



SOLAR ENERGY X PERTS



SOLAR POWER
UTILIZE EFFICIENTLY



CONTENT

AST - Your Solar Partner

Principle & Functionality „Solarabsorber-Technology“ 4

Transparency

Planning, Simulation of energy yield, ROI-calculation 5

Outdoor Swimming Pools

Extension of the season 6

Indoor Sports Pool, Wellness & Spa

Operating cost reduction 8

Industrial Applications

Hot water supply 10

Private Swimming Pools

The do-it-yourself solar plant 12

Useful Additional Informations

Dimensioning, Control System, Summary 14

Components of a Solar Plant

Absorber profile, Control System 15

Functional Diagram of Solar Plants

Directly flow through, with heat exchanger, combined with heat pump 16

Plant Construction

Installation variants 18



AST - YOUR SOLAR PARTNER

Principle & Functionality Solarabsorber-Technology

Are you concerned about climate change and what your personal contribution to CO2 reduction in your immediate working environment could be? You are already considering the question of what means or technical solutions you can use to make your operations more efficient, environmentally friendly and at the same time more profitable. We answer these questions and offer you the perfect long-term solution from a single source. AST designs, produces and installs solar thermal systems that are individually tailored to the local conditions of your company.

Operating Principle

The basic principle of how a solar system works in a swimming pool is relatively simple. Special solar mats are mounted on the roof surfaces absorbing the incident solar radiation.

Either the pool water is taken from the clean water pipe of the filter system and pumped through the solar mat using the solar circulation pump, or the solar mats are integrated into a separate heating circuit, where the heat energy generated is made available to the pool water via a heat exchanger.



AST solar mat 120/10

In the tubes of the solar mat, the water flowing through absorbs the incident solar radiation in the form of thermal energy and heats up by approx. 6 to 8°C before it is returned to the pool via the return pipe, or transferred to the heat exchanger.

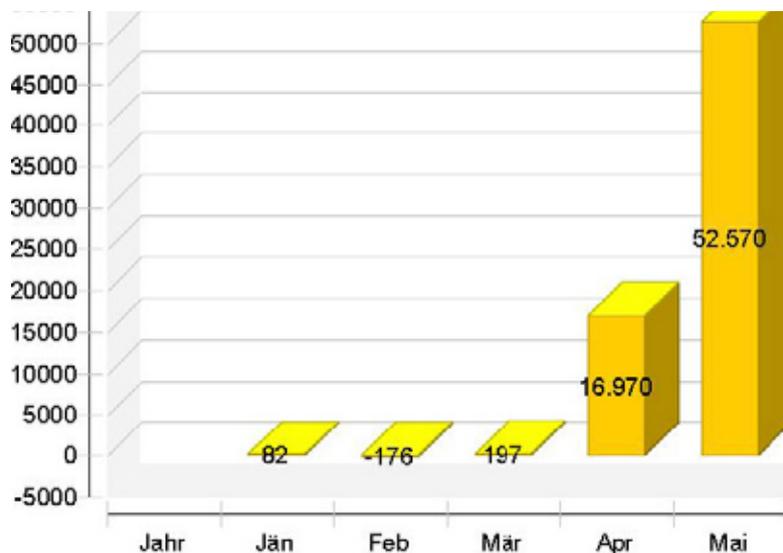
The system is automatically operated by an electronic control system that monitors this process by means of temperature sensors in the pool water and in the mat field. Precise control is of great importance for the performance of the solar system.

The circulation pump is switched on when the water temperature in the mat field on the roof is about 4 de-

grees above the temperature of the pool water. It is switched off when the temperature difference between the flow and return flow of the solar system (flow = pool water temperature) is 1 degree.

The relatively low investment costs, as well as the high efficiency and operational safety make the AST solar system the unrivalled leader among heating systems for this purpose, both technically as well as economically and ecologically.

Example graphic for the possible energy yield



TOTAL TRANSPARENCY

To determine the time window for the amortisation of your investment and the expected CO2 savings, AST can calculate the expected individual energy yield of the solar system on request.

Assisted by a permanently updated simulation software, which is based on both geographic and climatic actual values of the past 10 years, we can map the assumed energy yield in kWh on a monthly basis (see graphs below) and determine the time of amortization.

These well-founded key data represent a very realistic view of the future - but they also give you the necessary security in your decision to do the right thing.

SCOPE OF SERVICES

Each AST solar absorber system is individually planned and projected by AST technicians according to the targets defined together with you.

The solar systems are planned hydraulically and optimized for installation. We can supply the system complete with control system or integrate it into an already existing system.

AST also plans the installation and designs a suitable mounting solution. The solar absorber surface is adapted to the roof, whereby the appearance of the building barely changes.

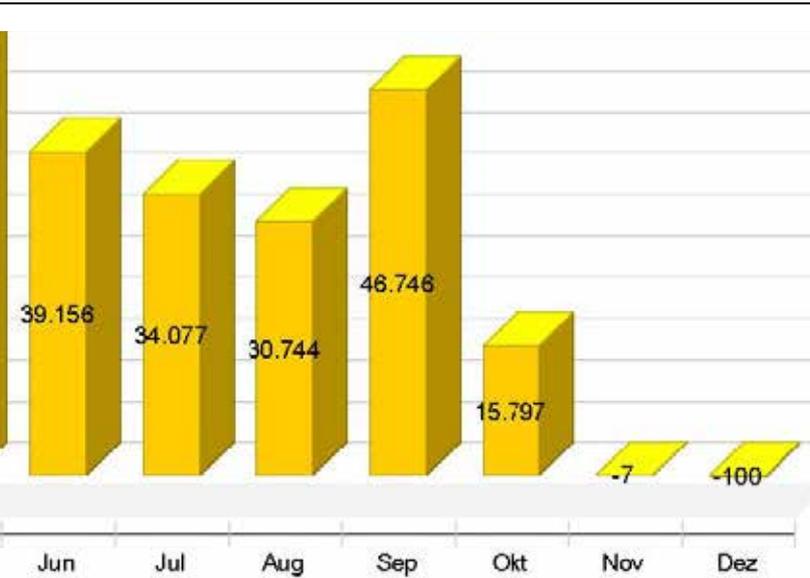
The amortization period of an AST solar system is 4.5 years on average.



Fig. above shows the mounting scheme adapted to the building structure (here five interconnected solar mat panels - in total 838m²)

The total solar energy reaching the earth's surface is about 10,000 times larger than the current energy requirements of mankind. We make a part of it usable for you!

kWh



OUTDOOR SWIMMING POOLS

**EXTENSION OF THE SEASON AND
SIMULTANEOUSLY REDUCED OPERATING COSTS**



EFFICIENT & SUSTAINABLE USE OF SOLAR ENERGY

In our latitudes the sun shines with an average of 800 to 1000W/m². This solar energy can easily be used to heat your swimming pool cost-efficient with AST solar mats.

The thermal performance and efficiency is enormous. Up to 87% of the incident solar energy is transferred to the water flowing through the absorber. This enables you to heat large quantities of water within a very short period of time at low cost using solar energy.

1m² absorber surface provides 250 to 350kWh of thermal energy in the bathing season. In the case of outdoor swimming pools, the solar energy supply coincides particularly favourably with the period of use, as the pool can be used as a heat accumulator, as it were.

The UV-resistant AST solar mats are one of the most efficient absorber solutions on the entire market due to their very narrow tube distribution. For example, 1m² of installed AST solar mat corresponds to an active solar capture area of 1.523m².

An AST outdoor pool solar system can:

- ♦ contribute 250 to 350 kWh thermal energy / m² / bathing season into the energy management system of your outdoor swimming pool
- ♦ make the water temperature more pleasant and also extend the bathing season
- ♦ effect a considerable saving of fossil fuel materials and thus optimise your operating costs
- ♦ contribute an active part of the CO₂ emission reduction of your municipality

Practical example (1L heating oil ≈ 11,4 kWh):

AST solar mat surface:	1000 m ²
Bathing season:	May - Sep. approx. 140 days
Energy yield:	approx. 300.000 kWh
Heating oil savings:	approx. 26.300 L
at EUR 0.63 / L:	approx. EUR 16.600 / year
Avoidance:	approx. 83,4 tons CO ₂



INDOOR SPORTS POOL WELLNESS & SPA

INTEGRAL PART OF A MODERN ENERGY SUPPLY

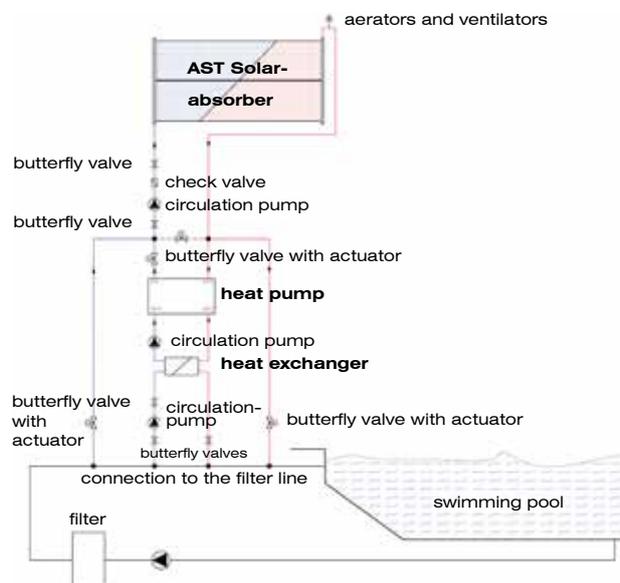


INTEGRATION OF AN ECOLOGICALLY WISE ENERGY RESOURCE INTO THE OVERALL CONCEPT

Indoor swimming pools are designed for year-round operation and therefore have a considerable hot water requirement. To ensure a constant water temperature, we therefore recommend our customers to combine the solar absorber system with a heat pump. This creates a sophisticated solar system that is capable of providing heated water in a cost-effective way up to an outside temperature of +5°C.

Especially for indoor sports swimming pools and SPA facilities, the AST solar system offers an enormous savings potential, as large quantities of hot water are required all year round.

Due to the optimized geometry of the AST 120/10 solar mat, the system has a very high flow rate, which means that large quantities of water can be heated and provided with the help of the sun.

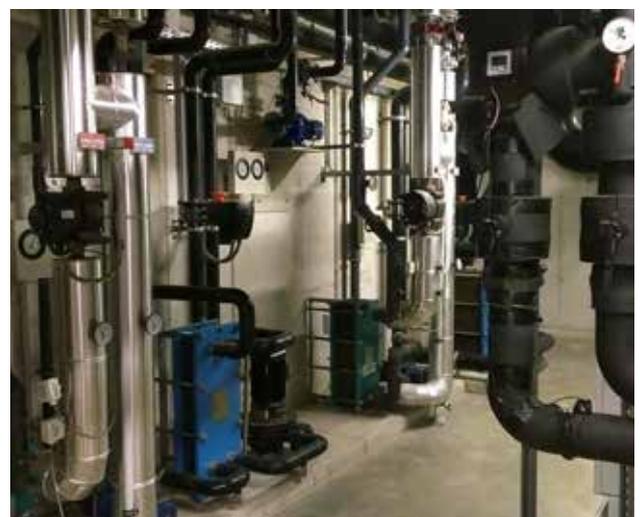


AST Solar-plant equipped with heat exchanger and heat pump

An AST solar absorber system can be integrated into the heating circuit with or without heat pump. To be able to keep the water temperature constant, the heat pump serves as an additional heat source. It is more environmentally friendly and consumes less energy than conventional fossil heating sources (e.g. gas).

In their regulation and control technology, the energy management systems integrated in the bathing and/or wellness facilities pay attention around the clock to obtain the energy just required from the most economically sensible resource at that time.

For this reason, engineering consultants and architects are increasingly integrating cost-effective solar absorber systems as an intelligent supplement to classic energy suppliers such as gas, PV and CHP, both in new construction and renovation projects.





THERMAL SOLAR SYSTEMS FOR INDUSTRIAL APPLICATIONS

THE SUPPLY OF HOT WATER FOR INDUSTRIAL PRODUCTION COMPANIES



REDUCTION OF PRODUCTION COSTS THROUGH ECOLOGICAL HOT WATER PRODUCTION

Especially in industry, there are many processes that require large quantities of hot water. Such applications are for example: breweries, dairies, leather industry, paper industry, industrial laundries, old people's homes, hospitals and many more.

The energy required to provide hot water is usually very high and often represents the largest part of production or operating costs. The AST solar system offers you enormous savings potential.

Operating the production lines with an AST solar absorber system, large quantities of water can be preheated using solar energy. The remaining difference up to the required target temperature is then overcome by conventional heating systems.



Large quantities of hot water are required in leather factories. When feeding ground water into the system, it is necessary to heat the water from approx. +8°C up to +90°C.

With the AST solar absorber system, the groundwater is preheated by the power of the sun up to +50°C. For further heating, conventional heating methods are used subsequently.

By installing the AST system, a leather factory in Uruguay was able to save 3000 litres of heating oil per day. That in turn enables a saving of approx. EUR 450,000 p.a. - respectively an avoidance of 1,500 tons of CO₂.





SOLAR PLANTS FOR PRIVATE SWIMMING POOLS

WELL ESTABLISHED IN THE PRIVATE SECTOR TOO - THE AST „ENERGY SAVING“ MATS



READY TO INSTALL SOLAR ABSORBER UNITS - COMFORTABLE FEELING IN YOUR OWN POOL

This AST product is a do-it-yourself absorber for the heating of your private swimming pool. These ready-to-install solar mats have the swimming pool water flowing directly through them, thus heating the water in your pool.

The solar mats used here are identical to those we install in outdoor, indoor and industrial swimming pools. They are UV-resistant and frost-proof when filled.

These solar mats also gain an energy yield of 250 to 350 kWh per m² of installed absorber surface per bathing season. With an installed solar mat surface of 70% of the pool area, water temperatures of approx. 23 to 25°C are achieved. You save approx. 50-60 L heating oil per m² of solar mat surface.



The system is installed on the roof and requires virtually no installation space for additional equipment in the living or garden area. The installation costs are relatively manageable, as no additional energy supply (oil, gas, electricity etc.) is required.



Depending on your technical skills, you can carry out the installation yourself or have it executed by a local installer.

In order to achieve the above mentioned water temperatures, we recommend a roof surface facing southwest (roof pitch ideally about 10°). The prefabricated installation units can be laid horizontally, diagonally or crosswise on almost any roof covering (house, garage roof).



The optimal dimensioning of your solar system depends primarily on the size of your pool. In addition, you have the possibility to purchase our ready-to-install kits with or without control of the temperature difference regulation.





AST SOLAR ENERGY

USEFUL ADDITIONAL INFORMATIONS

DIMENSIONING

Our experience has shown that the solar mat area should be between 50 and 80% of the water surface. In many cases the absorber surface is limited by the size of the existing roof surface. If this is less than 50% of the pool surface, it will not be possible to do without additional heating. If the roof surface is in the above-mentioned area of the pool surface, an additional heating system is not necessary.

In principle, however, the dimensioning depends on the so-called microclimate in the area of the basin. Also the willingness of the user to accept fluctuating or sliding pool water temperatures is also a factor for dimensioning.

In order to keep the pool water temperature constant, the solar system can be optionally equipped with a heat pump. This allows you to make maximum use of the solar yield. The heat pump can also maintain heating in bad weather. If desired, AST can design and install your solar system with integrated heat pump from a single source.

CONTROL & HYDRAULICS

The flow through the absorber mats must be uniform. When the flow path is divided into many parallel channels, the water seeks the path with the least resistance. AST pays attention to equal resistance in the design of its systems. This is possible if all paths are of equal length (so-called Tichelmann piping) and the pressure losses in the distribution pipes are not very significant.

In hydraulically well designed solar systems, the consumption of electrical energy for the pumps should not exceed 1 to 2% of the solar energy generated.

The flowrate characteristics of the absorber surfaces and distribution piping is designed in such a way that neither excessive temperature (and thus loss of effi-

ciency) nor excessive pump energy consumption occurs. During the construction of the system we make sure that the solar mats can be laid over large areas.

SUMMARY

For previously unheated outdoor pools, the installation of a solar system is not only the most environmentally friendly solution, but also the most economical. A solar system for an outdoor pool with 1000 m² water surface costs less than the installation of a boiler and the necessary operating equipment (operating building, gas connection or oil or gas tank, chimney). Running operating costs (except for pump energy) and environmental pollution do not arise with the solar system.

In the case of already heated open-air swimming pools, economic efficiency is achieved by saved heating energy. Since the temperatures in indoor pools are generally higher than in outdoor pools and year-round operation is offered indoors, the solar system in combination with a heat pump and a conventional heating system is optimally utilised as an efficient and environmentally friendly source of heating.

On the following pages we present the individual modules, functional diagrams, dimensioning and energy yield calculations as well as examples of plant construction.

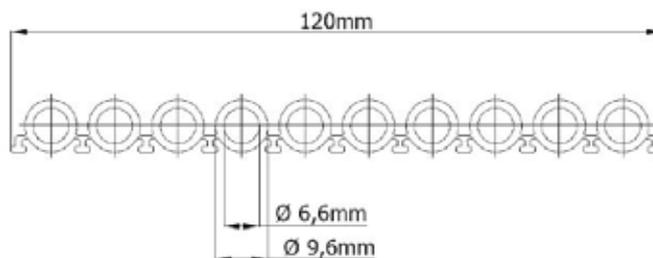
We would be pleased to be at your disposal for consultation - the pathway to your AST solar system is safe!

AST works according to the requirements of ISO 9001 and ISO 14001 with the demand for highest sustainability, quality and availability.

AST SOLAR ENERGY COMPONENTS OF A SOLAR PLANT

Technical details AST 120/10 solar- absorber mat

Absorber area	1,523 m ² /m ²
Absorber material	EPDM (Ethylen-Propylen-Dien-Monomer)
Absorber width	120mm (consisting of 10 tubes with a diameter of approx. 9,6mm)
Absorber length	variable up to 60m
Absorber weight	empty 4,83kg/m ² filled 8,13kg/m ² fill content ca. 3,3ltr/m ²
Flow rate per m ²	80 - 100 L/hour
Operating pressure	0,5 bis 2,5 bar
Pressure loss	0,2 - 0,3mWs (at length of 20m)
Temperature resistance	-50°C to +150°C (frozen walkable)
Energy gain / day	up to 6kWh/m ² absorber area
Energy gain / bathing season	250kWh up to 350kWh/m ² absorber area
Efficiency	0,87



AST Control system

The AST solar control unit is individually programmed. In this way we ensure that the operation of your solar system generates the maximum energy yield in an automated manner.



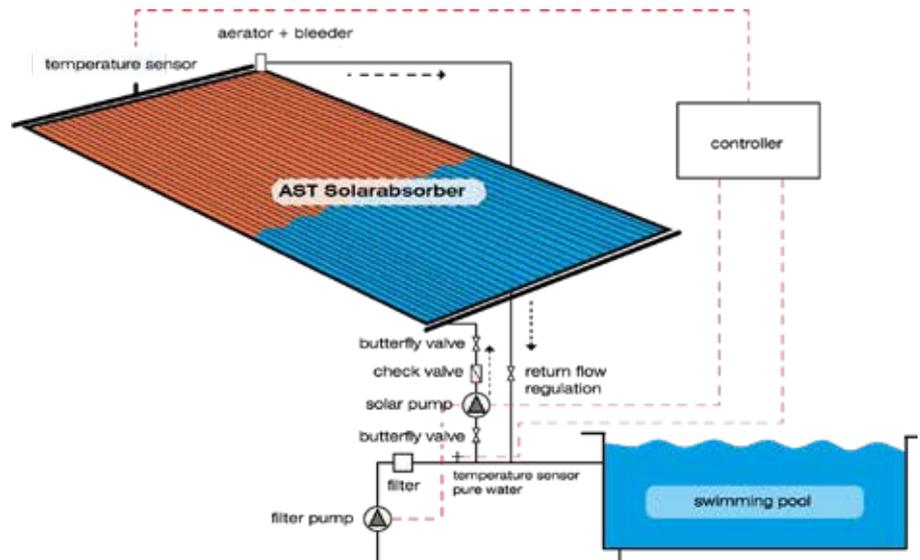
AST Plant construction

The solar absorber area mounted on the roof surfaces is connected to collecting pipes and connected to the water circuit via a supply or return pipe.



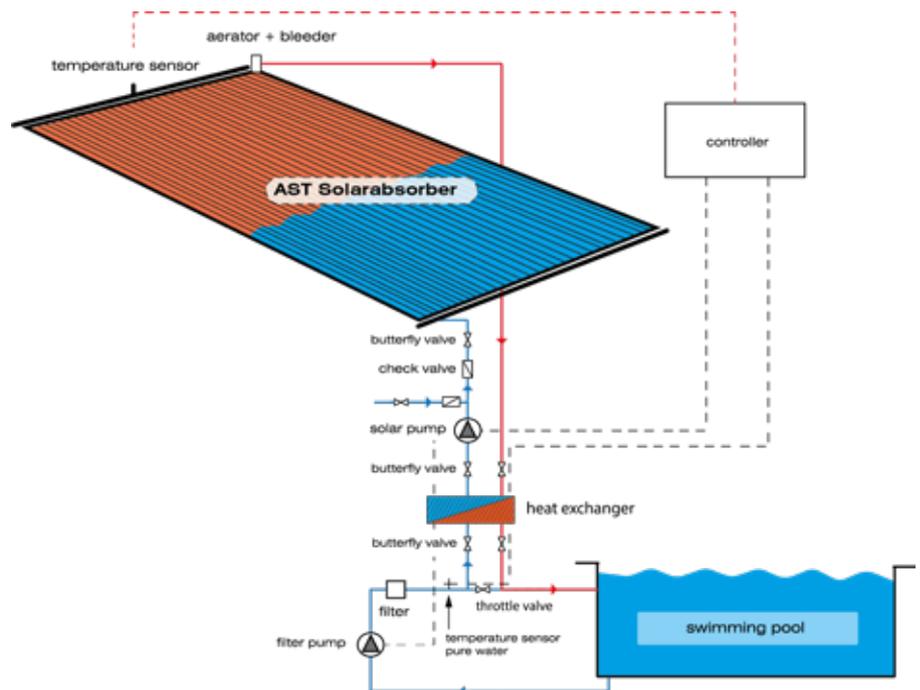
AST SOLAR ENERGY FUNCTIONAL DIAGRAM

Solar plant direct integration



Solar plant with heat exchanger

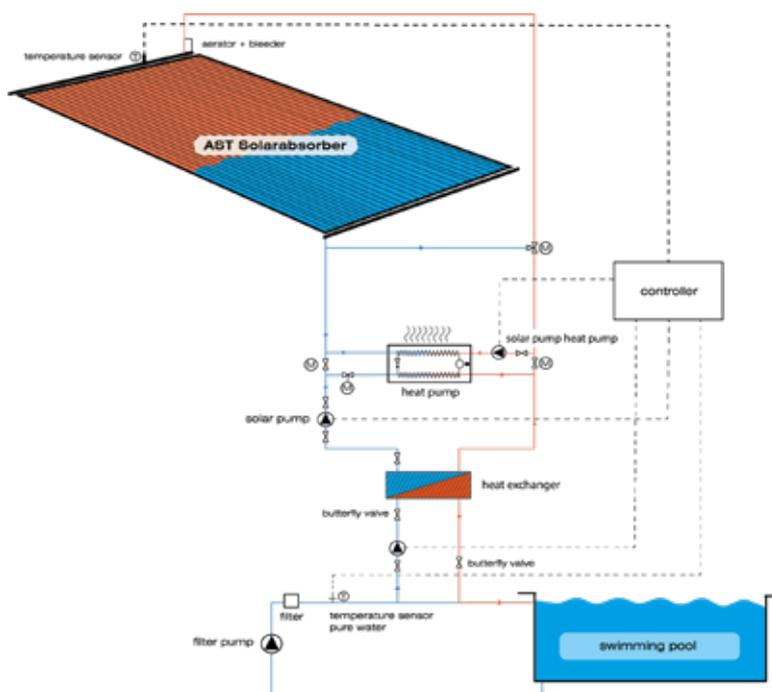
to meet maximum
hygienic standards



AST SOLAR ENERGY FUNCTIONAL DIAGRAM / DIMENSIONING

Solar plant with heat exchanger and heat pump

temperature stable due to heat pump operation during bad weather

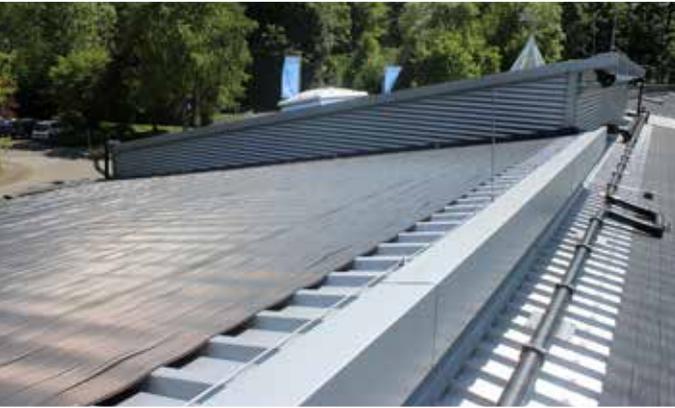


Dimensioning AST Solar Plant (outdoor swimming pool)

pool size	solar absorber area	energy yield/bathing season	savings heating oil	CO2 reduction
100 m ²	75 m ²	22.500 kWh	2.850 L	8.400 kg
500 m ²	375 m ²	112.500 kWh	14.250 L	42.000 kg
900 m ²	675 m ²	202.500 kWh	25.650 L	75.650 kg
1.250 m ²	950 m ²	285.000 kWh	36.100 L	106.500 kg
1.800 m ²	1.350 m ²	405.000 kWh	51.300 L	151.300 kg
2.500 m ²	1.800 m ²	540.000 kWh	68.400 L	201.800 kg

Heating output AST Solar Plant with heat pump (outdoor- & indoor swimming pool)

pool size	heating capacity heat pump		required solar area for		electrical connected load	
	outdoor (25°C)	indoor (30°C)	outdoor pool /	indoor pool	outdoor pool	indoor pool
100 m ²	30 kW	20 kW	60 m ²	40 m ²	7 kW	5 kW
500 m ²	150 kW	100 kW	300 m ²	200 m ²	35 kW	24 kW
900 m ²	270 kW	180 kW	540 m ²	360 m ²	63 kW	42 kW
1.250 m ²	375 kW	250 kW	750 m ²	500 m ²	88 kW	59 kW
1.800 m ²	540 kW	500 kW	1.500 m ²	1.000 m ²	162 kW	117 kW
2.500 m ²	750 kW	500 kW	1.500 m ²	1.000 m ²	162 kW	117 kW



SOLAR ENERGY XPERTS





AST Eis- und Solartechnik GmbH
Gewerbegebiet 2
AT 6604 Höfen

Tel. +43 5672 607 180
info@ast.at
www.ast.at | www.ast-shop.net

AST Eissport- und Solaranlagenbau GmbH
Lechhalde 1½
DE 87629 Füssen

AST Eissport- und Solaranlagenbau AG
Gewerbezentrum Walke
CH 9100 Herisau

AST Canada Inc.
200-3300 boul. des Entreprises
CAN J6X4J8 Terrebonne (Québec)

AST Refrigeration and Solar Technology (Beijing) Co. Ltd.
No. 74 Lugu Rd, Shijingshan,
Beijing, China 100040