



ABSOLICON
S O L A R C O L L E C T O R A B

**YOU CAN
BE A PART
OF THIS!**

A NEWSLETTER FROM ABSOLICON • WE DEVELOP THE WORLD'S BEST SOLAR COLLECTORS

**BREAKING
NEW GROUND!**

INVESTING IN SOLAR STEAM

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Welcome aboard!

We are always hearing on the news about how extreme weather and future climate changes threaten millions of people across the planet. The responsibility is often placed on us as private citizens, our driving and our energy consumption. And although the majority of us would gladly reduce our environmental footprint, this is not easy to do. Being eco-friendly in our professional roles can prove difficult as well.

HERE AT ABSOLICON, WE ARE IN THE ENVIABLE POSITION of working directly with the world's future energy supply. We know how the world's best solar collectors should be built and our vision is for the world to be able to replace oil and gas with solar energy within a few years. When the industry goes from fossil fuel to renewable energy, large scale installations of solar concentrators on industrial rooftops and fields will provide the industries with heat, steam, electricity and solar cooling. The first to adapt will be the Food and beverage industry. Each dairy or brewery burns enormous amounts of oil and gas to produce 160°C steam for their processes, steam that Absolicon can produce from sun on the industry's roof top to a much lower cost.

**WE KNOW HOW THE WORLD'S
BEST SOLAR COLLECTORS
SHOULD BE BUILT.**

ABSOLICON HAS A TRACK RECORD OF MANAGING rapid growth and will be one of the leading companies in the energy transition. In 35 years renewable energy will have replaced 80% of the oil, coal and gas in Europe, a market that has an annual turnover of SEK 2,000 billion at present. But it is wise to keep in mind that our vision to change the world's energy supply is bold, to say the least, and Absolicon will have to face many challenges.

SOLAR ENERGY IS THE SOLUTION to the world's energy problems and I can guarantee an exciting journey and unique insight into the rapid change the energy industry is undergoing and of which only a handful of people in Sweden are aware. You can join Absolicon in the quest for a fossil free world - one of the most important tasks for humanity today. If you are an individual, you can sign up to our newsletter on our website and if you are a company you are welcome to sign a cooperation agreement.

Welcome aboard!



Joakim Byström
Founder & CEO



MOVING TO larger building

Absolicon has moved its operation to house more equipment and personnel. "With a bigger workshop area we will be able to take on bigger projects," says Ingmar Öman, Production Manager, Absolicon.

The new address in Fiskegatan 5. The workshop spans an area of 1,000 m² which is well-suited to industrial production containing gantries and gangways as well as office space for over 30 employees.

"We are preparing to construct a full production line for our solar collectors," says Ingmar.

ABB's truck manufacturing operations once occupied the historic industrial premises but since decommissioning they have largely remained unused.

"Just call us and we'll set up a guided tour with a cup of coffee," says Ingmar.



• Jens Eriksson and Ingmar Öman in the new premises.



• Absolicon has moved into historic industrial premises. This was once home to ABB's truck manufacturing operations.

Green micro-loans

• Absolicon is a member of Kiva, an organisation that enables users to lend funds via the internet to entrepreneurs in developing countries. Absolicon has now established a lending team which you can be a part of. Absolicon primarily provides green loans that promote sustainable development. We want to back investments in eco-friendly technologies in every way we can. Kiva affords its member the possibility to provide micro-loans and we would very much like to

see more people getting involved with the organisation. Learn more at www.kiva.org



Publisher Joakim Byström

Production BlixtFokus AB

Photo Kristofer Lönnå, Pawel Maronski, Absolicon, Lars Wahlström, Lars Ling.

Print Mittmedia Print

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Investment support for the solar collector plan

• Absolicon has been granted funding to be used for the advancement of small and medium-sized companies and to promote regional investments. In its application, the company outlined an initial phase consisting of investments for machinery, marketing and the overhaul of the premises.

"The support given by the county administrative board to our business in this first stage will lay the groundwork for us to be able to partly fund even larger investments with state resources in the future," says CEO Joakim Byström.

Hospital roof is powering solar cooling

Absolicon concentrated solar collectors power the solar cooling for a hospital in Orense. The installation has now been put into operation with Absolicon personnel on site.

"To utilise the sun for cooling is a future technology with enormous potential and our solar collectors are particularly suited to lead this market," says CEO Joakim Byström.

HUGE MARKET

Owing to the vast amount of energy consumed by hospitals, they are a huge market for solar concentrators and the International Energy Agency (IEA) is anticipating the rapid development of technologies able to generate solar cooling.

"In the latest IEA forecast, they estimate that the world can install one billion m² of solar collectors for solar cooling by the year 2050 with an in-

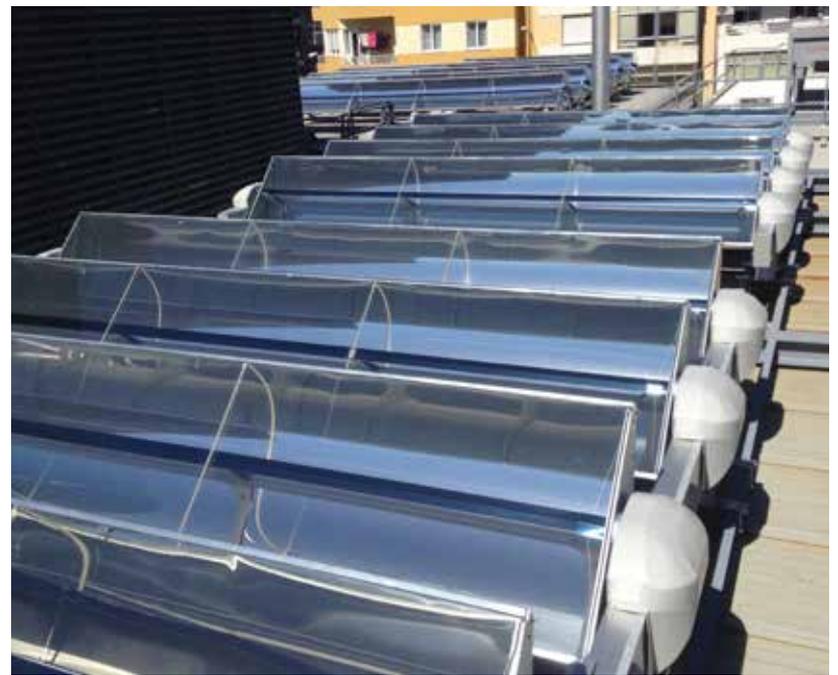
stallation value of SEK 1,000 billion.

Absolicon, in partnership with Climatewell, has previously installed solar cooling in the hospital in Härnösand.

MODERN ENERGY TECHNOLOGY

"It is exciting to be able to establish more installations in the health sector. Many new hospitals are being built across the globe and many utilise modern energy technology," says Joakim Byström.

At the hospital in Orense, Absolicon's solar collectors on the roof are connected to the central heating and power a cooling system together with a biomass boiler.



• The delivery to the hospital in Orense is Absolicon's second installation integrated with solar cooling.



• The plant in Spain is generating solar cooling and the customer is pleased with the installation. From left: Rubén, Laura, Manuel, Rubén, Felipe, José Manuel and Camilo.

FACTS • ORENSE

Location: Orense, Spain
Number of collectors: 21
Installation size: 127 m²
Mounting: Roof installation

Production: Solar cooling for a regional hospital in northern Spain.
Commissioned: 2015

Solar energy on hospitals

Hospitals are a large potential market for solar concentrators because they consume a lot of energy. The delivery to the hospital in Orense is Absolicon's second installation that is integrated with solar cooling.

– Our solar collectors are perfect for producing solar cooling, and in our development work over the coming years we will focus on generating even higher temperatures, which increases the efficiency of solar cooling installations, says Joakim Byström, CEO. We will be the best in the world at integrating concentrated solar collectors with solar cooling for large collector fields.

GENERATES SOLAR COOLING

Absolicon has worked with solar cooling since 2008. Especially in the health sector, the interest is growing. The company already has an installation with solar cooling on the community hospital in

**OUR SOLAR COLLECTORS
 ARE PERFECT FOR
 PRODUCING SOLAR COOLING.**

Härnösand. During the autumn of 2015, an installation with 127 m² of solar collectors was delivered that will generate solar cooling to a regional hospital in Orense, Spain.

MODERN TECHNOLOGY

– It is obviously exciting to be able to do more installations in the health sector. Around the world many new hospitals are being built and many use the most modern energy technology, says Joakim Byström.



• The community hospital in Härnösand has Absolicon solar collectors on the roof. The installation drives solar cooling air conditioning in the building.

FACTS • SOLAR COOLING

Solar heating can drive a solar cooling machine to generate free air conditioning for a building. There are several principles for how solar cooling can be generated by heat, but one rule is that the processes will be more efficient the higher the temperature used. Heat driven cooling is common in larger buildings and in industry.





• The installation with 40 solar collectors at Stödehuset.

FACTS • POOLS

Location: Stöde, Sweden

Number of solar collectors: 40

Installation size: 400m²

Mounting: Ground mounted

Production: Heat for the indoor and outdoor pools as well as electricity for the facility.

Commissioned: 2012



• The swimming pool water is heated by solar collectors that also generate electricity for the facility.

The sun heats the pools

Children who swim in the outdoor pool at Stödehuset have since 2012 had a wonderful experience. The water in the pool is heated by 400 m² of Absolicon solar collectors that also generate the electricity that powers the pool facility.

– Previously, we heated the water with an oil powered boiler and direct electricity, but now it is mainly the sun which warms the outdoor pool, says Sören Ullberg of Sundsvall Energi.

FOLLOWING THE SUN'S HEIGHT

The solar collector installation is located in a field nearby, surrounded by a neat fence. The solar collectors follow the sun's height and begin to generate energy whenever the sun comes out.

– A problem has actually been that the water in the indoor pool will be too hot on sunny spring days prior to the outdoor pool opening. But Absolicon has now added a control that limits the production of heat when the pool water reaches 32 degrees. It works very well, says Patrik Söderberg, the manager of Stödehuset swimming pool.

THE ENERGY PRODUCED

CAN BE USED DIRECTLY

AS HEAT FOR THE POOLS.

An environmentally friendly glycol circulates in the collectors to prevent them freezing in the winter. Inside Stödehuset there is a solar control unit where the heat is transferred directly to the pool water and the solar electricity is connected to the mains power. The solar control unit is made by Absolicon and contains all

the pumps, sensors and control units needed to supply the energy and to control the collectors.

The installation in Stöde is one of those that Absolicon usually demonstrates to foreign guests.

TEACHING INSTALLATION

– The installation is good because it so clearly shows how the energy produced can be used directly as heat for the pools, explains Anders Rammsy, export manager at Absolicon.



• Absolicon had a nice visit to their stand from Prince Daniel during the royal couple's visit. Photo: Lars Ling

Royal interest in environmental issues

When Crown Princess Victoria and Prince Daniel visited the region, on their second day solar energy was among other things on the programme. Absolicon was one of the exhibitors at the mini fair, and one of the visitors to the stand was Prince Daniel.

– Prince Daniel has experience in venture capital, and we had an interesting conversation, says Joakim Byström from Absolicon, who advised the royal couple to complement the pellet heating at their Haga Palace with solar collectors.

Absolicon's own solar collectors convert solar energy into both electricity and heat. Demonstration installations can, among other places, be found at Härnösand Energy Park and Västernorrland County Hall

– We are between development and large-scale production, says Joakim Byström, who later in the evening had dinner with the royal couple at the Residenset in Härnösand.

Several creative entrepreneurs from different parts of

Västernorrland and active in exciting new industries participated in the mini fair held at the Technichus Science Centre in Härnösand. Technichus is a popular centre for science, which through fun and experimentation promotes entrepreneurship and an interest in technology among children and young people.

– The royal couple show considerable interest in environmental issues, that is good for the future, says Joakim Byström.

• Crown Princess Victoria has a strong commitment to environmental issues. Photo: Charles Hammarsten



Commended in the solar industry

Absolicon has received several awards in the industry, including the Intersolar Award, the Oscars of the solar industry. The prestigious award was presented in Munich at the world's largest solar energy trade fair, Intersolar Europe.

Absolicon have worked hard over many years to achieve an international breakthrough. The Company participated with its own stand at the fair in Munich, which attracted close to 80,000 visitors.

THE PRIZE OF THE SOLAR INDUSTRY

The prize, the Intersolar Award, is awarded in a ceremony known as the the Oscars of the solar industry. The prize is awarded in three categories and recognises ground breaking products within the solar energy industry. Absolicon solar collectors generate electricity and solar heating simultaneously and are designed for large buildings such as hotels, hospitals and industries - a market that is growing rapidly in Europe and worldwide.

FANTASTIC RESPONSE

Visitors to Intersolar are mainly installation companies seeking new products. Absolicon can offer next-generation solar energy products and had a great response at the fair.



• Absolicon has exhibited at Intersolar Europe for several years, and here they receive the solar energy industry's own Oscar.



• The hotel in the inaccessible mountain village is energy self-sufficient with the solar collectors from Absolicon.

Solar collectors in Argentina

FACTS • LOS MOLLES

Location: Los Molles, Argentina

Number of solar collectors: 8

Installation size: 80 m²

Mounting: Ground mounted

Production: Electricity and heating for a hotel that is energy self-sufficient.

Commissioned: 2013

One of Absolicon's most inaccessible installations is located in the Andes in the Argentine mountain village of Los Molles. Fernando Smiele is the Argentinian technician who is responsible for the installation and who with great skill has developed the energy system at the hotel, which is energy self-sufficient, with support from Absolicon via Skype.

The installation supplies all the heat to the hotel via a large accumulator tank and together with a small wind turbine, charges the batteries with electricity. The Swedish solar collectors took the help of another Swedish innovation when installing

in the Andes - Skype. The internet communication program was created by Swede Niklas Zennström in 2003 and was later acquired by Microsoft for \$8.5 billion.

– The commissioning was a bit special as we did not visit, but ins-

tead connected via Skype and communicated continuously during the installation. They routed cables and installed while we instructed and operated the control system from Hårnösand in Sweden, says Joakim Byström.

FACTS • LUMICUM

In Hårnösand is the Lumicum research laboratory owned by the Foundation for Research on Concentrated Solar Power. Lumicum was funded by a donation from Sparbanksstiftelsen Norrland in 2006 and consists of advanced test and measurement equipment for concentrated solar power. There are, for example, one of the world's few test rigs for mid temperature solar collectors, climatic chambers, solar simulator for concentrated light and advanced laser characterisation equipment.

Lumicum builds unique heat and

Through a partnership between the Swedish Lumicum laboratory and European companies, the world's first installation that generates electricity both from solar cells and from a turbine has been erected at the Agricultural University of Athens. The solar collectors were supplied by Absolicon.

– Absolicon's unique CPV/T technology that generates both electricity and heat is the foundation of the project, says Olof Björkqvist, Foundation for Research on Concentrated Solar Power.

HEATS UP SOLVENT

The foundation has been the Swedish principal in the project, which resulted in a unique installation. The excess heat from the solar collectors is used to

heat up a solvent which boils at a low temperature and drives a turbine for electricity.

MANY CHALLENGES

In this way we generate electricity twice - first with solar cells and then with the turbine. The challenges have been many - the solar cell operating temperature has been raised to 95 degrees and the solar collectors is tuned to give optimal production.



• Absolicon's installation in Argentina could be commissioned with support from Sweden via Skype.

were installed via Skype

Absolicon installations are all connected to the internet and can be remote controlled. It is reducing down maintenance costs and repairs. Los Molles was perhaps the final proof that it is possible to operate worldwide from a base in Härnösand.

– We now have a dozen solar installations that we monitor daily from Härnösand. In the long term, we envisage that we will have supervision of all installations from a control centre in Härnösand 24

hours a day, in the same way that hydro power is monitored.

One of the local tourist attractions is the geological formation 'Source of the Spirits' or Pozo de las Ánimas. The huge sink hole was created when the porous rocks deep underground were dissolved by groundwater, making underground caves which then collapsed. The sink hole is 300 metres in diameter and 100 m deep. According to a local legend, you can hear the spirits whispering when the wind blows.



• Pozo de las Ánimas, one of two huge sink holes near the installation. Images © 2015 CNES/Astrium, Digital Globe, Map data © 2015 INAVI Geosisternas SRL

power installation

FACTS • CPV/RANKINE

Location: Agricultural University of Athens

Number of solar collectors: 10

Installation size: 100 m²

Mounting: Ground mounted

Production: Generating electricity from solar cells and electricity from a turbine.

Commissioned: 2015



• The solar collectors from Absolicon are generating electricity from solar cells and heat that powers electricity production from an ORC turbine.



• Absolicon already has a display installation at the Energy Park. The new steam installation is being built close by.

The Energy Park grows

Absolicon, Alfa Laval and HEMAB are working together to build a demo installation for solar steam, which will be the world's best energy solution for large industries that want to reduce their energy costs.

The pilot installation, financed by the Swedish Energy Agency and built by Absolicon in collaboration with Alfa Laval and Härnösand Energy and Environment (HEMAB), will produce 160°C steam directly from the sun. The installation is being built to the west of the Absolicon X10 field, which has produced electricity and heat for Härnösand residents since 2010.

The steam is produced by the new solar collectors, model T160. The Absolicon T160 is built on its long

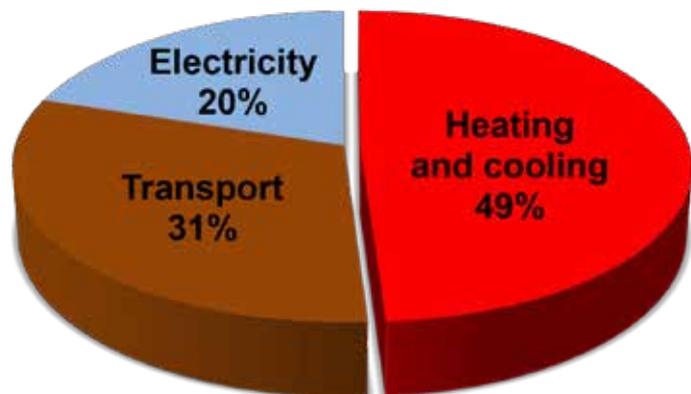
experience of concentrated light and is optimised for low manufacturing costs and a high level of efficiency at higher temperatures. In mass production, they will provide the lowest ever costs for solar steam and begin to oust oil and gas.

– The new installation of the T160 in the Energy Park is important to us. We have many visitors from around the world and need a larger installation in the immediate area where we can showcase our technology, says Christer Olsson, office manager.

FACTS • PILOT PLANT

Location: Härnösand, Sweden
Number of solar collectors: 8x T160
Installation size: 44 m²
Mounting: Ground mounted
Production: Solar steam
Commissioned: During 2015/2016

Steam - larger than electricity



Steam between 120°C and 160°C is a major energy carrier in industry. Absolicon's new T160 solar collector generates steam directly from the sun and has been developed for industrial roofs.

In the energy debate it is often electricity that we think of, electricity for lights and household appliances. But electricity only accounts for 20% of the world's final energy consumption. 49% is heating and cooling, and of this industry accounts for half.

GREATER CONSUMPTION THAN ELECTRICITY

Steam, like electricity is an important energy carrier, and in many industrial segments such as the chemical industry, textile industry, pharmaceutical industry and the food sector, it accounts for a larger proportion of energy use than electricity. It is something that more and more people are noticing and now Absolicon is making a concerted effort to become the world leader in industrial steam genera-



• Ingemar Forzelius, CEO of HEMAB and Joakim Bystrom, CEO of Absolicon break the ground for the new solar steam installation.

with steam demo plant

Absolicon T160

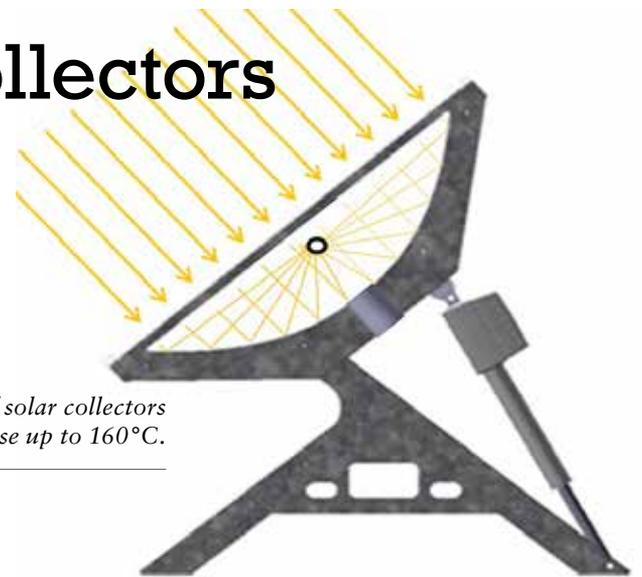
A new generation of solar collectors

Absolicon launches a new generation of solar collectors with lower manufacturing costs and higher efficiency.

The solar collector model with the designation T160 is considerably cheaper than the current X10 collector and generates up to 160°C. The new solar collectors are installed in groups of eight that share a common control system in order to reduce costs. The concept has been developed over several

years and it is expected that the amount of components can be reduced considerably, while at the same time increasing the efficiency. The new solar collectors from Absolicon are subject to several new patent applications.

• A new generation of solar collectors Absolicon T160 for use up to 160°C.



in the industry

ted by solar energy. By installing concentrating solar collectors on industrial roofs, a large percentage of the energy demand can be met.

HIGHER TEMPERATURES

Absolicon has extensive experience in the field. As early as 2010 the company manufactured a first solar collector for higher temperatures that was tested in Austria. But since then, the research laboratory Lumicum (see pages 6-7) has developed test equipment for solar collectors up to 200°C, so now the product development can take place in Härnösand.

To produce steam directly from the sun instead of from oil is not only an issue of halting the green house effect, it also provides cheaper energy. The sun costs nothing, and once the investment in solar collectors is paid, the industry has free energy that no international crisis, blockade or carbon dioxide tax can put a stop to.

FACTS • SOLAR STEAM



A quarter of the world's energy is used for manufacturing goods that we consume. In industry there is usually a boiler where oil or natural gas is burned and the steam piped out into the factory to provide heat for various processes. With concentrating solar collectors it is possible to produce solar steam which is fed into the steam network. In sunny countries solar steam can be generated very cost effectively – even without subsidies, solar energy can out compete oil.



• When the Kenyan Ambassador Ms Purity W. Muhindi visited Västernorrland, the Energy Park was one of the most praised of the study visits over the two days.



• Anders Rammsy answers questions and gives a tour of the Energy Park.

Study visits from all over the world

The Energy Park in Härnösand is an inspiring meeting place for companies, researchers and educators. Amongst other things it has Europe's first solar power station for electricity and district heating utilising solar collectors from Absolicon.

– Härnösand's Energy Park has been very important for Absolicon's development. It is a perfect demonstration installation for our technology and the visits are appreciated by our customers from around the world, says Anders Rammsy, salesman at Absolicon.

Since its inauguration in 2011, the Energy Park had about a thousand visitors each year. The owner and founder is the municipal energy company Härnösand's Energy and Environment.

– We want to contribute to the development of small-scale renewable electricity and heat, says the project manager for energy technologies, Pär Marklund. Along with other energy-related investments in Härnösand such as the training and research from Mid Sweden University and Higher Vocational Education, as well as Lumicum's laboratory, we are contributing to Härnösand becoming an authority in the development of new energy.

The next installation in the park will be a pilot installation, which will produce steam directly from the sun. The project has been developed in collaboration with Absolicon, Alfa Laval and HEMAB. Read more on pages 8-9.



• Study visits from Pakistan and Chile. Photo: Lars Ling



• In connection with the solar park there is a control centre on display.

FACTS • THE ENERGY PARK

Härnösand's Energy Park was opened in June 2011. The facility is a unique display space for new technologies in small-scale energy production. In the first year the facility had 1,700 visitors, of which a number were international, including from Africa and Asia. The park features a solar power station, a small wind turbine and sun tracking solar cells. The energy produced goes out to both the electricity and district heating network. The owner is Härnösands Energy and Environment (HEMAB).

• Dong Kyo Lee from Hyundai Engineering received intensive training in solar cooling in Härnösand.



Storage of solar energy

What possibilities are there to store heat from Absolicon's collectors? This question will be answered by the prospective energy engineer Erik Persson in his thesis.

– One exciting approach is to use a substance that melts at a certain temperature, so-called Phase Change Materials (PCM). An example is paraffin, which melts at 53°C. By using such materials, the storage be both compact and less expensive, says Erik Persson.

ABLE TO BE STORED FOR A LONG TIME

Erik Persson attends Umeå University and for his thesis, he is investigating the possibilities of using various innovative methods to store heat from Absolicon's solar collectors from day to night and even from summer to winter.

– At higher temperatures chemical processes can also be used, for example the heat from the solar collectors can be used to expel water from lime. When the water is returned the heat comes back. In this way, the energy can be stored for a long time, even several years, says Erik.



• Erik Persson, who works with energy storage helps Malin Öberg to prepare reflectors for testing in the climatic chamber.

BATTERIES FOR DAILY STORAGE

There are a lot of exciting things happening within energy storage, both for storing electricity and heat. Denmark has systems to store solar heat for district heating in both boreholes and pit storage, water-filled pools that are covered with insulation. In this way heat energy can be stored from summer to winter. In Germany batteries are being increasingly built for daily storage of solar energy.

Recently the CEO of Absolicon, Joakim Byström, had the honour of chairing the session on the storage of solar energy at Germany's leading industry conference for solar energy, SMEThermal in Berlin.

– The ability to store energy is important for increasing the share of an industry's energy needs that we can cover with solar energy, says Joakim.

• The industry conference in Berlin gathered over a hundred experts from many of the world's leading solar collector manufacturers. Absolicon's CEO Joakim Byström (left) was invited to chair the session on thermal storage.

Photo: Stephanie Banse



Patents that protect unique technology solutions

Patents protect Absolicon's unique design principles and material selection. Currently two patents have been granted and more are in the pipeline.

During the next two years Absolicon reckons it will apply for 3-4 new patents, both for new solar collectors and the components and processes developed for production.

TRADE SECRETS

Until a solution has been submitted as a patent it is a trade secret, and as long as it cannot be detected, this can in many cases be preferable to public publication as a patent. Absolicon has been granted two patents

and one design protection, which especially within the EU provides a good additional protection against copying.

EXPERTISE MOST IMPORTANT

– The most important thing is of course to have the expertise and strong partners, but the patent can be an important supporting component, especially in negotiations, says Anders Rammsy, salesman at Absolicon.

FACTS • ABSOLICON'S PATENTS

Currently Absolicon has been granted two patents:

- SE 533481. Receptor for sunlight with solar cells where the losses are minimised by a special black paint on other surfaces. It is an inexpensive method which increases the efficiency considerably
- SE 533498. The principle of inserting the receptor on a rail in the solar collector, almost essential in the type of solar collector we build, in order to in the future be able to upgrade the receptor with better solar cells.

The patents are also filed in the United States, the EU and India, where the process of granting is ongoing.



34

PERCENT

The increase in the global warming effect caused by greenhouse gases between 1990 and in 2013.

2550

GIGATONS

The carbon which is commercially available. If we burn it then we destroy the global climate.

850

GIGATONS

The amount of carbon that humankind can burn if we want to keep the temperature increase below 2 degrees Celsius.

4,9

MILLION

barrels of oil were spilled into the Gulf of Mexico after the Deepwater Horizon exploded and sank on 20 April 2010.

80

PERCENT

Is the size of the risk that the southern and mid-western United States will be affected by a drought lasting for 35 years during this century - if we do not do something about global warming. One of those behind the study is Toby Ault, a researcher at Cornell University, who notes that a long period of drought would have disastrous consequences, among other things for agribusiness

The world does not need to be dependent on oil

Sweden is a good example of how quickly fossil fuels can be replaced with renewable energy. The transition made by Sweden need repeating in the rest of the world.

Many people in Sweden have changed their heating system and removed old oil tanks from their homes. Taxes and subsidies have allowed property owners to quickly replace oil. In 1970, 12 million tons of oil was burned to warm Swedish homes. Today, oil-fired heating in Sweden has virtually ceased and has been replaced by district heating, pellets and heat pumps.

SANCTIONS AGAINST OIL HEATING

But globally oil is still widely used to generate heat, above all within industry. There will be huge carbon emissions when industry burns oil and gas to produce clothing, food and other things we consume.

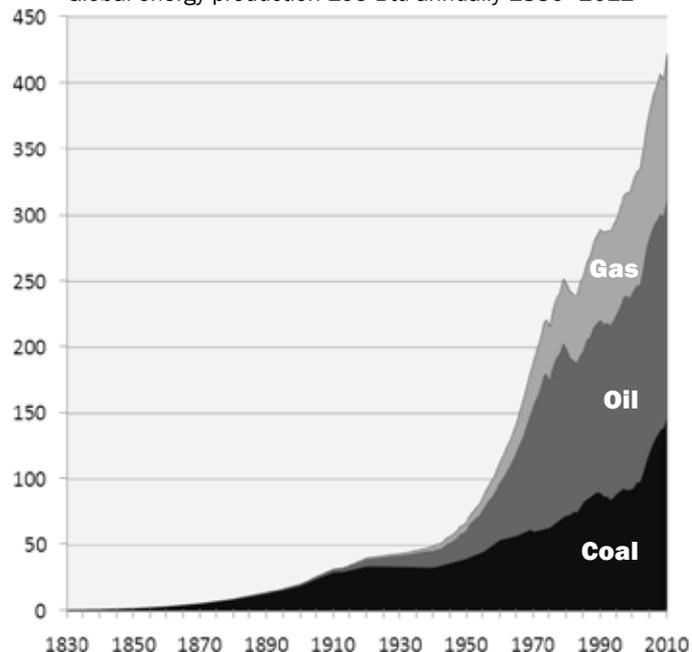
There are also already major emissions from the extraction of the crude oil. For each cubic meter of oil burned in an industry, more than 2690 kilograms of carbon dioxide is released into the atmosphere. But an additional 700 kg is emitted during the oil extraction and refining before the fuel is even used. The oil and gas industry is the industry that has the greatest impact on climate. In the US, 24% of industrial climate impact is from the oil and gas industry.

POLITICAL RISKS

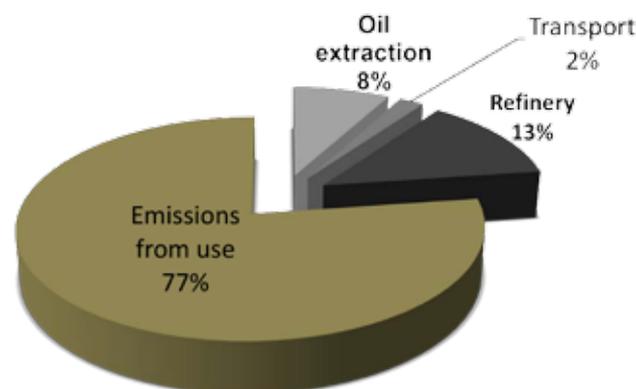
Oil has during the 20th century been the cause of major political conflicts and wars. Today, the world's largest reserves of oil and gas are under the control of authoritarian and unpredictable regimes. A world without oil dependency would be a safer world.

Finally, a reduction in the emission of particulates and toxins from burning can save lives, especially in developing countries. In India alone it is estimated that 600,000 people die each year from air pollution. As oil is running out, the world must transition. The only renewable energy source that has the potential to meet the world's energy needs is solar energy.

Global energy production 105 Btu annually 1830–2012



• The use of fossil fuels has increased rapidly worldwide. Source: BP Statistical Review of World Energy 2011



• For each cubic meter of oil supplied, large amounts of greenhouse gases have already been emitted. Source: Life Cycle Well to Wheels Assessment of GHG Emissions, Jacobs Consultancy.



Huge solar potential in industrial processes

It is not all energy that can be replaced by solar energy, but a considerable proportion. This has been ascertained by a working group within the International Energy Agency (IEA), which collated current research.

The report estimated that 30% of all the energy used in industry is heat with temperatures between 50 and 200 degrees. It can be concluded that 'the potential for solar

steam within European industry is enormous'.

It is a combination of new products and capital for funding that is required for the development to take off. But if Europe is to reach its ambitious climate targets, then industry must find other ways to heat their processes than by burning fossil fuels.

It is estimated in the report that European industry could install 150 million square metres of solar collectors, which is equivalent to a market value of €15 billion in Europe alone.

Climate Fund finances the conversion

Large investments are needed to convert the energy supply. The Green Climate Fund will finance a share of developing countries' efforts.

The costs of replacing oil and coal plants with energy sources that do not emit carbon dioxide is breathtaking. The International Energy Agency (IEA) estimates that in order to keep the temperature increase below 2 degrees Celsius, an extra 1,100 billion dollars must be invested annually until 2050. But the savings from reduced imports of oil and gas mean that the investments can actually become profitable.

FOCUS ON RENEWABLE ENERGY

More and more attention is now paid to renewable energy raising the competitiveness of industry. Once the investment has been made, sun and wind provide free energy for decades.

In developing countries, the transition is however more difficult to finance. Therefore, OECD countries in climate negotiations promised to transfer \$100 billion



• *The Green Climate Fund was established at the UN climate summit in Copenhagen in 2009. Its mission is to support developing countries with work on climate change adaptation.*

every year in investment to developing countries, including the Green Climate Fund (GCF). Sweden has already promised to contribute €400 million to the fund.

In order for climate negotiations to come to fruition and to keep the temperature increases under 2 degrees, or more preferably, below 1.5 degrees, it is crucial that the richer countries help finance solar energy projects.



80
PERCENT

The EU has agreed to reduce its greenhouse gas emissions by 40% by 2030 and by 80-95% by 2050.

150
MILLION

square metres of solar collectors can be installed at European industrial companies to provide heat and steam.

106
000
TONS

The amount of spilled oil collected between 2010 and 2013 on Louisiana's beaches from the Deepwater Horizon oil rig. The clean up effort has cost BP 14 billion dollars

100
BILLION

dollars per year. Aid that rich countries promised to contribute for climate investments in the south.

38,2
GIGAWATTS

The amount of solar cells, Germany had installed by the end of 2014, it provides 474 W per solar cell/inhabitant. Germany has installed the most solar cells in the world, 5.8% of the electricity production in 2014 was solar electricity



• Absolicon's solar collectors can be found in many places throughout the world. The picture shows an installation on a regional bus terminal.

• Joakim Bystrom where he prefers to be - in the workshop. Over the years Absolicon has developed three generations of solar collectors.

– Solar energy is the solution to the world's energy problems

Absolicon's solar collector was nominated in 2013 as one of the world's 100 most promising solutions for a sustainable future.

– We know that solar energy is the solution to the world's energy problems, and we know we can build the world's best solar collectors, says Joakim Byström.

The Absolicon story started when Joakim went as a youth delegate to the UN conference on the environment. He had an opinion on a wording and the Swedish delegation's leader, former Environment Minister Olof Johansson, sent Joakim up to the UN rostrum. His proposal, a four word long addition to a sentence, was adopted and included in the final document.

– It was fun, but when I came home it felt empty. Four words in a very thick document that not many people could read. It felt pretty meaningless. I wanted to change the world! Do something practical.

He did. Because one can also say that the history of Absolicon began at a party in 2002, where Joakim and some of his technically minded friends solved the world's energy problems on some napkins. They

calculated and designed a solar collector, which concentrated solar rays into a small area. This significantly reduced the need for expensive solar cells.

STARTED AS A HOBBY

– It looked too good to be true. We were convinced that we had made some errors in thinking so we decided to meet again and start building.

The project continued as a hobby for a few years and as they built and calculated they constantly concluded that the idea must work. Joakim went to Uppsala and ploughed through all the research in existence on concentrated solar power and found that everyone had arrived at roughly the same thing, but no one had succeeded in every aspect.

– I was very upset. Would such a good thing fail

due to various small parts not working.

Development continued, and in 2006 the first installation was made at Skule Visitor Centre in the High Coast.

FOLLOW THE SUN

Besides concentrating solar rays the Absolicon's collectors have two other special properties. One is that they follow the sun throughout the day to get maximum insolation, and the second is that they can produce both electricity and heating and cooling.

In 2007 the company was properly started and thereafter followed a five year long race. Installations were sold not only locally, but also for example in Spain, Chile and India. Absolicon followed the curve as a growth company should. Sales doubled every year, the number of employees increased, the premises became bigger and so on.

– It's very special to drive a growth company. Conditions change all the time and above all it costs money. You spend a lot of time and energy in sourcing new capital.



• Awarding of the Sustainable Stockholm Award by King Carl XVI Gustaf.

Built his first solar collectors in school

The idea for Absolicon was born when Absolicon founder and CEO Joakim Byström age 11 built a concentrating solar collector in a school craft lesson.

In the past two years Absolicon has scaled down and is now a small and relatively prosperous service and development company that sells knowledge rather than physical installations. Joakim can take things more easy and spend more time where he most wants to be - in the workshop.

PRIZE WINNING COMPANY

– We know that solar energy is the solution to the world’s energy problems, and we know we can build the world’s best solar collectors. Now we wait in the wings, ready for the right opportunity to invest again.

The walls of the break room are covered with diplomas and other awards. Over time, Absolicon is probably one of Härnösand’s most celebrated companies. The latest recognition came in June 2013 when Absolicon collectors were included on the Sustainia100 list of the 100 most promising solutions for a sustainable future. Absolicon is one of ten companies in the energy company category.

– I actually took down another diploma to make space for this.

Behind Sustainia are a number of companies, organisations, foundations and researchers. The jury consists of, among others, Arnold Schwarzenegger and Gro Harlem Brundtland.

Prior to the meeting, I read what I wrote the last time I interviewed Joakim Byström.

It was in 2007, just when Absolicon was on the starting blocks, and I read the conclusion of the article to him. Where he says: "This project is my destiny. I have to pursue it all the way."

– Did I say that already? It is the same now. If one is the best in the world at something that has the potential to change the world then one must of course pursue it!



JOAKIM BYSTRÖM

CEO Absolicon

Age: 46

Family: His wife Sara and their children Saga and Dag

Lives: House on Östanbäcken in Harnosand

Drives: Toyota Prius Ladd hybrid

After studies in Uppsala Joakim became president of the Federation of Young Researchers and was invited to join the Swedish delegation to the UN body, the Commission for Sustainable Development.

WANTED TO DO SOMETHING CONCRETE

Returning home from the UN building in New York, he wanted to do something more concrete for the climate and in 2002 took the initiative with an ambitious research project for solar concentrators.

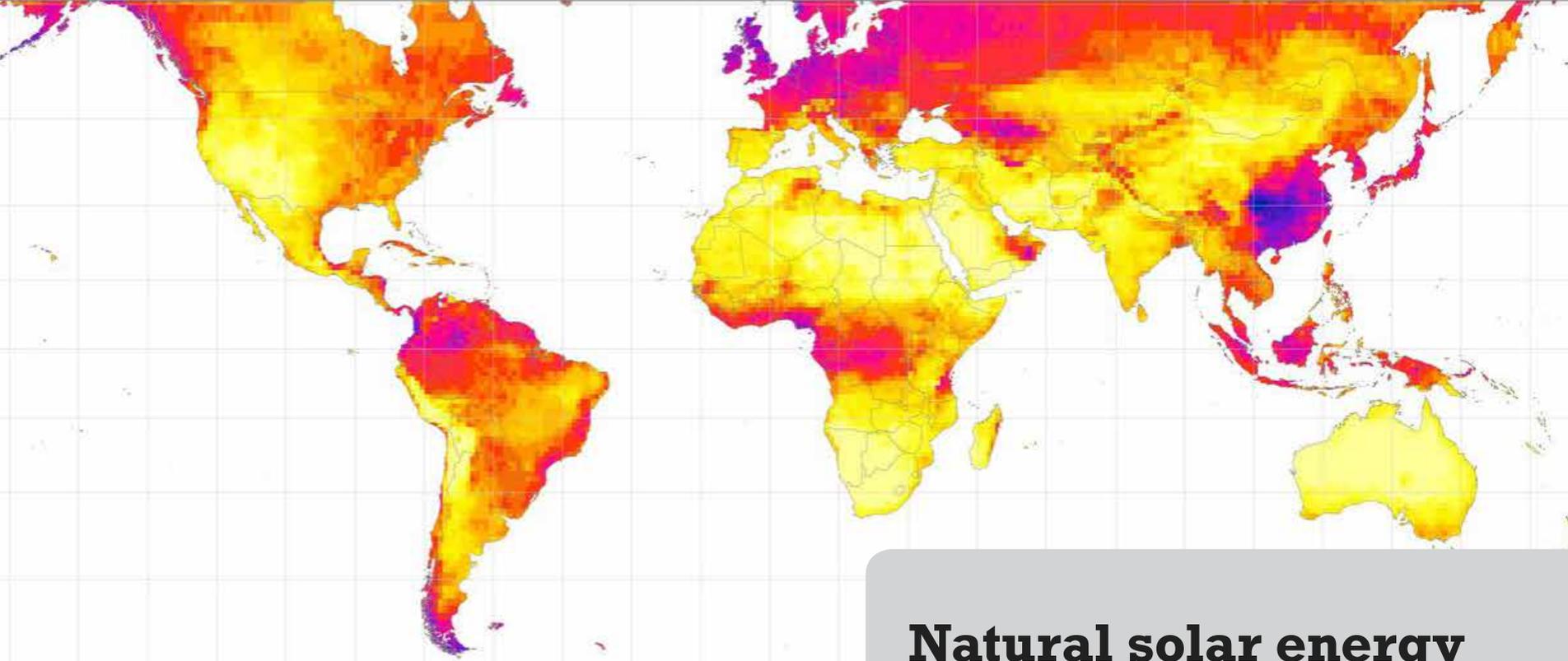
The work with the solar concentrators was very successful, and later led to the formation of Absolicon in 2007.

Joakim Byström also initiated the Stockholm Junior Water Prize with Crown Princess Victoria as the patron and he is chairman of the solar energy engineering course at the Higher Vocational Education college in Härnösand.

POLITICAL INVOLVEMENT

Through his political commitment, he has been a board member of Härnösand Energy and Environment, Länstrafiken Västernorrland and the science center Technichus in Härnösand.

Joakim Byström was awarded the WWF Carl Mannerfelt Prize for his ability to combine a deep commitment to technology, environment and sustainability issues.



• The solar radiation map shows the annual inflow of direct solar radiation for different places in the world.

The sun shines all over the world!

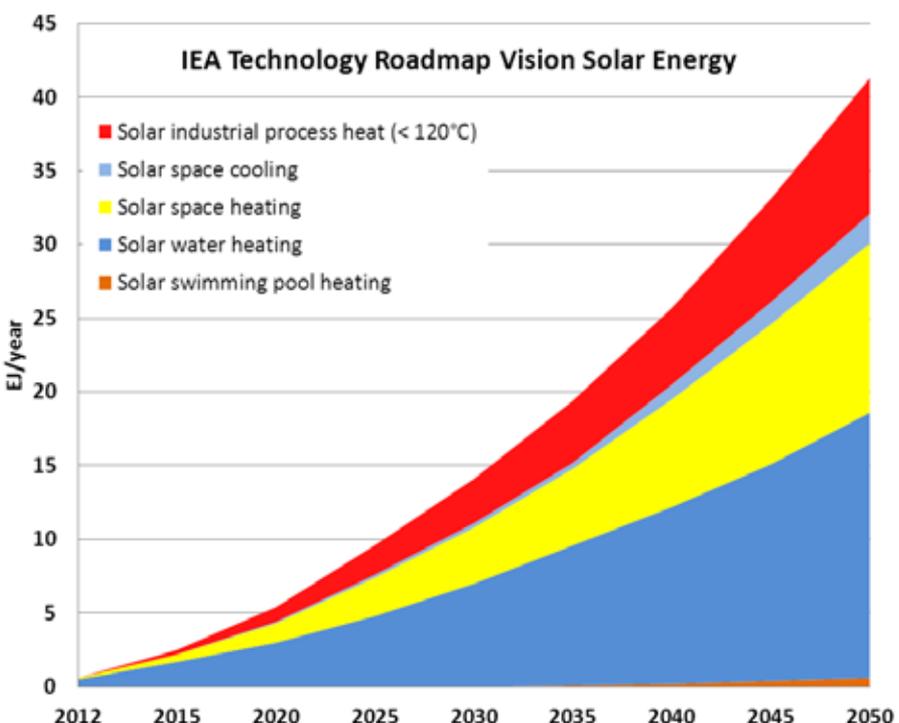
Solar energy can be used all over the world, from sunny California to the South Pole. Absolicon solar panels have proven to work well in Sweden, but they give three times higher yields in southern Spain.

Absolicon collectors focus the light as a burning glass does. They are unique in that you can change the receiver, and either generate electricity and heat for buildings or generate solar steam up to 160°C for process heating or solar cooling - even in Sweden. But the more the sun shines, the higher the production!

IEA FORECASTS FOR THE GROWTH OF THE SOLAR INDUSTRY

The International Energy Agency (IEA) recently presented a 'Roadmap' for solar heating and solar cooling. Absolicon has from this estimated how many m2 of solar collectors are needed and what investment this will be.

The IEA conclusion is that the world can by 2050, cover 15% -20% of heating, process heating and cooling with solar energy. The investment required in solar panels is SEK 5,000 billion. For electricity the IEA believes that parabolic solar collectors and flat solar cells can cover 27% of the world's electricity needs.



• The chart shows the IEA roadmap for how the market for solar heating and solar cooling can be developed until 2050.

Natural solar energy



SOLAR STEAM

Industry currently consumes huge amounts of fossil fuels. In industry there is usually a boiler where oil or natural gas is burned and the steam piped out into the factory to provide heat for various processes.

Potential: With concentrated collectors, solar steam can be produced that is fed in directly at the boiler. According to IEA forecasts, 3 million m² of solar collectors for industry can be installed by 2050.

Our installations: Pilot plant at the Energy Park in Hårnösand.



SOLAR COOLING

Solar heating can drive a solar cooling machine to generate free air conditioning for a building.

Potential: By using the heat from the solar collectors, cooling can be generated. According to IEA forecasts, 1 billion m² of solar collectors for air-conditioning can be installed by 2050.

Our installations: Absolicon has installed solar cooling on the community hospital at Hårnösand. In 2015 Absolicon delivered a similar facility to a regional hospital in northern Spain.



SOLAR HEATING

Many home owners have set up solar collectors for domestic hot water, but solar heating can also be installed in large fields for district heating.

Potential: In several places there has been a rapid expansion of solar heating that is fed into the district heating network. According to IEA forecasts, 1 billion m² of solar collectors for heating and hot water can be installed by 2050.

Our installations: Absolicon has several installations producing heat in combination with electricity.



SOLAR ELECTRICITY

By using solar cells it is possible to generate your own electricity on your roof. Electricity can also be produced by heat in the collector driving a turbine. The electricity that is not used in the house is fed into the grid.

Potential: Germany has installed the most solar cells in the world, 5.8% of the electricity production in 2014 was solar electricity.

Our installations: Absolicon has several installations that produce electricity and heat with solar cells, as well as through turbines.



ABSOLICON
S O L A R C O L L E C T O R A B