



## GENERATE COLD WITH WASTE HEAT

ENERGY EFFICIENT COOLING SOLUTIONS FOR INDUSTRY AND TRADE

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## The Drive for Innovation is our Capital.

Climate change, a scarcity of resources worldwide and constantly rising energy prices make rethinking how we deal with energy more urgent than ever. Particularly in the building sector, one of the largest energy users, the deployment of new, innovative technologies is the key to energy savings and protecting the environment.

Early on – long before the topic of energy efficiency had reached politics and the broad public – we at SorTech had recognized an especially enormous energy and cost savings potential that existed within the waste and process heat generated by industry and trade. We were equally certain that the adsorption chiller technology would be able to offer brand new and previously unimagined possibilities of realizing this potential.

Since the company's formation in 2002 we have conducted intense research in our R&D department and – in true pioneer fa-

shion – continuously optimized and advanced the technology. Today, satisfied customers, in industry and trade worldwide, profit from our knowhow. Wherever SorTech is deployed, the goals are always the same: For waste heat to be used in the best way possible to generate cold, resulting in a reduction of operating costs and better protection of the environment.

Together with our current staff, all specialists in their respective fields, we are proud to tackle the challenges of the future. We encourage you to take advantage of the bundled knowledge of all SorTech staff members – from our engineers to our service technicians – along with our ambition to again and again break new ground with creative solutions. Innovative systems are not just comprised of great components, but most and foremost a result of great ideas. Something we live by every day.

Sincerely

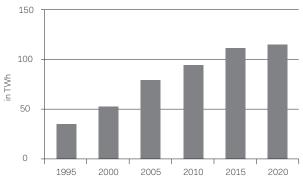
Walter Mittelbach
Chief Executive Officer

# Demand for Refrigeration Rises Drastically.

Let's Master this Challenge Together.

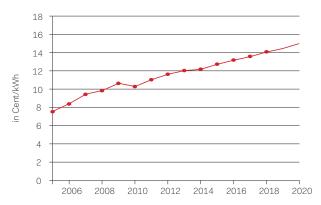
For years the need for air-conditioning in industry and trade has surged – a trend that will continue in the future. Production, administration and warehouses are subject to this challenging trend as well as gastronomy, trade and the service sector.





Annual Air-Conditioning Demand of 15 Most Important EU States Growing

Not just the price for electricity, but also the need for cooling within the EU countries is on the rise.



#### Increasingly Expensive Electricity

Prices for electric power in the EU continue to rise – even for industry and trade. It is estimated that by 2020 the kWh will cost around 15 Cents.



This development is increasingly becoming a problem, because most chillers and airconditioning systems are powered by electricity and the ever-mounting electricity prices pose an extreme cost factor for businesses. Therefore – as well as in view of tighter EU climate protection goals – energy efficient and simultaneously environmentally friendly systems technology is more in demand than ever.

Most of the conventional chillers or cooling technologies are pure 'electricity guzzlers' while at the same time emitting dangerous  $CO_2$  into the environment. In addition they often run on environmentally hazardous cooling agents, which in turn have the potential to lead to material damage.

The scheduled countdown to 2030, the year in which the almost complete abandonment of the use of climate damaging, fluoride containing cooling agents becomes effective, is dominating the European legislation governing refrigeration and airconditioning technology. Consequently, within the EU year after year stricter laws and regulations take effect. In concrete terms, beginning this year many refrigeration systems may no longer be maintained. For the affected entrepreneurs this means that these systems have to be retrofitted at great expense or simply replaced by new equipment. However much a challenge this poses for industry and trade, now - due to the access to SorTech's environmentally friendly and extremely power-saving adsorption chiller systems - the result will bring a multitude of positive results with it.

ENORMOUS ENERGY SAVINGS POTENTIAL IN THE HEATING AND COOLING SECTOR.

## THE POWER OF SORTECH: INNOVATIVE COATING TECHNIQUE.

The adsorption chiller aggregate operates on the principle of sorption of solids called adsorption. During processes of adsorption, steam from sorption material (silica gel or zeolite) is "sucked" in and taken up (adsorbed) whereby the water evaporates and cold is being generated. Once the material is saturated, adding heat into the supply will again regenerate it. This process results in intermittent cooling.

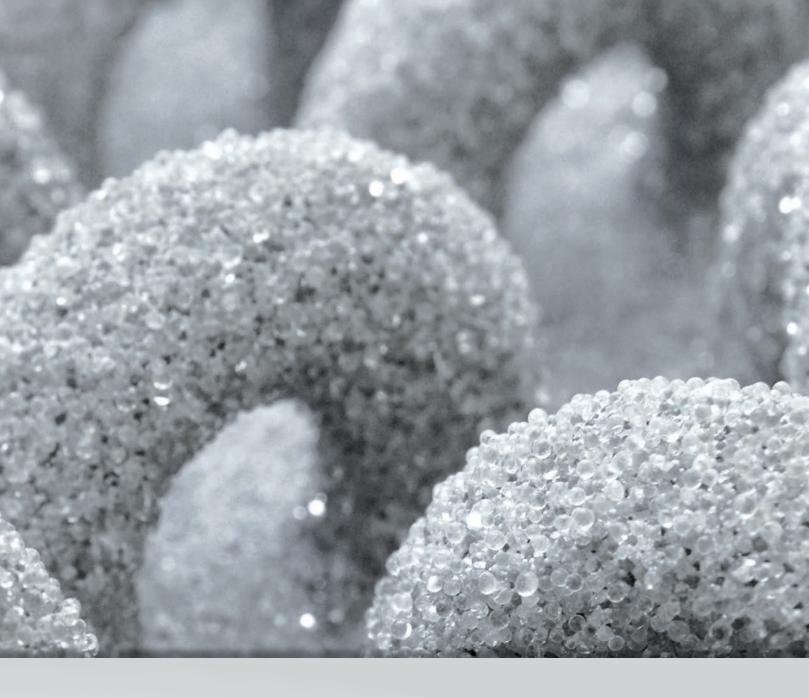
## The Classic.

## Adsorption Refrigeration with Silica Gel.

The generation of adsorption chiller aggregates named eCoo produces cold by accumulation of water vapor on porous solids. We use silica gel as the adsorbent for this process. Silica gel is porous sand, completely non-toxic and ecologically harmless, consisting of SiO<sub>2</sub>. Pure water serves as the cooling agent. In stark contrast to other cooling agents, water is another safe component.

The adsorption process itself is 100 percent reversible and functions without any mechanical support. This means the transport of the cooling agents requires no pumps, compressors or valves. Consequently there is also no wear and tear in the inside of the vacuum module. The vacuum modules are hermetically sealed and maintenance free. Contrary to conventional technologies this system will not experience any loss of cooling agents during its years in operation.

SorTech aggregates operate reliably starting at a drive temperature of 50 °C. The casing of the vacuum module consists of a thin stainless steel material, which follows the "sandwich principle or coffee packaging rule" by directing the driving force – the atmospheric pressure – onto the inner construct of the module.



## More Innovation.

## More Options with Zeolite.

In order to broaden the range of applications even further and to serve other markets, in particular climate zones with higher temperatures, our engineers have developed the new zeolite technology (PST-Process – partial support transformation). With this revolutionary coating process, zeolite – like silica gel, an environmentally friendly, non-toxic substance – can be crystalized directly onto the surface of a conventional (gill type) heat exchanger, a foam or sponge molding and it will even attach to fibrous material.

Compared to conventionally coated adsorbers, this SorTech innovation achieves a particularly high power density thanks to its exceptional water capacities and optimized heat transfer conditions. Furthermore, the crystalized zeolite coating manifests itself as a robust compound to the substrate and provides excellent corrosion protection. The fact that this coating process forgoes the use of any binding or adhesive layers is one of the secrets behind the system's optimized heat transfer.

Finally, thanks to this innovative material makeup, the size of the integrated heat exchanger can be significantly reduced – while still generating the same output. Weight, volume and costs are being reduced in unison.



## First-Class Refrigeration.

## Adsorption Chiller Aggregates Made and Engineered in Germany.

#### » Simple Design for Cost Effective Operation

Compared to competitive equipment, SorTech's chiller aggregates operate at a significantly better cost-efficiency ratio and with lower maintenance requirements.

#### » Reliable Dimensioning due to Simple Assembly and Flexible Operation

The compact tower construction is especially space saving, because the aggregates can be mounted without any spacing between them. Alternatively, they can even be stacked on top of each other.

#### » Variable Control Technology Ensures Maximal Energy Efficiency

The control technology and the interface configuration allow for simple data transfer as well as smooth system integration.

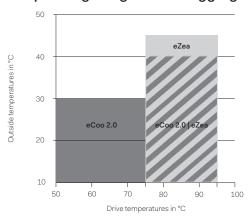
#### Interconnection – Chiller System Clusters

Interconnecting several adsorption chiller aggregates will result in a higher cooling capacity of up to 240 kW or a greater heating output of up to 800 kW, respectively.

#### Operation as Heat Pump to support Heating Activities

SorTech chiller systems can also be operated as a heat pump to benefit your heating requirements. Deployment of the system increases the effectiveness of conventional heating systems by a substantial 50 %, resulting in significant cost savings.

#### Operating Ranges of the Aggregates



	eCoo	eZea
Working medium	Silica Gel	Zeolite
Refrigerant	Water	Water
Application range	North and Middle Europe	South and Middle Europe
Drive temperature	50 - 95 °C	75 – 95 °C
Outside temperature	22 – 40 °C	22 – 45 °C
Cold water temperature	8 – 21 °C	8 – 21 °C
Max. Capacity (in power mode)	12 (16) kW	11 (13) kW
Max. cooling capacity in cluster	240 kW	200 kW
Installation surface	0,5 m²	0,38 m²
Operational Weight	357,0 kg	234,5 kg

### Better Performance.

## Synchronized Components.

#### Recooler - Heat Dissipation

The energy efficient SorTech recoolers provide the necessary recooling of the supplied heat energy thus being the perfect counterpart to the chillers.

## Reciprocator Chiller – Peak Load Coverage

In order to guarantee an efficient load factor to cover cooling needs throughout the year, one can opt for integrating a reciprocator chiller into the system cluster. By doing so, the required refrigeration capacity will be made available 100 percent of the time, even at high summer temperatures of up to 45 °C.

## System Separation – Water/Water-Glycol-Mix

To fully meet individual customer needs, SorTech offers the option of system separation. This enables a complete separation of the inner and outer recooling circuit by utilizing prefabricated components. As a result a proper operation of the recooler circuit is guaranteed in regions with temperatures under 0 °C. The compact groups are made of premium components that are functionally synchronized to each other.

#### Optional Accessories Interphase Adapter VBus®LAN

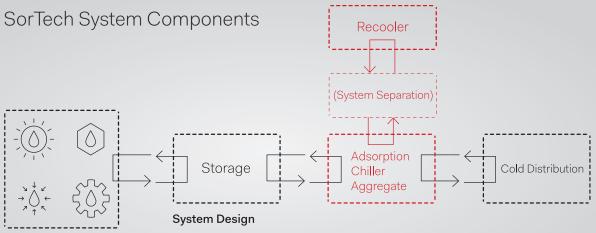
The network connection for the refrigeration aggregate. Network-wide direct access to aggregate data. Remote parameterization of equipment via VBus®. Data entry via RSC software with a PC.

#### **VBus®Touch**

(mobile app) optional in connection with VBus®LAN. Detailed temperature data on call. Display of values. System overview.

#### Datalogger

Data gathering / parameterization of up to 6 chiller aggregates. BACnet-functionality for BACnet-conform data transfer and reception. Selection of data via integrated web interface.



SorTech provides the core of an intelligent, energy efficient and comprehensive refrigeration system.



## **Adsorption Chiller Technology +**

The energy saving cooling and heating solutions from Sor-Tech can be combined with heat and power sources easily and effectively.





Almost any business requires heating of some sort. In addition, manufacturing processes commonly lead to excess process heat. By deploying adsorption technology, both heat sources can be used efficiently for air-conditioning or to cool additional process steps.

This improves the environmental and energy balance significantly and enhances the attainability of sustainability goals. The recovery of heated air in buildings can translate into heating cost savings of 20 to 30 %.



When combined with a CHP unit the adsorption chiller system can be utilized for customized power-heating-cooling cogeneration. Intelligent control technology assists in optimizing the combined system and in flexibly regulating the ratios of heat and power generation. This extends the lifecycle of a CHP unit significantly.

The economic efficiency will be increased and the energy policy concept of decentralized energy supply will be supported, because simultaneously an energy generating cooling system has been created.

Besides its high supply efficiency and the savings in energy costs resulting from grid power redundancy, not least the systems combination also offers highest grid reliability in case of an electric power outage.



There is more to solar thermal units than hot water generation and heating purposes. When combined with adsorption chiller systems the excess heat energy serves as a source to generate environmentally friendly and efficient cold for the solar cooling of buildings and processes. The pay-off is especially attractive during the summer, when the demand for air-conditioning is high and the sun generates heat in abundance.

Thanks to adsorption refrigeration technology the components of a solar unit (storage and collectors) can now be better utilized and protected from overheating and overload. In turn, this extends the lifespan of the system and increases its economic efficiency. Another benefit of adsorption chiller technology is the very low supply temperature a solar system would have to deliver to sustain the cooling process and to maximize the usage of the solar heat.

Last but not least: this intelligent technology can function as a heat pump during the winter heating period. With this alternative option even low solar collector temperatures can generate additional usable thermal heat.



To supply heating and warm water by utilizing an insulated piping system is especially problematic during the summer, when a mostly low load factor translates into poor grid productivity. Nonetheless, by combining district heating with adsorption chiller technology for cooling purposes, this effect can be countered and the district-heating provider will also be able to optimize its grid.

For businesses this strategy even results in a double pay-off. For one, the subsequent extension of the CHP technology's operational life ensures a higher electric power production and sale – in some cases at rather attractive terms. At the same time, the deployment of adsorption refrigeration technology also makes a contribution in support of the worldwide climate protection targets, since one can forego the use of electricity and synthetic cooling agents for air-conditioning purposes.



# Adsorption Chiller Systems Made by SorTech.

Deployed Successfully Worldwide.

SorTech adsorption chiller aggregates are versatile. They are ideally suited for cooling office space, commercial property and for use in industrial applications. In many cases their deployment leads to new dimensions in the achievement of energy efficiency.



The Fraunhofer Institute for Solar Energy Systems ISE advocates a sustainable, economical, secure and socially just energy supply system. With energy generation, efficiency, supply and storage as its research focus, ISE employees in these sectors number about 1.300. ISE's applied research results in the creation of technical prerequisites for an efficient and environmentally friendly energy supply for industry applications.

The adsorption refrigeration system has been running since 2005 as a pilot project. As such it has been cooling the cafeteria in

the summer while heating its air supply during the winter. Very low maintenance expenditures and a long lasting operational life stand to confirm the quality and potential of the adsorption aggregate.

Power Source	Solar Thermal (Backup CHP)
Drive Temperature	70 – 80 °C (Backup 65 °C)
Refrigeration Capacity	6 – 8 kW
Cooling Temperature	11 °C
Recooling	Geothermal
Initial Start-up	2005
Annual Operating Time	Up to 2300 hrs.



#### LEIBNIZ DATA CENTER OF THE BAVARIAN ACADEMY OF SCIENCES AND HUMANITIES (LRZ)

Power Source	Process Heat
Drive Temperature	55 – 65 °C
Refrigeration Capacity	4.5 kW
Cooling Temperature	18 – 20 °C
Recooling	Dry Recooler
Initial Start-up	2012
Annual Operating Time	8700 hrs.

#### **OEDING PRINT**

Power Source	CHP
Drive Temperature	65 – 80 °C
Refrigeration Capacity	20 kW
Cooling Temperature	10 °C
Recooling	SorTech Recooler
Initial Start-up	2014
Annual Operating Time	8760 hrs.

#### ZENTRUM ZUKUNFT

Power Source	CHP
Drive Temperature	75 °C
Refrigeration Capacity	12 kW
Cooling Temperature	15 °C
Recooling	SorTech Recooler
Initial Start-up	2011
Annual Operating Time	5500 hrs.

## Together into the Future.

## Your Benefits at a Glance.

#### Reduction of Energy Costs

In the true sense of a sustainable optimization of a company's own energy efficiency concept.

#### » Scalability and Longevity

At a nominal refrigeration capacity of up to 240 kW the adsorption chiller aggregates adjust to the respective cooling requirements. In addition, compared to compressor chiller aggregates they achieve a significantly longer operational life span.

#### Cost Certainty

We guarantee you lasting low energy costs – even amidst a rise of the general price for electricity.

#### High Overall Efficiency and Environmental Care

By deploying our chiller aggregates, the utilization of existing heat as well as the resulting savings in electricity costs and the reductions of Co<sub>2</sub>, will empower you to achieve a very high overall efficiency. Furthermore, almost any waste heat process will now actively contribute to the protection of the environment.

#### Flexible Applications

Power sources like solar thermal, process heat, district heat or combined heat and power plants can be integrated into the cooling concept, so both system components amortize even faster.

Since the formation of SorTech in 2002, research and development has played a central role in this adsorption refrigeration pioneer's business activities. Based on our own ideas in conjunction with the requirements posed by our customers, we develop and manufacture innovative, energy efficient and patented solutions to generate and store cold and heat – everyplace where cold is needed and waste heat is available. To remain competitive in the long term, we have secured over 20 patents for thermal cooling and solutions on the basis of solid sorbents, both nationally and internationally.



#### Continuous Innovation Backed-up by Solid Capital Investment.

The support by financially sound and innovation-oriented shareholders ensures SorTech's leadership position in technology and innovation.





#### » Rapid Amortization

The investment in modern cooling technology saves on costs from the very start, because compared with electrically powered systems the energy consumption can be lowered by up to 75 %.

#### Future-proof Investment

The efficient and environmentally friendly technology shields your capital against the unpredictability of legislation. It is highly unlikely for water as a cooling agent or the use of waste heat to become targets of criticism in the future.











# PIONEER IN ADSORPTION CHILLER TECHNOLOGY: SORTECH.

SorTech AG, headquartered in Halle an der Saale (Germany), is the leading developer of adsorption methods and solutions on the basis of solid sorbents like silica gel and zeolite. In addition, we are a manufacturer of adsorption chiller aggregates and assemblies for heating and cooling purposes, which will be integrated or processed into a complete system through our partner companies.

Customers profit from our comprehensive service portfolio and our profound expertise in the realm of thermal cooling. A dynamic and open corporate culture is instrumental in optimizing our customer focus as well as the economic development of SorTech AG.

Company formation	2002
Executive Board	Walter Mittelbach (CEO)
Employees	>25
Installed aggregates*	>500
Headquarters	Halle (Saale), Sachsen-Anhalt   Germany
Sales regions	entire European region, North America, South America, Asia Pacific, Middle East and North Africa



## SorTech-Partner.

## Proven Competency in Refrigeration.

For more than a decade SorTech technology has been proving its efficiency and adaptability to different demands all over the world. SorTech relies on a qualified, worldwide partner network for optimal dimensioning and integration of the adsorption chiller aggregates to fit any refrigeration application. When choosing SorTech partners our emphasis rests with their special skill and high quality workmanship. A proven track record of successfully putting our refrigeration systems into operation after careful dimensioning and installation is of equal importance.

Your business specializes in air-conditioning and you would like to become a SorTech Partner? Profit from the exchange within an international network of excellence with far reaching experiences!







# SorTech-Academy. Our Know-how is Your Success.

Our SorTech ACADEMY training seminars reach across industry sectors. You will come to learn anything there is to know about adsorption chiller technology: From the basics of refrigeration within the various areas of application, to the practical operational case studies.

Depending what your current requirements are as well as your prior knowledge, our experienced advisors will provide you with a clear and complete overview of the technology in a comfortable training atmosphere. Ultimately, you and your technicians will then be able to apply the acquired expert knowledge of this technology directly to your day-to-day scope of work. Let our practice-oriented training seminars serve as the basis of your success.



#### SorTech AG

Zscherbener Landstraße 17 06126 Halle (Saale) Germany

Fon: +49 (0) 345 27 98 09-0 Fax: +49 (0) 345 27 98 09-98

www.sortech.de

E-Mail: office@sortech.de

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