EIE-06-085 SOLPOOL

Intelligent Energy Europe

Solar Energy Use in Outdoor Swimming Pools SOLPOOL

National Fact sheet Reports on the state of the Demand and Potential of Solar Heating of Outdoor Swimming Pools

FRANCE

D05 National fact sheets on boundary conditions

D06 Requirement sheet for solar thermal use

D07 Funding sheet on existing grant schemes and new approaches

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List of Acronymes

ALE	Agence Locale de l’Energie de l’Agglomeration Lyonnaise
ST	Solar Thermal
A + G	Solar absorbers and Gas

Etc.

1 Introduction

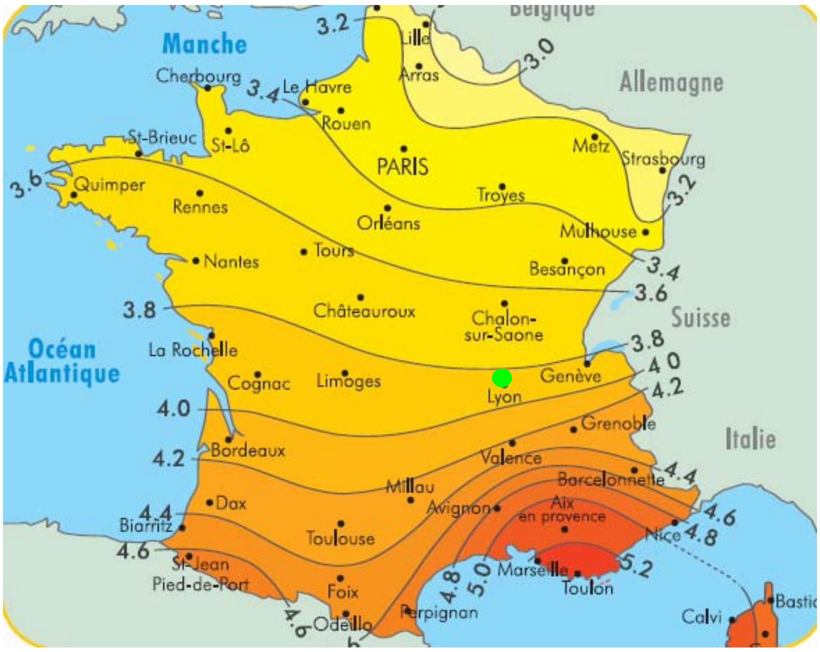
In Europe, the suppliers and the owners of outdoor swimming pools spend every year several million euros to maintain a comfortable temperature of pool water. The increase of the cost of the energy and the ecological disadvantages of the systems of heating represent big challenges for the owners of swimming pools opened to the public. Now the energy necessary to warm the water is supplied free of charge during summer: the power of the sun guarantees comfortable temperatures, even the cloudy days. The use of solar absorbers for the heating of the water offers a convincing alternative, which has more the advantage to answer the economic requirements.

In the region of Lyon, there are 57 municipalities (1 300 000 inhabitants) and 28 public swimming pools, that's why the ALE decided to participate in the Solpool project.

2 Environmental conditions for the use of Solar Thermal systems

Lyon and its suburb have a moderate climate, with 1976 hours/year of insolation, and 825 mm/year for the rain (the meteo station is in Bron; height: 197m, lat: 45°43'24"N, lon: 04°56'12"E). The outdoor swimming pool season is from June in August.

<table>
<tr><th colspan="2">Radiation in Lyon</th></tr>
<tr><td>Climatic</td><td>Solar map of France. In Lyon, the year average insulation is between 3.8 and 4 kWh/m².day (45° - South).



In Lyon (●), the insulation is, per month,</td></tr>
</table>

- 0°, South, kWh/m² per day

Insulation :	jan	fév	mars	avr	mai	juin	juil	août	sep	oct	nov
Global (IGP)	1	1.85	3.21	4.54	5.33	5.97	6.34	5.09	3.68	2.24	1.11

- 45°, South, kWh/m² per day

Insulation :	jan	fév	mars	avr	mai	juin	juil	août	sep	oct	nov
Global (IGP)	1.42	2.46	3.83	4.6	4.81	5.12	5.57	4.95	4.15	2.96	1.53

(Source: Sunmaster)

3 State of the Art of Solar Thermal Applications

Solar heating of open-air swimming pool water has some decisive advantages over other methods of using solar energy thermally:

- Temperature level: The required temperature level is comparatively low at 18°C to 26°C. This permits the use of inexpensive plastic absorbers.
- Solar radiation and time of use: The time of the highest solar radiation matches the time of use very well. Commonly at latitudes in Central Europe open-air pools are operated from beginning/middle of May until the middle of September. During this period approximately 65 – 75% of the annual solar radiation occurs.
- Simple system design:The pool water flows directly through the absorber. The storage tanks normally required for solar energy systems are not required since the pool itself takes over this function.

Solar heating for open-air swimming pools have been used for several decades now and are a well- established technology. However, this does not mean that this application of solar thermal energy has reached its limits yet.

According to statistics in Sun in Action II, about 3-4.000 m^2 of unglazed collectors have been placed yearly in the 90's. The estimated production and sales for 2000 and 2001 is 10.000 m^2 yearly.

If we look at the developments over recent years, heating of the pool is too costly for most swimming pool owners. Existing older conventional heating systems are however often replaced either by absorber systems or the owners do without heating altogether.

3.1 Absorber Systems

3.1.1 Systems without auxiliary eating

Solar circuits in public open-air baths are normally operated with a separate solar circuit or absorber circuit pump. The hydraulic construction is much more complex than for private swimming pools because of the hygiene requirements.

A system in a large open-air pool functions according to the following principle:

The wastewater is led from the pool into a central water storage tank. This tank acts as a “water level display” for the whole swimming pool water circuit. Evaporated water is replaced here by fresh water. The water is pumped through the filter from the water tank. One (or according to the design of the filter system) several parallel-connected filter pumps are responsible for this. After this the water is returned to the pool via the water treatment system.

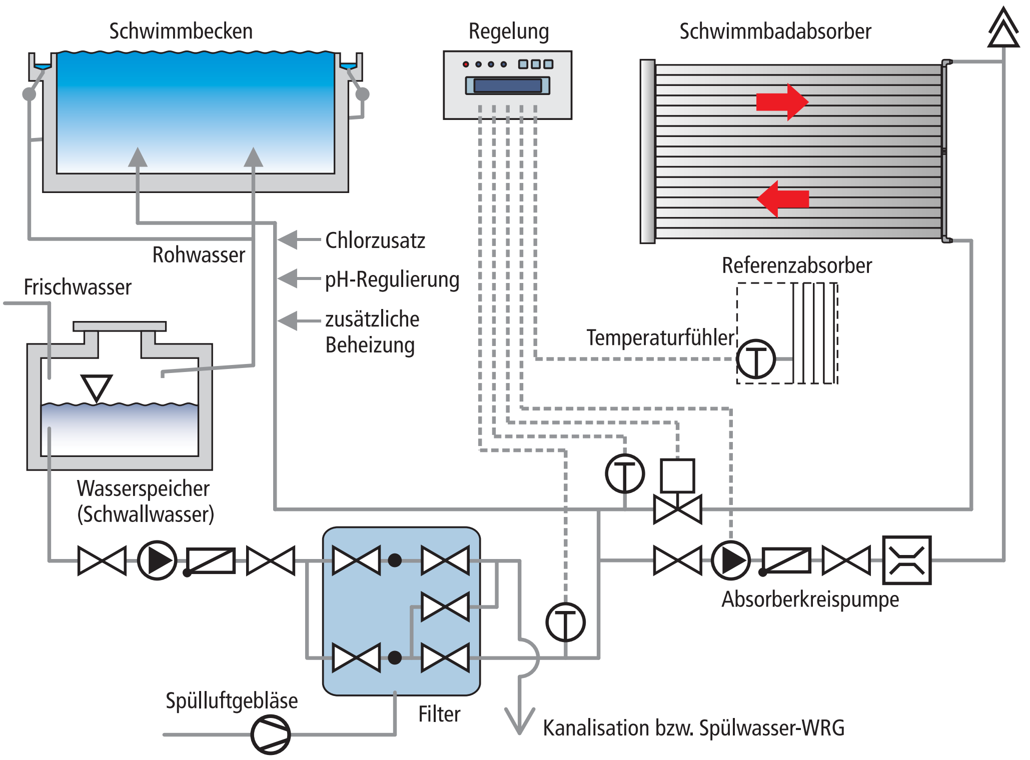


Figure 1: Circuit diagram of open-air swimming pool heating

In front of the water treatment system, the absorber field is connected to the circuit in a by-pass system. The solar loop pump diverts part of the volumetric flow and pumps it through the absorber field. The size of the partial volumetric flow depends on the size of the absorber field. The solar heated water is led to the main flow again after the diversion and finally arrives back in the pool.

A motorized valve should be installed in the absorber circuit feed line and a non-return valve after the solar pump. These two fittings prevent the absorber field from running empty when the system is not in operation.

Before the water reaches the pool the hygiene parameters are set. Chlorine and chemicals are introduced to regulate the pH value as necessary. The chlorine injection point should always be integrated behind the absorber field diverter since the chlorine concentration in the absorber circuit must not exceed 0.6 mg/l. If there is a pulse of chlorine (under certain circumstances up to 10 mg/l) the absorber may be damaged.

3.1.2 Systems without auxiliary eating

Conventionally operated auxiliary heating is necessary if the pool water has to be maintained at a constant temperature. Some open-air pools wish to offer their visitors warm swimming pool water independently of the sunshine, which requires auxiliary heating when the solar radiation is insufficient.

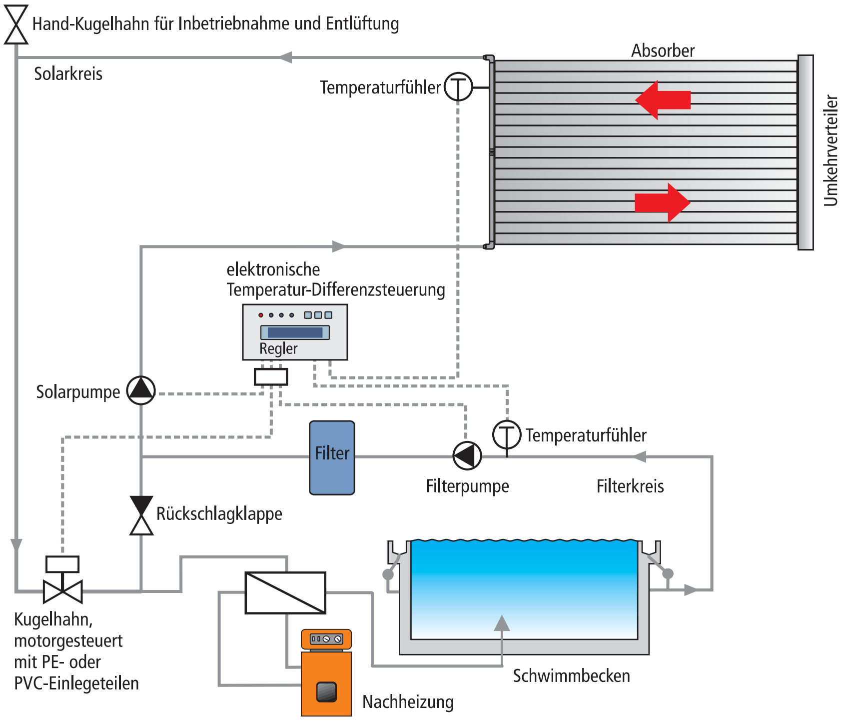


Figure 2: Circuit diagram of large absorber systems with additional heating

Auxiliary heating is operated by means of a conventional system (preferably gas heating systems) and an additional heat exchanger. In a dual-heated system, the auxiliary heating should always follow solar heating. If the water is not of the required temperature after recirculation to the filter circuit the auxiliary heating covers the residual heat requirement.

3.1.3 Unglazed absorbers

Solar open-air pool heating uses absorbers to collect the energy. The collector design is characterized by the lack of transparent cover and housing as well as thermal insulation. This simple construction is possible since the systems operate with low temperature differences between the absorber and the surroundings and with relatively uniform return temperatures (10°C – 18°C).

The swimming pool absorber is usually made from plastic.

The use of unglazed and un-insulated absorbers for solar open-air pool water heating has some advantages due to the special operating conditions:

In the typical operating range, with a temperature difference $\Delta\vartheta$ between the outside temperature and the mean absorber temperature of 0-20 K, absorbers often operate with a higher efficiency than glazed collectors. This can be explained by the fact that the optical losses (normally about 10 to 15% with respect to the amount of solar radiation) through a transparent cover do not arise and that the thermal losses are not so significant because of the low temperature difference $\Delta\vartheta$. These thermal losses increase with operating temperatures, which however rarely occur due to the moderate absorber temperatures found under normal operating conditions. The wind speed is the decisive factor, which causes losses and hence has a negative effect on the absorber efficiency. This was established in an investigation of absorber testing and test results of solar open-air pool heating.

Apart from a few special designs plastic absorbers can be subdivided into two groups:

- Tube absorbers (small tube absorbers)
- Flat absorbers

The tube absorber is the simplest design. A number of smooth or ribbed tubes (small tubes) are arranged in parallel and according to the design are connected together with intermediate webs or by retainers at a given spacing. Absorber lengths of up to 100 m can be achieved and obstructions like chimneys or rooflights can easily be circumvented.

In the case of flat absorbers, sometimes also called plate or cushion absorbers, the channels are linked together structurally. This produces plates of different dimensions with a smooth surface. This has the advantage that there are no grooves in which dirt or leaves can accumulate and solidify. The self-cleaning effect during rain is also better.

The influence of the design form on the conversion factor with different inclination angles can be measured but it is minimal. Variations of the angle of incidence lead to small differences in the conversion factor only for flat collectors. In the case of ribbed tube absorbers they lead to larger variations than with normal tube absorbers.

All absorbers are very easy to handle (see also the installation chapter), thus for example all common types can be walked on.

The following figures show a summary of the absorbers available on the market and the different methods of connecting the absorber to the collecting and distributing pipes.

Figure 3: Unglazed absorber field

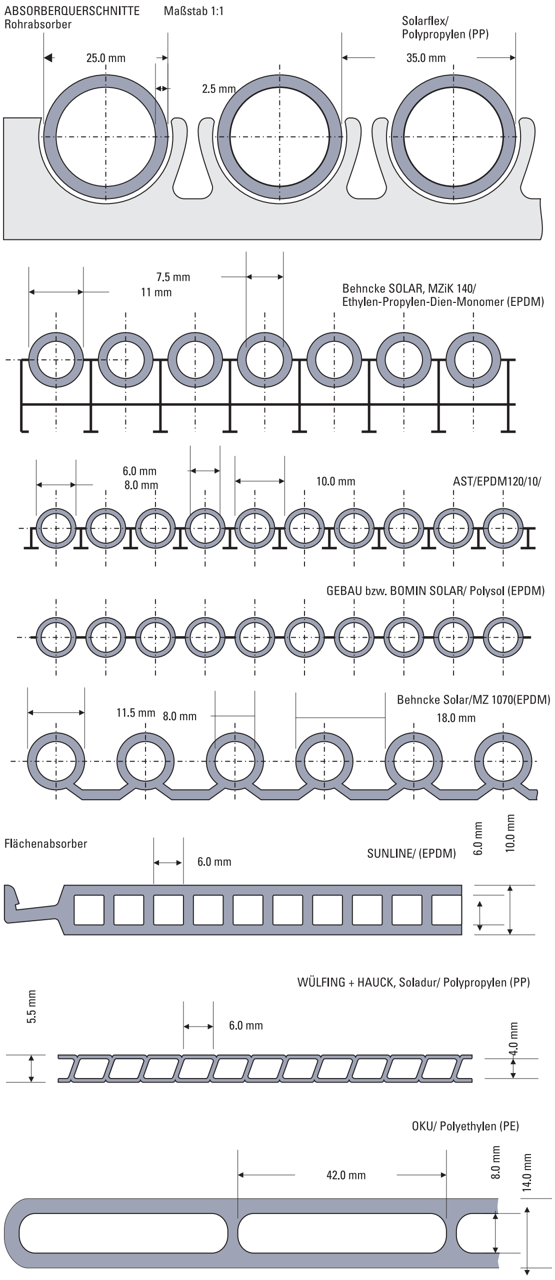


Figure 4: Different designs of absorber in cross-section

Solar absorbers are exclusively made from plastic. They can be hard and rigid or soft and flexible according to the plastic mixture. The use of plastic permits operation of the solar system with chlorinated swimming pool water. It is however necessary to consider the chlorine content. A high dose (from about 5 mg/l) can damage the absorber. The exact limits, from which damage can occur, depend on the plastic composition.

Plastics are also used for pipelines. These are however made from rigid materials.

The following plastics are basically the ones that can be used:

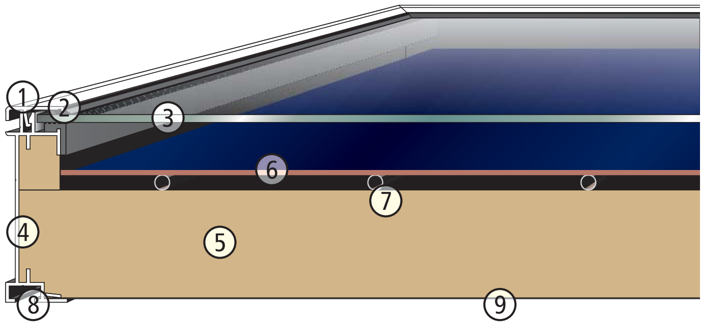
EPDM Ethyl Propylene Diene Monomer

PP Polypropylene

PE	Polyethylene
ABS	Acrylnitrile Butadiene Styrene copolymer
PVC	Polyvinyl Chloride (hard or soft)

3.2 Flat plate collectors

In open air swimming pools flat plate collectors may be installed if also a solar heating of domestic hot water for showers is required. Almost all glazed flat-plate collectors currently available on the market consist of a metal absorber in a flat rectangular housing. The collector is thermally insulated on its back and edges, and is provided with a transparent cover on the upper surface. Two pipe connections for the supply and return of the heat transfer medium are fitted, usually to the side of the collector.



1. Frame
2. Seal
3. Transparent cover
4. Frame-side-wall profile
5. Thermal insulation
6. Full-surface absorber
7. Fluid channel
8. Rear wall

Figure 5: Section through a glazed flat-plate collector

Because of the risk of corrosion of thermal collectors with copper absorbers, these can only be operated in solar systems for swimming pool heating if a separate solar loop is installed (i.e. indirect) including an external heat exchanger.

3.3 Hybrid systems

In some cases a combination of different collector types may be the appropriate solution for heating an open air swimming pool. In Germany some examples exist were a glazed flat-plate collector is combined with an unglazed absorber field. The flat-plate collector field is thus designed for heating domestic hot water for the showers while the absorber field is directly linked to the swimming pool water for heating.

Figure 6: Absorber- and flat-plate collectors for solar heating

Another hybrid solution may be a combination of air collectors and absorbers in order to use different global radiation input for the different oriented collector surfaces.

Figure 7: Combination of air collectors and unglazed absorbers

3.4 Existing norms and standards

The existing French standards and norms for the installation and use of solar thermal heating devices are stated here. Additional outdoor swimming pool norms and standards concerning solar thermal heating systems are listed. All important standards, which impacts the installation and usage of a solar thermal system are named and will be concerned by the development of the campaign strategies.

Solar Thermal pool heating:

- DTU (Documents techniques unifiés) regulation
- CSTB or Solarkeymark to solar equipment reference

- Referenced installers (Qualisol)

Solar thermals applications:

- CSTB or Solarkeymark to solar equipment reference
- Referenced installers (Qualisol)
- DTU (Documents techniques unifiés) regulation

Outdoor pool operation concerning ST heating:

- Etienne Gagnaire, Villeurbanne, France
- Lyon Vaise, France

4 Market analysis

France is one of the first European markets for swimming pools, with more than 1 million of privates swimming pools. In ten years, the French park doubled.

At this time, more than 3000 firms work in the swimming pool sector: around 200 manufacturers and more than 2500 installers.

Concerning the public swimming pool area, there is as this time no official recording of the swimming pool installations, so it would be inexact to say a precise number of the public swimming pool or of the private swimming pool where public can come like hotels or sport centres.

Most of the public swimming pools in France are gas boilers heated.

How to get the swimming pools list (publics: local authorities and privates: where public people can come):

The public swimming pools list was easy to get (by Internet) but the list of the privates' ones was more complicated. We had to contact major municipalities and local sanitary departments to obtain the list, as the privates' swimming pools (like hotels, hostels, sport centres, and so on), where all people from the public sector can come, ought to have a correct sanitary system. It was quite difficult to convince every municipality and, for the time being, around half of the contacts is surely missing.

Results / Questionnaires:

The first questionnaire (Q1) has been sent to all the contacts we had by mail:

for the public swimming pools: to the swimming pool manager and to the municipality technician in charge of the swimming pool

for the private swimming pools: to the manager of the sport centres, hotels…

We didn't get as much as results as expected: it is very rare to get answers and if we get one, people don't always want to take part of the Solpool project.

That is why we had to contact them several times by e-mail, phone…

So the second questionnaire (Q2) has been sent in 2007 by mail or e-mail only to the people interested in the project. That is why we didn't have all the results we needed to do the "real" state of the art in the Agglomeration of Lyon.

To complete this reworked version of demand and potential report (solpool WP2), we contacted in october owners of public swimming pools to get more informations.

You'll find the table with results of Questionnaire 2 for 10 public swimming pools in a table in the end of this report.

4.1 Public sector

4.1.1 Number of pools

Concerning the public swimming pools, we contacted 28 public swimming pools. We can't say exactly how there are heated. Only 50% of people did answer to the whole questionnaires after several phone calls and e-mails. Some of them where not interested in the Solpool project.

On the public swimming pools, 24 are outside or "in and outside" and heated.

For the swimming heated with solar panels (basin and sanitary hot water), this system is always combined with another heating system, usually gas, reported in the table there.

4.1.2 Used heating systems

In the agglomeration on Lyon, we can report at this time:

Total number of outdoor and in and outdoor swimming pools	More than 47
thereof gas heated	More than 5 + 5 with solar
thereof oil heated	?
thereof wood heated	none
thereof waste heat heated	1

thereof solar thermal heated	6
thereof cogeneration heated	1 with solar
thereof heat pump heated	1 with solar and gas
non heated	More than 23

4.1.3 Cost comparison of the different heating systems

Economical information (Information needed from technical aspect)

4.1.3.1 Economical information	
Economical impact of this technique	The resulting energy savings depends on the collector type used but an average of the different producers is: unglazed thermal solar collector: Flexible unglazed thermal solar collector: 250 – 300 kWh/m².an No flexible unglazed thermal solar collectors: 350 – 450 kWh/m².an glazed thermal solar collector: 500 – 600 kWh/m².an
Cost-Benefit analysis	The total investment cost depends on the collector type used but an average of the different producers is, the products and installation cost: unglazed thermal solar collector: Flexible unglazed thermal solar collector: 100 - 200 €HT/m² No flexible unglazed thermal solar collectors: 200 - 400 €HT/m² glazed thermal solar collector: 800 - 1200 €HT/m²

4.2 Private sector

At this time, we contacted 27 privates swimming pools (the persons in charge of the other privates swimming pools did not want to send us the list), and 28 public swimming pools.

On the private swimming pools:

23 are outside and non-heated

4 are inside and heated

Then we assumed than the majority of the privates swimming pools we couldn't contact are on one hand outside non-heated and on the other hand inside.

4.2.1 Number of pools

- See 4.2 above

4.2.2 Used heating systems

- See 4.2 above

4.2.3 Cost comparison of the different heating systems

- See 4.2 above

5 Best practices

5.1 Pool 1 – Example of the public Swimming pool of Vaise in Lyon, France

Figure 8: Swimming pool of Vaise in Lyon, France (Source: ALE)

Technical Date of the Absorber System

Tube Absorber surface area (for pool water)	650m^2
Flat Absorber surface area (for sanitary water)	200m^2
Pool surface area and volume	1.130 m^2 / 2260 m^3
Year of installation	2007
Operator	City of Lyon
System Installer	AMEC SPIE South-East
Type of collector(s)	Giordano (tube), AS Solar (flat)
Auxiliary heating system	Gas heating system
Specific yield	260 kWh/m^2 and season
Energy savings	290 000 kWh gas per year
Environmental gain	70 tons / year of CO_2
Costs for the solar system	240.000 € (incl. planning and installation)

Short description of the system

The City of Lyon made a commitment on a policy of reducing energy consumptions on its building heritage. The Swimming pool of Vaise is the only swimming pool of Lyon equipped with an Olympic pool covered with 50 m of length. The municipality made works of renovation in 2006-2007 with the aim of reorganizing changing rooms and opening in summer period (opening pool outwards by creating a sun terrace). Energy savings were taken into account by the implementation of 2 solar installations.


Example sheets of Local Energy Agency (ALE) of Greater Lyon

ALE Agence Locale de l'Energie de l'Agglomération Lyonnaise

SOLAR HOT WATER

OLYMPIC SWIMMING POOL OF VAISE

LYON 9TH

ST - 0805

solar thermal

The City of Lyon made a commitment on a policy of reducing energy consumptions on its building heritage.

The Swimming pool of Vaise is the only swimming pool of Lyon equipped with an Olympic pool covered with 50 m of length.

The municipality made works of renovation in 2006-2007 with the aim of reorganizing changing rooms and opening in summer period (opening pool outwards by creating a sun terrace).

Energy savings were taken into account by the implementation of 2 solar installations.

This project benefited from the accompaniment of the ALE notably in the executive of the European program Solpool which aims the increased use of solar thermal systems for heating the water in swimming pools.

Solar system :
- 650 m² of solar tube absorbers for the preheating of the pool water
- 200 m² of solar flat absorbers for the preheating of the sanitary water
  Such a surface for a public building is the first one in France
- Mechanical fixing on roof
- Auxiliary heating is operated by gas heating system

Results expected :
- Solar production of 290 000 kWh / year, representing an economy on the invoice of 13 600 € / year (equivalent to 23% of the total needs of the site).
- Environmental gain : replacement of the equivalent of 70 tons / year of CO_2

Financial plan :
- Investment except engineering : 240 000 € (except tax)
- Subsidy of the Region Rhône-Alpes : 85 000 €

Partners :
- Client : City of Lyon
- Office study : Etamine et Séchaud (Lyon - 69)
- Solar thermal system : Giordano (Aubagne - 13) for solar tube absorbers and AS Solar / importer CEL (Migennes - 89) solar flat absorbers
- Installer : AMEC SPIE South-East (Rillieux-la-Pape - 69)
- Accompaniment : ALE

Agence Locale de l'Energie de l'agglomération lyonnaise
8, rue Béranger - 69006 Lyon - France
tél : +33 (0)4 37 48 22 42 / fax : +33 (0)4 37 48 04 57
e-mail : info@ale-lyon.org

GRANDLYON communauté urbaine | RhôneAlpes Région | Solpool

Find all the example sheets of the greater Lyon on our web site
www.ale-lyon.org

Information : ALE : +33 (0)4 37 48 22 42
City of Lyon - Technical Services

Intelligent Energy Europe

Partners :

- Client : City of Lyon
- Office study : Etamine et Séchaud (Lyon - 69)
- Solar thermal system : Giordano (Aubagne - 13) for solar tube absorbers and AS Solar / importer CEL (Migennes - 89) solar flat absorbers
- Installer : AMEC SPIE South-East (Rillieux-la-Pape - 69)
- Accompaniment : ALE

Contact Address :

Mr. COMBES Michel
Hôtel de Ville de Lyon,
Annexe de l'hotel de ville de lyon
Place Louis Pradel - BP 1065,
69205 Lyon Cedex 01
Tél : + 33 – (0)4 72 10 35 35

5.2 Pool 2 – Example of the public Swimming pool of Etienne Gagnaire in Villeurbanne, France (Source : ALE)


Figure 9: Swimming pool of Etienne Gagnaire in Villeurbanne, France (Source : ALE)

Technical Date of the Absorber System

Tube Absorber surface area (for pool water)	1110m^2
Pool surface area and volume	2000 m^2 / 2050 m^3
Year of installation	2005
Operator	City of Villeurbanne
System Installer	GIRUS
Type of collector(s)	Giordano
Auxiliary heating system	Gas heating system
Specific yield	270 kWh/m² and season
Energy savings	380 000 kWh gas per year
Environmental gain	91 tons / year of CO_2
Costs for the solar system	184.500 € (incl. planning and installation)
System costs in EUR/m²absorber area	166 EUR/m²

Short description of the system

The City of Villeurbanne made a commitment in a politic of reduction of energy consumptions on its heritage. Near half of the surface of the roof of the Olympic pond was covered with solar cells allowing to preheat the water of both outside ponds and that of the internal ponds.

Partners

- Client : City of Villeurbanne
- Office study : Girus (Vaulx-en-Velin - 69)
- Solar thermal system : Giordano (Aubagne - 13)
- Installer : Etablissement Larue (Saint-Victor-sur-Rhins - 42)
- Accompaniment : ALE

Contact Address :

Mr. MAZANA Roger
Hôtel de Ville de Villeurbanne, Annexe Hôtel de Ville 52 rue racine BP 5051
69100 Villeurbanne, Tél : + 33 – (0) 4 78 03 67 19, Fax 04 78 03 67 76

6 Finances

6.1 Specific System costs in your country

	Small Pools surface: <100 m²	**Medium pools surface: 100 to 500 m²**	**Large pools surface: >500 m²**
Tube absorbers systems			
Investment cost range in EUR/m²	180 EUR/m²	150 EUR/m²	120 EUR/m²
Operation costs in EUR/year	9 EUR/year	2745 EUR/year	2340 EUR/year
Flat absorbers systems			
Investment cost range in EUR/m²	650 EUR/m²	630 EUR/m²	600 EUR/m²
Operation costs in EUR/year	383 EUR/year	1710 EUR/year	3150 EUR/year

Source : Giordano , Installer and supplier of solar absorbers.

6.2 Funding and Financing schemes

Grant Schemes :

In France:

France had a high development in thermal solar collectors at the end of the seventies – the beginning of the eighties, but today, France is only at the 4^{th} – 5^{th} European row. Yet, the market is increasing constantly: the annual thermal collectors surfaces installed in 2005 is more than 164 000 m², the equivalent power is 115.5 MWth, with the major part in the Islands.

The cumulated capacity of thermal solar collectors installed in France at the end of the year 2005 is around 914 000 m² and around 640 MWth.

In April, 2007, 53 manufacturers or importers are referenced on the list of ADEME (National Energy Saving and Environmental Agency) for the individual sanitary hot water solar system and 30 are referenced for the heating and sanitary hot water solar system. (*www.enerplan.asso.fr)*

In May, 2007, exactly 9676 installers are referenced on the QUALISOL list en France and 1464 in Rhône-Alpes Region.

(www.qualisol.org)

In Rhône-Alpes Region:

Around 36 000 m² have been installed in Rhône-Alpes Region in the year 2006 with:

- 53% of individual sanitary hot water
- 32.5% of heating and sanitary hot water
- 14.5% of collectives projects (with 2% of basins heating)

(Source : Région 2006)

<u>In the department of Rhône:</u>

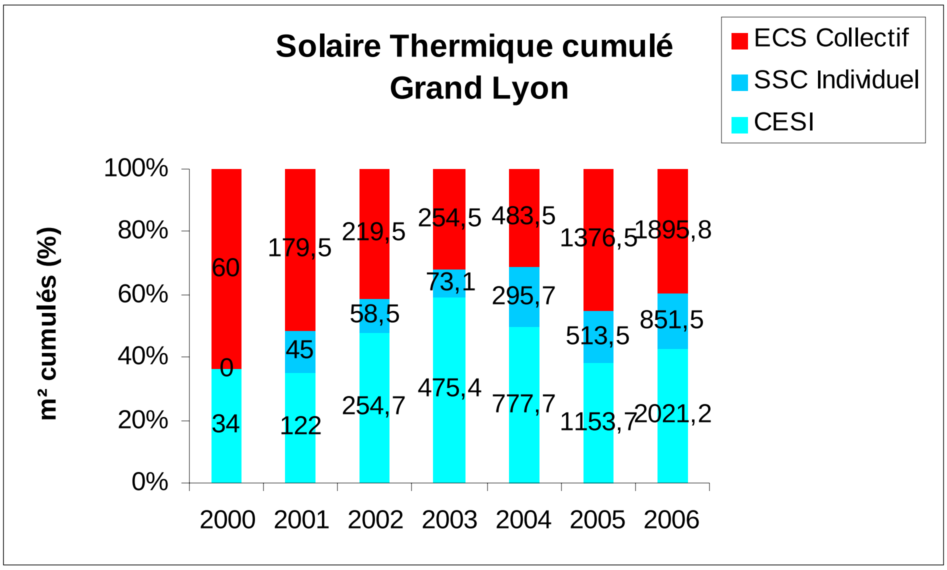
Rhône is only at the 5th row in the Rhône-Alpes Region, with 223 referenced QUALISOL installers *(Mai 07).*

More than 5 100 m² have been installed in Rhône Department in the year 2006 with:

- 42.4% of individual sanitary hot water
- 27.6% of heating and sanitary hot water
- 30% of collectives projects (with 12% of basins heating)

(Source : Région 2006)

<u>In Lyon agglomeration:</u>



ECS Collectif = Solar collective sanitary hot water

SSC Individuel = Solar Individual heating and sanitary hot water

CESI = Solar individual

(Source: ALE)

Since 1999, European Union (for specific projects), French state, ADEME, Regions, some departments and several municipalities give grants to develop sustainable energies.

The department of Rhône, where the agglomeration of Lyon is, gives grants only since the beginning of aril, 2007.

In 2007:

- French State: 50% of the price of the solar equipment for specific private people (SSC, CESI)

- Rhône-Alpes Region:
  - 300€ for a CESI,
  - 1200 € for a SSC
  - 30% of the global investment (€HT) for collective project
  - 20% for summer swimming pool
- Rhône department: 300 € for the maintenance of a CESI for individual people
- Value Added Tax: 5,5% (instead of 19,6%)

Which policies exist?

A specific Guideline of Grand Lyon exists, where the level of renewable energy as solar system is higher than in the country. The solar occurs as soon as possible in the constructions with the Guideline.

It is an obligation to use this specific guideline in every buildings of the Grand Lyon which presents the thermal regulations, stricter as the French national thermal regulations, and where it is an obligation to install renewable energy when it is possible.

Which regulatory issues (e.g. permits) exist?

The rules have people to have a specific building permit for the new buildings and an authorisation to installation such an installation of solar system in the case of renovations.

Moreover, there are protected zones in France where it is quite impossible to install solar systems.

6 collectives swimming pools benefited from financing schemes for solar thermal systems in Lyon.

6.2.1 Organization 1 - ADEME

Organization	ADEME : National Energy Saving and Environmental Agency
Street	10 rue des Emeraudes
Postal code	69006
City	LYON
Email	www.ademe.fr
Telephone	+33 – (0)4 72 83 46 00
Type of Support	subsidy
Share of total budget	In 2007-2008, up to 30% of the global investment (€HT) for specific collectives projects
Who can apply	Local authorities and private collective pools owners
Requirements for application	Collective swimming pools for summer (public and private)
Targeted areas	/
Documents	Grant document
Source of information	www.ademe.fr

Year of beginning	From 1999 to 2005 for individuals projects and still today for specific collectives projects
Information website	http://www.ale-lyon.org/formulaire.html

6.2.2 Organization 2 - Rhône-Alpes Region

Organization	Rhône-Alpes Region
Street	78 rte Paris
Postal code	69260
City	CHARBONNIÈRES LES BAINS
Email	www.rhonealpes.fr
Telephone	+33 – (0)4 72 59 40 00
Type of Support	subsidy
Share of total budget	In 2007-2008, 20% of the global investment (€HT) for specific collectives projects for summer swimming pools, (eligible expenses with an upper limit at 0,6 HT / kWh saved annually)
Who can apply	Local authorities and private collective pool owners
Requirements for application	Collective swimming pools for summer (public and private)
Targeted areas	/
Documents	Grant document
Source of information	www.rhonealpes.fr
Year of beginning	From 1999 to 2005 for individuals projects and still today for specific collectives projects
Information website	http://www.ale-lyon.org/formulaire.html

6.2.3 Complement

Financing schemes for solar thermal systems for sanitary and heating hot waters for private individuals (a part of the production by heating system can be used for pools) :

Funding scheme	
Name of the funding/ organisation involved (government, Munipality, bank,etc.)	- French State - Rhône-Alpes Region - Rhône department - Several municipalities in Lyon agglomeration
Description of the funding (Region, Amount of money, disposition of it in time)	In 2008, for thermal solar systems: French State: 50% of the price of solar equipment for individuals projects (owners) Rhône-Alpes Region: 500€ for an individual sanitary hot water system 1200 € for an individual heating and sanitary hot water system Rhône department: 100 € for the maintenance of an individual sanitary

	hot water system (only in renovation) Municipalities in Lyon Agglomeration: Feyzin: 300€ for an individual sanitary hot water system or 500€ for an individual sanitary hot water system (only in renovation) Dardilly: 300€ for an individual solar system
Year of beginning/Year of end	French State: from 2001 for individual projects Rhône-Alpes Region: from around 30 years for individual and collective projects Rhône department: from April 2007 for individual projects Municipalities in Lyon Agglomeration: from May/June, 2007
Valid application field (PV, thermal solar, etc.)	The application of the grants is depending of the organisation involved. In 2007: French state: all sustainable energies, heat pump, condensing boiler, low temperature boiler, i.e. for individual projects (owners) Rhône-Alpes Region: all sustainable energies, individuals and collectives projects Rhône department: all sustainable energies, individuals projects Municipalities in Lyon Agglomeration: solar individual projects
Requirements to receive such a fund	fill in a grant document have the good criterion different from each organisation

Cost Benefit Analysis

6.2.4 Small Pools

<u>Small Pools example 1 : tube absorber system</u>

The investment in a tube absorber system for a 100 m² outdoor swimming pool would be amortised in 5 years, see table below.

Basic datas :

- Pool area : 100 m²
- Solar tube absorbers area : 80 m²
- Gas demand : 20 000 kWh/an

Heating system	Gas	Tube absorber	Unit
Investment costs	5500	14400	€
Grants	0	4320	€
Capital costs	561	1028	€/a

Net Energy consumptions	25000	200	kWh/a
Gas- and Electricity costs	1145	20	€/y
Maintenance	140	144	€/y
Total yearly costs	1846	1192	€/y
Heat price	0,074	0,047	€/kWh
Amortisation time		5	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Electricity costs		0,1	€/kWh
Absorber surface		80	m²
Time Frame		7	year
Interest rates		3	%

Source : Giordano , Installer and supplier of solar absorbers.

Small Pools example 2 : Flat absorber system

The investment in a flat absorber system for a 100 m² outdoor swimming pool would be amortised in 16 years, see table below.

Basic datas :

- Pool area : 100 m²
- Solar flat absorber area : 30 m²
- Gas demand : 20 000 kWh/an

Heating system	Gas	Flat absorber	Unit
Investment costs	5500	19500	€
Grants	0	5850	€
Capital costs	561	1392	€/a
Net Energy consumptions	25000	8500	kWh/a
Gas- and Electricity costs	1325	383	€/y
Maintenance	200	205	€/y
Total yearly costs	2086	1980	€/y
Heat price	0,083	0,079	€/kWh
Amortisation time		14	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Electricity costs		0,1	€/kWh
Flat plate collector surface		80	m²
Time Frame		16	year
Interest rates		1	%

Source : Giordano , Installer and supplier of solar absorbers.

6.2.5 Medium Pools

For medium swimming pools, we compare the investment of a system of gas heating, with the investment of a solar system and a complement with a gas system.

Medium Pools example 1

The investment in an tube absorber system and a gas system for a 500 m² outdoor swimming pool would be amortised in 10 years, see table below.

Basic datas :

- Pool area : 500 m²
- Solar tube absorbers area : 200 m²
- Gas demand : 100 000 kWh/an

Heating system	Gas	Tube Absorber and Gas	Unit
Investment costs	15000	45000	€
Grants	0	9000	€
Capital costs	1530	3672	€/a
Net Energy consumptions	125000	61000	kWh/a
Gas-costs	5625	2745	€/y
Maintenance	500	800	€/y
Total yearly costs	7655	7217	€/y
Heat price	0,061	0,057	€/kWh
Amortisation time		10	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Absorber surface		200	m²
Time Frame		15	year
Interest rates		5	%

Source : Giordano , Installer and supplier of solar absorbers.

Medium Pools example 2

The investment in a flat absorber system and a gas system for a 500 m² outdoor swimming pool would be amortised in 20 years, see table below.

Basic datas :

- Pool area : 500 m²
- Solar flat absorber area : 150 m²
- Gas demand : 100 000 kWh/an

Heating system	Gas	Flat absorber	Unit

		and Gas	
Investment costs	15000	109500	€
Grants	0	28350	€
Capital costs	1530	8277	€/a
Net Energy consumptions	125000	38000	kWh/a
Gas-costs	5625	1710	€/y
Maintenance	500	700	€/y
Total yearly costs	7655	10695	€/y
Heat price	0,061	0,057	€/kWh
Amortisation time		20	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Flat plate collectors surface		150	m²
Time Frame		22	year
Interest rates		0	%

Source : Giordano , Installer and supplier of solar absorbers.

6.2.6 Large Pools

For large swimming pools, we compare the investment of a system of gas heating, with the investment of a solar system and a complement with a gas system.

Large Pools example 1

For an interest rates of 3 % the investment in a tube absorber system and a gas system for a 1000 m² outdoor swimming pool would be amortised in 7 years, see table below.

Basic datas :

- Pool area : 1 000 m²
- Solar tube absorbers area : 600 m²
- Gas demand : 200 000 kWh/an

Heating system	Gas	Tube absorber and Gas	Unit
Investment costs	40000	112000	€
Grants	0	21600	€
Capital costs	4080	9220	€/a
Net Energy consumptions	250000	52000	kWh/a
Gas-costs	11500	2340	€/y
Maintenance	1200	1800	€/y
Total yearly costs	16780	13360	€/y
Heat price	0,067	0,053	€/kWh
Amortisation time		7	year
Calculation assumptions:			
Gas costs		0,045	€/kWh

Absorber surface		600	m²
Time Frame		9	year
Interest rates		3	%

Source : Giordano , Installer and supplier of solar absorbers

Large Pools example 2 : Lyon Vaise

In the case of Lyon Vaise swimming pool, there was a gas heating system, and the owner decided to invest in solar absorbers. The investment in this tube absorber system for heating a 1110 m² outdoor swimming pool will be amortised in 11 years, see table below.

Basic datas :

- Pool area : 1110 m²
- Solar tube absorbers area : 650 m²
- Gas demand : 222000 kWh/an

Heating system	Gas	Tube absorber and Gas	Unit
Investment costs	40000	97500	€
Grants		29250	€
Capital costs	4080	11041	€/a
Net Energy consumptions	277500	108500	kWh/a
Gas-costs	12488	4883	€/y
Maintenance	1200	1500	€/y
Total yearly costs	17768	17424	€/y
Heat price	0,064	0,062	€/kWh
Amortisation time		11	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Absorber surface		650	m²
Time Frame		15	year
Interest rates		3,2 %	%

Source : Giordano , Installer and supplier of solar absorbers.

Large Pools example 3 : Example of the public swimming pool of Etienne Gagnaire in Villeurbanne, France

The investment in this tube absorber system for a 1110 m² outdoor swimming pool will be amortised in 11 years, see table below.

Basic datas :

- Pool area : 2000 m²

- Solar tube absorbers area : 1110 m²
- Gas demand : 400 000 kWh/an

Heating system	Gas	Tube absorber and Gas	Unit
Investment costs	70000	254260	€
Grants		55278	€
Capital costs	7140	20296	€/a
Net Energy consumptions	500000	167000	kWh/a
Gas-costs	22500	7515	€/y
Maintenance	1200	1500	€/y
Total yearly costs	30840	29300	€/y
Heat price	0,061	0,058	€/kWh
Amortisation time		11	year
Calculation assumptions:			
Gas costs		0,045	€/kWh
Absorber surface		650	m²
Time Frame		15	year
Interest rates		4,5 %	%

Source : Girus , Installer of solar absorbers.

6.2.7 Overview

Pa-rameter	Small pools			Medium pools			Large pools		
	Pool1 Example Giordano	Pool2 Example Giordano	Pool3 Example Impact Advisor	Pool1 Example Giordano	Pool2 Example Giordano	Pool3 Example Impact Advisor	Pool1 Example Giordano	Pool2 Example Etienne Gagnaire	Pool3 Example Lyon Vaise
Specific System costs (EUR/m²)	180	650	150	630	120	150	166	180	650
Specific Yield (kWh/m² season)	310	550	320	580	330	260	270	310	550
Heat price (EUR/kWh)	0,047	0,079	0,057	0,057	0,053	0,062	0,058	0,047	0,079

Amorti-sation time (static)	5	14	10	20	7	11	11	5	14

6.2.8 Conclusion

The investment cost for solar heating systems for outdoor pools depends strongly of the kind of absorber, and the amortisation is around 10 years, but with the increase of the price of the fossil fuels, it will be divided by 2 before some years.

7 Summary

This report present the climate conditions around Lyon in France and the state of the art for solar thermal applications in a first part. It shows that solar thermal systems are used most of the time for public swimming pools around Lyon. It presents the investment for “Tube” absorbers and Flate plate absorbers, and the description of systems and amortising time between 3 differents types of swimming pools : area < 100 m², area between 100 and 500 m², area > 500 m².. The investment in a solar thermal system for public swimming pools needs subsidies to be interesting in our region.

7.1 Boundaries for the implementation of Solar Heating systems for outdoor swimming pools

Technical barriers:

- Inadequate workforce skills and training like the lake of scientific, technical and manufacturing skills for solar or renewable energy development.
- Lack of educational system to provide adequate training in new technologies, trainings exist for solar thermal systems (Qualisol) but no trainings for solar in swimming pools, the market is at this time too small.
- Lack of reliable solar installation, maintenance and inspection services.
- Solar panels surfaces needed for swimming pools installation are very high and it is difficult to find enough place.

Financial Barriers:

- High cost of solar and other renewable energies and technologies, plus an additional cost compared with conventional energy

- Inadequate financing options for renewable energy in swimming pool projects, it does exist several kind of grants for solar installation (national, regional, municipalities, i.e.) but there are slight for solar swimming pool installation.

Governmental barriers:

- Lack of government policy supporting renewable energy like the lake of regulations to support the development of solar or other renewable energies
- Lack of adequate codes, standards, interconnection between partners and guidelines
- Lack of stakeholder/community participation in energy choices and solar projects
- As the solar surfaces needed are high, it is very complicated in France to get the acceptation of the authority for the installation (urbanism and architectural problems, building permit, i.e.).

Social barriers:

- Lack of information dissemination and consumer awareness about solar energy
- Difficulty overcoming established energy systems, for example it is difficult at this time to introduce innovative energy systems
- Poor perception by public of renewable energy system as esthetics
- Failure to account for all costs and benefits of energy choices (effects of air pollution or risk of supply disruption for conventional energy and cleaner air or security for renewable energy), difficult to add a solar system to a working installation with conventional energy, for example.

7.2 Requirements for the implementation of Solar Heating systems for outdoor swimming pools

In France, the rules have people to have a specific building permit for the new buildings and an authorisation to installation such an installation of solar system in the case of renovations.

If an operator/owner/installer has a project, they need to collect basic datas relative to the project, concerning the outside swimming pools :

- Location of the pool
- number of swimming pools
- details of pools : area, depth, color, temperature of water, climate (air temperature, wind, solar radiations)
- details of piping, pumps, insulation
- the energy supply if there is an existing heating system, and energy consumptions with their costs

One of the most important requirement is the opening of the swimming pool, which must be in summer. An other important requirement is having a roof/floor with an important surface for solar absorbers, without solar mask.

8 References

www.ale-lyon.fr

www.ademe.fr

www.rhonealpes.fr

9 ANNEXE

Table 1: Complement to 4. Market Analysis : Results of Questionnaire 2 for 10 public swimming pools

Name of the pool		Centre Nautique Etienne Gagnaire	Piscine de Vaise	Centre nautique de Bron André Sousi	Centre nautique de Décines-Charpieu	Piscine de Charbonnières les bains	Piscine municipale du Roule à la Mulatière	Centre nautique municipal de Oullins	Piscine municipal Sainte Foy les lyon	Centre aquatique du Loup Pendu Rillieux la pape	Piscine de Caluire
Owner		City of Villeurbanne	City of Lyon	City of Bron	City of Décines-Charpieu	City of Charbonnières les bains, La Tour de Salvagny and Marcy l'Etoile	City of La Mulatière	City of Oullins	City of Sainte Foy les lyon	City of Rillieux	City of Caluire
Opening month		January	January	January	January	June	January	January (june for summer pools)	January (june for summer pools)	January	January (june for summer pool)
Closing month		December (interior pool : closed 2 weeks in february and 2 weeks in september for maintenance, exterior pools : opened from june to september)	December	December	December	September	December	December (august for summer pool)	December (august for summer pool)	December	December (september for summer pool)
Contact		MAZANA Roger	COMBES Michel	M. CIMETIERRE	M. ARNAUD	Hélène CARRE	M. Texier christian	Mme VAN BINNEVELD Jocelyne	M. Clément FUGIER	M. BARTHOLOME	M. GERARD Daniel
Address		59 avenue Marcel Cerdan	50 avenue Sidoine Apollinaire	Place Gaillard Romanet	110, rue Emile Zola	avenue du Casino	25 rue de Verdun	44 Grande Rue	10 rue Deshay	196 avenue de l'Hippodrome	310 rue Elie VIGNAL
Post code		69100	69009	69500	69150	69260	69350	69600	69110	69140	69300
City		VILLEURBANNE	LYON	BRON	DECINES CHARPIEU	CHARBONNIERES LES BAINS	LA MULATIERE	OULLINS	SAINTE FOY LES LYON	RILLIEUX LA PAPE	CALUIRE ET CUIRE
Tél		04 78 03 67 19	04 72 10 35 35	04 72 81 06 66	04 72 05 12 12	04 78 87 07 65	04 78 86 62 17	04 72 66 12 40	04 72 32 59 54	04 78 88 70 33	04 37 26 00 20
Fax		04 78 03 67 76	04 72 10 35 08	04 72 81 06 69		04 78 87 83 01	04 78 86 62 15	04 72 66 12 41	04 72 32 59 46	04 78 97 12 91	/
Mail		roger.mazana@mairie-villeurbanne.fr	michel.combes@mairie-lyon.fr	jean-francois.cimetiere@ville-bron.fr	jlarnaud@mairie-decines.fr	hcarre@charbonnierelesbains.com	christian.texier@lamulatiere.fr	jvanbinneveld@piscine.fr	clement.fugier@ville-saintefoyleslyon.fr	eric.bartholome@ville-rillieux-la-pape.fr	/
Internet adress		http://www.mairie-villeurbanne.fr/	http://www.lyon.fr/vdl/sections/fr/sports_loisirs/	http://www.ville-bron.fr/	http://www.mairie-decines.fr/307/sport/310/le-centre-	http://www.lyonweb.net/agenda/e/2275/Piscine-de-	http://www.ville-lamulatiere.fr/associations/ulsm_assos/	http://www.ville-oullins.fr/index.php?id=236	http://www.saintefoyleslyon.fr/index.php?rubrique=337	www.ville-rillieux-la-pape.fr	http://www.ville-caluire.fr/actu.php
Pool 1	Surface	1000	1050	1000	510	375	250	312	250	375	313
	Volume	2050	2100	1800	1020	675	394	412	400	1000	400
	T°C of water	27	26	28	28	25	28	28	28	27,5	28
	Covered	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Pool 2	Surface	1000	77	240	115	345		312	375	250	300
	Volume	1800	150	240	115	350		875	1000	375	330
	T°C of water	27	26	26	26	25		26	27	28	28
	Covered	No	Yes	Yes	Yes	No		No	No	Yes	No
Pool 3	Surface	80		200	227			250		72	50
	Volume			60	227			312		60	30
	T°C of water	27		26	26			26		28,5	28
	Covered	No		No	Possibility to uncover			No		Yes	Yes

Name of the pool			Centre Nautique Etienne Gagnaire	Piscine de Vaise	Centre nautique de Bron André Sousi	Centre nautique de Décines-Charpieu	Piscine de Charbonnières	Piscine municipale du Roule à la Mulatière	Centre nautique municipal de Oullins	Piscine municipal Sainte Foy les lyon	Centre aquatique du Loup Pendu Rillieux la pape	Piscine de Caluire
Heating system	Gas	Age (year)	2000	2005		2005		1989	1999	1997 & 2004		2008
		Power (kW)	1160 x 3	1,16 & 1,22		1630		450	365-495	300 & 285		570 x 2
	Cogeneration gas	Age (year)			2000							
		Power (kW)			300							
	Propane	Age (year)					2007					
		Power (kW)					/					
	Urban heat of incineration installation	Age (year)									1997	
	Solar tube absorbers	Surface (m²)	1110	650								
		Age (year)	2006	2007								
		Investment costs (without grant)	184500	107250								
	Solar plate absorbers	Surface (m²)		200								
		Age (year)		2007								
		Investment costs		120000								
	Glazed absorbers (for sanitary water)	Surface (m²)			150	50						200
		Age (year)			2007	2005						2008
		Investment costs			160000	42000						110880
	Maintenance (EUR/an)		1800		/	/	/					
	Yearly energy consumptions (kWh/an)		3 800 000	Solar production tube and flat plate absorbers : 290 000 kWh/year = 26% of the whole consumptionns	Solar thermal production / year : 6200 kWh	Solar thermal production / year for sanitary water : 28000 kWh (20% of sanitary consumptions)	140690	2400000	1239415	800000	401653 kWh of electricity	Solar thermal production / year : 119949 kWh (21% of consumptions for pool's water and sanitary water)
Do you program to renove your heating system soon ?			No	No	No	No	Yes	Yes	Yes	No	No	No
Is it possible to use solar energy ?			Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Do you want to receive informations about solar systems ?			No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Toiture	Available surface		2400	3000	1275	/	/	/	863	Yes	Important	Important
	Inclinaison		4%	10%	/	0°	/	Dome	30	/	Flat	Flat
	Orientation		Flat	South-West	Flat	Flat	/	all	/	/	/	/
Users / year			350000	260000	260000	180000	37800		35400	75646	171575	