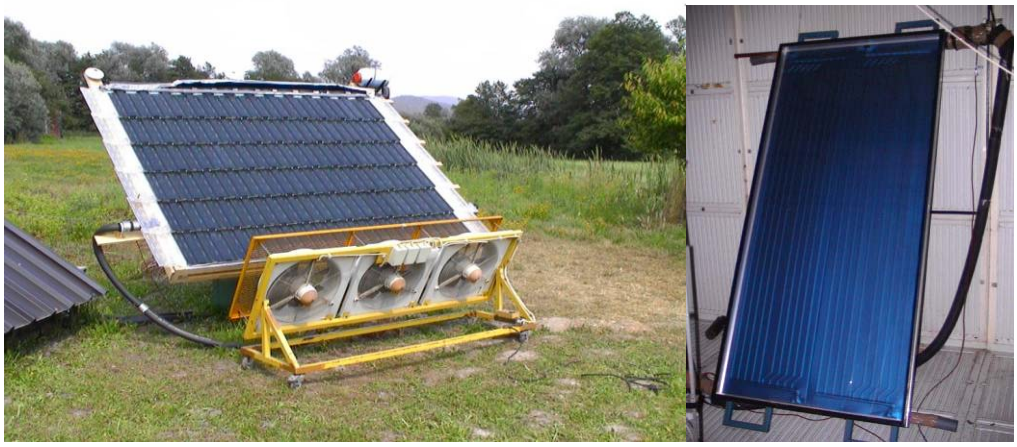


Figure 34: Outdoor and indoor testing stand at University of Ljubljana, Faculty of Mechanical Engineering

Some companies have simple testing facilities, including: STROJ d.o.o. and Gorenje Tiki.

In the year 2007 there was a solar thermal platform established in Slovenia which joined all companies working on the field of solar thermal systems. There are the following solar thermal organizations in Slovenia:

- SLOSE, Slovenian association for solar energy, Ambrožev trg 5, 1000 Ljubljana
- SITHOK, Slovenia association for heating, cooling and air conditioning, Aškerčeva 6, 1000 Ljubljana

17.1. B.Sc, M.Sc, PhD study

- University of Ljubljana, Faculty of Mechanical Engineering, B.Sc, M.Sc, PhD study, Aškerčeva 6, 1000 Ljubljana, Contact: assoc. prof. Sašo Medved, saso.medved@fs.uni-lj.si
- University of Ljubljana, Faculty of Electrical Engineering, B.Sc, M.Sc, PhD study, Tržaška 25, 1000 Ljubljana, Contact: assoc. prof. Marko Topič, marko.topic@fe.uni-lj.si
- University of Ljubljana, PhD Environmental protection study, Kongresni trg 12, 1000 Ljubljana, Contact: Mrs. Sergeja Mitič, sergeja.mitic@uni-lj.si

17.2. Workshops organizers, professional education:

- Agencija za prestrukturiranje energetike, d.o.o. (APE d.o.o.), Litijska c. 45, 1000 Ljubljana, Contact: Franko Nemac, franko.nemac@ape.si
- SLOVENIAN E-FORUM; Society for Energy Economics&Environment, Dimičeva 12, 1000 Ljubljana, contact: se-f@siol.net
- Building and Civil Engineering Institute (ZRMK), Dimičeva 12, 1000 Ljubljana, contact: Mrs. Marjana Šijanec, PhD, marjana.sijanec@gi-zrmk.si
- Kubus Inženiring d.o.o., Kotnikova 30, 1000 Ljubljana, Contact: info@kubus.si

17.3. Education for citizens

A national grid of energy consultancy offices exists which offers free of charge support for citizens. There are 33 offices spread across the territory of Slovenia (see picture below) with 73 trained consultants. They also organize the solar systems self made groups.

Figure 35: List of national energy consulting offices for citizens

- Building and Civil Engineering Institute (ZRMK), Dimičeva 12, 1000 Ljubljana, contact: Matjaž Malovrh, matjaz.malovrh@gi-zrmk.si

17.4. Companies and manufacturers

See Annex A.

18. Objectives for the solar industry / market

The new subsidy scheme is targeted for a goal of 20.000 m² yearly installed solar collectors by year 2011 and additional 10.000 m² for every year after. By the year 2010 the plan for the amount of solar collectors per 1000 inhabitants is planned to be 100 m².

18.1. Prospects for market development by sector.

Table 6: Plans for new solar thermal collectors installed until 2010

	PROSPECTS 2010				
	Total Solar Collector Surface Area (m²)	Solar collector productivity MWh/ m².year	Annual solar energy supply MWh	Total CO2 Emissions avoided tonnes/ year	Employment Number of permanent jobs
Domestic hot water production	159.500	0,6	95700	32538	
Large collective solar systems	20.000	0,6	12000	4080	
Space heating,	25.000	0,6	15000	5100	
District heating	2.000	0,6	1200	408	
Air conditioning and industrial process heating	500	0,6	300	102	
Unglazed collectors	3.000	0,6	1800	612	
Total	**210.000**				

Table 7: Plans for new solar thermal collectors installed until 2020

	PROSPECTS 2020				
	Total Solar Collector Surface Area (m²)	Solar collector productivity MWh/ m².year	Annual solar energy supply MWh	Total CO2 Emissions avoided tonnes/ year	Employment Number of permanent jobs
Domestic hot water production					
Large collective solar systems					
Space heating,					
District heating					
Air conditioning and industrial process heating					
Unglazed collectors					
Total	**400.000**				

Solar thermal systems are, despite quite good solar geographical location, still quite rare. Acording to statistical office of Slovenia there are only 3% of dwelling equipped with solar thermal installation. The solar thermal systems are mainly used for domestic hot water and some of them also for space heating. There was 10.000 m² of solar collectors installed in year 2007. The new subsidy scheme is targeted for goal of 20.000 m² yearly installed solar collectors by year 2011 and additional 10.000 m² for every year after. By the year 2010 the plan for amount of solar collectors per 1000 inhabitants is planned to be 100 m².
Additional subsidies will be offered to those, who will install solar thermal system not only for domestic water, but also for space heating.
The amount of money for subsidies is planned to be 3.000.000 Euros for the first year, 4.500.000 Euros for the second year and 6.000.000 Euros for the third year.

19. Strategy to overcome the barriers to market development

19.1. Description of major barriers by category

19.1.1. Technical

There are only three national producers of solar systems in Slovenia. The technology of selective coatings is not developed. Solar absorbers are imported. There are no vacuum tube solar collector manufacturers in Slovenia.

19.1.2. Institutional

Subsidies for solar thermal system are targeted to private individuals, not for legal entities.

19.1.3. Economic

No subsidies for hotels and companies using industrial process heat; relatively small solar thermal market in absolute figures; long payback period for non-subsidized solar thermal systems

19.1.4. Cultural

Mental barriers in architecture thinking that say buildings with solar system don’t look as nice

19.1.5. Educative

Not enough user awareness raising campaigns, not enough knowledge about Solar Keymark quality certification scheme,

19.1.6. Quality

Quality of self produced solar collector is inconsistent; not many distributors of Solar Keymark certificated solar thermal systems

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

19.2.1. Technical

New products – introducing envelope-integrated solar collectors and other innovative solar collectors concepts

19.2.2. Institutional

More quality control over installers; quality conditioned subsidies for solar thermal systems; GSR control and monitoring

19.2.3. Economic

Promotions of solar thermal system; tax reduction for large systems and legal entities

19.2.4. Cultural

Visit tours, seminars

19.2.5. Educative

Dissemination of Solar Keymark as a GSR certification scheme, education of architects about available solar thermal design solution and practice

19.2.6. Quality

Higher subsidies for quality solar thermal system selections and also for installation and control

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

- Technical: education of innovative solar thermal approaches
- Institutional: quality control of subsidized systems
- Economic: solution of possible incentives for legal entities
- Cultural: visit tours
- Educative: information leaflets, media campaigns
- Quality: quality control of installed systems
- Other

The solar thermal market in the private sector in Slovenia is quite well developed and the plans for further development are quite optimistic. The main barrier for the solar thermal market is a lack of large solar thermal systems, which are very rarely installed. The price of dwellings in multi storage buildings don't vary regarding the amount of energy needed in the apartment for heating and also for cooling. For that reason, there is not much interest from the investors for large solar thermal systems. There is also lack of available feasibility studies and demonstration projects. There is also a lack of knowledge in planning of large solar thermal systems. Large solar thermal systems are the main barrier for further solar thermal development.

Some of the barriers that should be overcome to ensure self-developing solar thermal market are:

- with regard to low price of electricity, solar thermal systems can hardly compete with heat pumps;
- although Slovenia adopts international standards for solar thermal systems, they are not required and there is no authorized laboratory for quality control;
- subsidy schemes are developed only for small solar systems; the subsidies were available for large solar systems between the year 2002 and 2004 but with low investors interest (only 4 applications were requested, total area on installed solar collectors was 135 m²); according to successful subsidy schemes for smaller solar thermal systems, the subsidy scheme for larger ones could help to develop the solar thermal market, but this will, by far, not be enough without developing professional skills;
- technical services are of poor quality; the best case examples, for example pilot project on different segments (camping places, hospitals, public buildings), will be necessary to encourage planers, installers and investors; of course performance monitoring must be implemented and available to the public;
- knowledge about planning, installing and maintaining large solar thermal systems is poor

Suggestions from key actors:
The questionnaire was sent 150 producers and installers of solar thermal systems. 16 completed questionnaires were received. The results of the questionnaire are presented below.

What are the technical barriers of Slovenian solar thermal market:

- 54% of companies think there is not enough experience with the operation of solar thermal systems
- 72% of companies think solar thermal systems are not well designed
- 36% of companies think there should be more pilot projects available to be seen by the public
- 36% of companies think the systems should be designed as turnkey projects

What are the institutional barriers of Slovenian solar thermal market:

- 82% of companies think the legal procedures for subsidies approval are too complicated
- 64% of companies think there are not enough subsidies approved. There should be a guaranteed subsidy for every applicant
- 54% of companies think there are not enough obligatory laws encouraging the use of solar thermal systems

What are the economical barriers of Slovenian solar thermal market:

- 73% of companies think the subsidies for solar thermal systems are too low
- 45% of companies think people are not informed enough about the available subsidies
- 73% of companies think the pay back period of solar thermal systems is too long
- 64% of companies think solar thermal systems are too expensive
- 54% of companies think the relatively low standard in Slovenia influences solar thermal system investment decisions

What are the economical barriers of Slovenian solar thermal market:

- 64% of companies think there is a lack of knowledge of solar thermal system among designer
- 73% of companies think there is a lack of knowledge of solar thermal systems among installers
- 54% of companies think there is lack of knowledge of solar thermal systems among investors

What are the quality barriers of Slovenian solar thermal market:

- A lot of companies think the Chinese product are not of sufficient quality, require a lot of repairs and put a bad light on other quality solar thermal systems
- 45% of companies think that there is lack of maintenance of solar thermal systems

Suggestions for improvements of solar thermal market:

- Introduce quality conditioned subsidies for solar thermal systems (subsidies approved only for installed and quality tested systems)
- Liberalization of legislation for use of common areas in multifamily buildings (there are a lot of problems with solar thermal systems installation on roofs of multifamily buildings because not everybody agrees with the installation)
- Guaranteed subsidies (not limited by the amount of money available, because only the first applications are approved)
- More education and training about solar thermal systems for of architects, installers and economists
- More public pilot projects
- Law for obligatory solar thermal investments for new buildings
- Minimum quality standard for solar thermal products
- More cooperation between suppliers, planners and installers
- Introduction of 0% VAT for investments in renewable energy sources
- More marketing of solar thermal systems in all forms of media
- More turnkey solar thermal systems
- Less bureaucratic procedures for solar thermal subsidies
- Increase the subsidies
- Encourage quality products

20. Concluding remarks

The solar thermal market in the private sector in Slovenia is quite well developed. Slovenia has approximately 50 m² of solar collectors per 1000 capita installed, what is the sixth most dense in Europe. The plans for further development are quite optimistic.

There is a lack of solar thermal heating systems in Slovenia and the lack of large solar thermal systems in Slovenia. The public buildings are seldom equipped with solar thermal system, which could be solved by appropriate laws.

There is not much interest for solar thermal system in new multifamily buildings since there are no financial benefits reflected on the price of the dwelling.

There is also a lack of knowledge in planning of large solar thermal systems.

References

[1] Faculty of Mechanical engineering, University of Ljubljana

[2] Minister of the Environment and Spatial Planning (AURE)

[3] Statistical office of the Republic of Slovenia

List of Figures

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Annex A: Solar Thermal Directory

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

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
1	Stroj d.o.o.	Dvorska vas 31c	04 53 33 070	franc.stroj@siol.net		Producer	
2	Hidria IMP Klima d.o.o.	Godovič 150	05 374 30 00	klima@hidria.com		Producer	
3	Lentherm-invest d.o.o.	Industrijska ul.1	02 720 70 43			Producer	
4	ETIKS d.o.o.	Prožinska vas 15, 3220 Štore	03 428 28 80	etiks@siol.net		Trader	
5	VIESSMANN	Cesta XIV divizije 116a, 2000 Maribor	02 480 55 50	viessmann@viessmann.si		Trader	
6	ZEUSSSOLAR d.o.o.	Mače 6, 4250 Preddvor	04 255 57 80	zeussolar@siol.net		Trader	
7	BUDERUS SLOVENIJA	Trnoveljska cesta 2e, 3001 Celje	03 428 86 02	buderus@kovintrade.si		Trader	
8	WEISHAUPT d.o.o.	Tehare 1, 3001 Celje	03 425 75 50	info@weishaupt.si		Trader	
9	SONCU d.o.o.	Tomaičeva 1, 4270 Jesenice	04 583 73 10	info@soncu.si		Trader	
10	KON TIKI SOLAR d.o.o.	Ljubljanska c 21k, 1240 Kamnik	01 831 03 80	kon.tiki.solar@siol.net		Trader	
11	DOKAN TRADE	Grajska cesta 6 2312 Orehova vas	02 605 76 31			Trader	
12	TILIA d.o.o.	Ljubljanska c. 89 8000 Novo mesto	07 332 44 42	info@tilia.si		Trader	
13	VELUX Slovenija d.o.o.	Ljubljanska c. 51A 1236 Trzin	01 724 68 68	velux@velux.si		Trader	
14	ZARJA KOVIS d.o.o.	Molkova pot 5 1240 Kamnik	01 830 86 00	info@zarja-kovis.si		Trader	
15	FIRŠT s.p.	Radegunda 54 3330 Mozirje	03 898 35 00	info@first.si		Trader	
16	IBERSOLAR ENERGIA S.A.	Pot na Tojnice 48 1360 VRHNIKA	01 755 12 56	gregor.sedej@ibersolar.com		Trader	
17	EKODOM d.o.o.	Celovška cesta 122 1000 Ljubljana	040 493 400	info@ekodom.si		Trader	

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
18	Eso d.o.o.	Žagarska cesta 21 1291 Škofljica	01 366 37 31	sse@eso.si		Trader	
19	EnND, Dejan Gradišnik s.p.	Stepišnikova 1, 2310 Slovenska Bistrica	040 351 283	info@ennd.net		Trader	
20	ARTIM razvoj in projektiranje d.o.o.	Virmaše 210 4220 Škofja Loka	051 206 692	info@biomasa-herz.si		Trader	
21	Klima Center Horizont d.o.o.	Vodovodna ulica 30c 2000 Maribor	02 300 44 80	info@horizont.si		Trader	
22	SELTRON d.o.o.	Ruška cesta 96 2345 Bistrica ob Dravi	(02) 671 96 00			Trader	
23	Central vod Kraševec Stanislav s.p.	Metulje 4 1385 Nova vas	01/ 709-12-43			Installer	
24	Bernard Kotnik s.p.	Stražgonjca 25 2331 Pregersko	02/ 792 -04-11			Installer	
25	EVJ Elektroprom d.o.o.	Loke pri Zagorju 22 1412 Kisovec	03/5657150			Installer	
26	Ogrevanje Gaber d.o.o.	Draga 27 4220 Škofja Loka	041/ 600-323			Installer	
27	Adrijan Masten s.p.	Tomačevica 1 6223 Komen	05/ 766-87-88			Installer	Installer
28	Instalacije Jožef Dulc s.p.	Stranje pri Škocjanu 7 8275 Škocjan	07 33 747 20			Installer	
29	Ellatron d.o.o.	Rogaška cesta 29 3240 Šmarje pri Jelšah	03/ 490-68-50			Installer	
30	Instalacije Horvat Stanislav s.p.	Prekmurske čete 94 9232 Črešovci	02/ 570-17-46			Installer	
31	Evromojster Tuner d.o.o.	Rusjanov trg 6 1000 Ljubljana	041/ 741-861	instalacije1@gmail.com		Installer	
32	Viljem Potočnik s.p	Zgornja Luša 16 4227 Selca	04/ 514-12-33	voda.potocnik@siol.net		Installer	
33	MAS d.o.o.	Partizanska cesta 123 6210 Sežana	031/ 282-969	tempos1@siol.net		Installer	
34	Instalacije Martin Slinkar s.p.	21. oktobra 17/c 8340 Črnomelj	07/ 30 53 148			Installer	

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
35	Instalacije centralnih kurjav, Ursic Anton s.p.	Jezero 101 b 1352 Preserje	031/ 485-805	mateja.ursic@volja.net		Installer	
36	Montaža centralne kurjave, Horvat Milan s.p.	Izluskova 19 9262 Rogašovci	02/ 557-12-71			Installer	Trader
37	Stojan Ivan s.p., Stojan Vid	Bodrišna vas 21 3231 Grobelno	03/ 579-41-91			Installer	
38	Mago d.o.o.	Skladiščna ulica 3 6210 Sežana	05/ 730-14-60	info@mago.si		Installer	
39	Martin Tršinar s.p.	Telčice 7 8275 Škocjan	07/ 30 77 690	martintrsinar@siol.net		Installer	
40	Ivan Masle s.p.	Nova pot 141 1351 Brezovica	031/ 485-805	majda.masle@volja.net		Installer	
41	SLEM d.o.o.	Landek 10 3203 Nova Cerkev	03/781 8060	slem.ovcar@gmail.com		Installer	
42	Termoklima Koper d.o.o.	Šmarska cesta 5b 6000 Koper	05/ 625-06-60	termo.klima@siol.net		Installer	
43	Radiator d.o.o.	Vihre 24 8216 Mirna peč	07/ 30 78 589	radiatormirnapec@volja.net		Installer	
44	Jenko Branko s.p.	Žeje 4b, Komenda	041/686-806	brane.jenko@siol.net		Installer	
45	Adrijan Masten s.p.	Vojčica 15 8296 Kostanjevica	041/ 811-638			Installer	
46	VOPIN inštalacije s.p.	Černelčeva cesta 3 8250 Brežice	07/4962777	vopin.instalacije@email.si		Installer	
47	Lojze Štebe s.p.	Brniška cesta 48 1217 Vodice	01/832 -37-87	lojze.stebe@siol.net		Installer	
48	Sanitar d.o.o.	Vojkova 58 1000 Ljubljana	01/568 27 29	sanitardoo@siol.net		Installer	
49	EKODOM d.o.o.	Celovška cesta 122 1000 Ljubljana	040 493 400	info@ekodom.si		Installer	
50	INŠTALACIJE Krušec Tomaž, ing., s.p.	Štula 3 1210 Ljubljana - Šentvid	01 512 03 42			Installer	Installer
51	CENTAL, INŠTALACIJE Cene Drago s.p.	Krajnčica 31 3230 Šentjur	3 574 18 11			Installer	
52	ECO - CENTRAL Nabergoj Branko s.p.	Prušnikova ulica 40 2000 Maribor	2 420 64 51			Installer	
53	ELEKTRO GRELKO Forjan Alojz s.p.	Melinci 131 9231 Beltinci	2 541 21 86			Installer	

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
54	IMH INSTALATERSTVO Hudak Marijan s.p	Sečje selo 15 8344 Vinica				Installer	
55	INSTALACIJE Jožef Dulc s.p.	Stranje pri Škocjanu 7 8275 Škocjan	7 337 47 20		http://www.dulc.net	Installer	
56	KOVI Jermol Simon s.p.	Ozeljan 19B 5261 Šempas	5 308 82 70		http://www.klimekovi.com	Installer	
57	MONTAŽA CENTRALNEGA OGREVANJA Oskar Franca s.p.	Hrvatini 147B 6280 Ankaran - Ancarano	5 651 47 10			Installer	
58	MONTAŽA IN SERVIS CENTRALNEGA OGREVANJA Gabrovšek Tomaž s.p.	Cvetlična pot 2 1354 Horjul	1 754 94 73			Installer	
59	MONTAŽA OGREVALNIH NAPRAV Čebron Franko s.p.	Preserje 80A 5295 Branik	5 305 72 19			Installer	
60	MONTAŽA VODOVODNIH IN SOLARNIH NAPRAV Bezjak Zvonko s.p.	Borovci 14A 2281 Markovci	2 755 31 31			Installer	
61	S.O.V. SOLARIJ - OGREVANJE - VODA Toplak Ivan s.p.	Log 165 2345 Bistrica ob Dravi	2 665 01 11			Installer	
62	STROJ OGREVALNE NAPRAVE IN HELIKOPTERSKI PREVOZI Stroj Franc s.p.	4 533 30 70	4 533 30 70			Installer	
63	VULČIK TIHOMIR s.p. TIHOMIR SPLOŠNO VARJENJE KOVIN	Babnikova ulica 15 2000 Maribor	2 461 34 60			Installer	

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
64	CENTRALVOD Cmrečnjak Jožef s.p.	Podgrad 132 6244 Podgrad	5 783 54 60			Installer	
65	I.C.I., d.o.o., KRANJ	Ulica Janeza Puharja 6 4000 Kranj	4 253 51 70			Installer	
66	INSTALACIJE CENTRALNE KURJAVE Kučan Tibor s.p.	Šalovci 164C 9204 Šalovci	2 559 13 00			Installer	
67	INSTALACIJE Horvat Stanislav s.p.	Ulica Prekmurske čete 94 9232 Črenšovci	2 570 17 46			Installer	
68	INSTAL - OGREVANJE, VODOVOD, KLIMA NAPRAVE Dorn Boris s.p.	Ulica bratov Vedenikov 8 3000 Celje	3 492 75 94			Installer	
69	INŠTALATERSTVO CENTRALNIH KURJAV, VODOVODA IN SERVISIRANJE Pleteršek Ermin s.p.	Suhodolčanova ulica 2 2204 Miklavž na Dravskem polju	2 629 23 73			Installer	
70	INŠTALATERSTVO OGREVALNIH IN VODOVODNIH NAPRAV Simonič Zdenko s.p.	Vzhodna ulica 36 2000 Maribor	2 471 02 29			Installer	
71	INŠTALATERSTVO Zupanc Anton s.p.	Vodruž 6A 3230 Šentjur	3 574 36 66			Installer	
72	ITT - INSTALACIJE TOPLOTNE TEHNIKE Pokrivač Tone s.p.	Valjevska ulica 12 2000 Maribor	2 613 41 10			Installer	
73	MONTAŽA CENTRALNE, VODOVODNE IN PLINSKE INSTALACIJE Zagoričnik Bojan s.p.	Preserje 7A 3314 Braslovče	3 570 93 53			Installer	

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
74	MONTAŽA IN UPRAVLJANJE ENERGETSKIH NAPRAV Kešar Janez s.p.	Jama 47 4211 Mavčiče	4 250 54 20			Installer	
75	MONTAŽA OGREVALNIH NAPRAV Šantič Ivan s.p.	Gažon 98 6274 Šmarje				Installer	
76	MONTER ENERGETSKIH NAPRAV Pergar Jurko s.p.	Lokavec 158A 5270 Ajdovščina	5 364 22 77			Installer	
77	OGREVALNE IN HLADILNE NAPRAVE Z IZOLACIJO Povalej Zvonko s.p.	Loka pri Žusmu 25 3223 Loka pri Žusmu	3 577 12 45				
78	STROJNE INSTALACIJE Gobec Alojz s.p.	Irje 33C 3250 Rogaška Slatina	3 819 22 00				
79	TERMOVOD INŠTALACIJE VODOVODA IN CENTRALNE KURJAVE, MONTAŽA OLJNIH GORILCEV Blatnik Jože s.p.	Dvor 84 8361 Dvor	7 308 83 32				
80	TOPLINA d.o.o.	Kotlje 22 2394 Kotlje	2 822 38 73				
81	VODOSAN d.o.o.	Trg Alfonza Šarha 12 2310 Slovenska Bistrica	2 818 52 50				
82	VOPIN INŠTALACIJE Ivan Neral s.p.	Černelčeva cesta 3 8250 Brežice	2 017 496 27 77				

Annex B: List of major legislative documents

SIST EN 12975-1:2006 - Toplotni sončni sistemi in sestavni deli – Sprejemniki sončne energije – 1. del: Splošne zahteve - Thermal solar systems and components - Solar collectors - Part 1: General requirements

SIST EN 12975-2:2006 - Toplotni sončni sistemi in sestavni deli – Sprejemniki sončne energije – 2. del: Preskusne metode - Thermal solar systems and components - Solar collectors - Part 2: Test methods

SIST EN 12976-1:2006 - Toplotni sončni sistemi in sestavni deli – Industrijsko izdelani sistemi – 1. del: Splošne zahteve - Thermal solar systems and components - Factory made systems - Part 1: General requirements

SIST EN 12976-2:2006 - Toplotni sončni sistemi in sestavni deli – Industrijsko izdelani sistemi – 2. del: Preskusne metode - Thermal solar systems and components - Factory made systems - Part 2: Test methods

SIST ENV 12977-1:2002 - Toplotni sončni sistemi in sestavni deli - Neserijsko izdelani sistemi - 1. del: Splošne zahteve - Thermal solar systems and components - Custom built systems - Part 1: General requirements

SIST ENV 12977-2:2002 - Toplotni sončni sistemi in sestavni deli - Neserijsko izdelani sistemi - 2. del: Preskusne metode - Thermal solar systems and components - Custom built systems - Part 2: Test methods

SIST ENV 12977-3:2002 - Toplotni sončni sistemi in sestavni deli - Neserijsko izdelani sistemi - 3. del: Določanje značilnosti hranilnikov toplote za sisteme ogrevanja s soncem - Thermal solar systems and components - Custom built systems - Part 3: Performance characterisation of stores for solar heating systems

SIST ISO 9806-1:1997 - Metode za preskus sprejemnikov sončne energije - 1. del: Termični učinek zasteklenih sprejemnikov s kapljevino kot prenosnikom toplote, vključno z določitvijo padca tlaka v sprejemniku - Test methods for solar collectors - Part 1: Thermal performance of glazed liquid heating collectors including pressure drop

SIST ISO 9806-2:1997 - Metode za preskus sprejemnikov sončne energije - 2. del: Ovrednotenje preskusnih postopkov - Test methods for solar collectors - Part 2: Qualification test procedures

SIST ISO 9806-3:1997 - Metode za preskus sprejemnikov sončne energije - 3. del: Termični učinki nezastekljenih sprejemnikov sončne energije s kapljevino kot prenosnikom toplote (samo z

zaznavnim prenosom toplote), vključno z določitvijo padca tlaka v sprejemniku - Test methods for solar collectors - Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop

oSIST prEN 15316-4-3:2006 - Grelni sistemi v stavbah – Metoda za preračun energijskih zahtev in učinkovitosti sistema – 4-3. del: Sistemi za ogrevanje prostora, toplotni sončni sistemi - Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-3: Space heating generation systems, thermal solar systems