

TOPICS
IN THIS
ISSUE

2 | Intro

3 | Smart Standard

4 | envia Tel

New envia TEL data center with energy efficient air conditioning from STULZ

6 | Vtesse

Direct Free Cooling for London's IT

8 | Test Center

Field-based tests for optimum dimensioning

12 | Hotspot Cooling

Correcting hotspots in data centers/ Using AirBoosters

16 | The Company

Rapid decision-making and room for maneuver

18 | Data Center

Modular Data Centers

20 | Serviceportal

The Service Portal as the data center manager's digital assistant

22 | STULZ Academy

Product training and webinars

24 | Africa

Trends and options for data center air-conditioning in West, Central and East Africa

26 | Australia

10 Years STULZ Australia

28 | China

Efficient solutions in demand

30 | Hamburg's Best Employers

STULZ singled out

31 | CyberCool 2

100 megawatt cooling capacity

32 | Global Dates

32 | Legal Information, Contacts

STULZ

CLIMATE. CUSTOMIZED.

Nº 1

As a specialist in data center air conditioning, STULZ has been offering made-to-measure air conditioning solutions since 1971. From the very beginning, STULZ's philosophy has meant that we have never been satisfied simply with standard solutions. Even though these days an extensive range of international standards, compliance requirements and country-specific regulations have to be observed during the development of precision air conditioning systems, STULZ still pursues the goal of incorporating each customer's individual requirements in its work. For us, it doesn't matter whether an air conditioning system is a traditional closed-circuit air conditioning unit with raised floor, a row-based air conditioning solution, chillers or an air handling unit for outdoor installation.

The STULZ customer magazine

COOLING SOLUTION FOR EVERY SCALE





Dear customers, partners, and colleagues,

We're sure that you know about the many projects we've started to help you use STULZ solutions to stay ahead of the growing competition. On our way to becoming the one-stop-shop for energy-efficient temperature and humidity management technologies for critical operating environments, we have already revised our entire product portfolio and developed new solutions. Now, the time has come to communicate our new positioning to the outside world and present ourselves as the globally uniform company we are. We have set many changes in motion with our new corporate identity.

The first visible results are the new website that we'll roll out internationally, new advertising campaigns, and the claim CLIMATE. CUSTOMIZED. With this new claim, we intend to communicate that we develop and construct solutions with a high range of options that are highly adaptable and always align with our customers' requirements—and not vice versa. CLIMATE. CUSTOMIZED. is also the name of our new magazine, which will regularly bring you news on important issues all around cooling.

STULZ is among the worldwide leaders in the field of air conditioning for mission-critical applications—a fact from which you as a STULZ customer or STULZ partner benefit. Though we're a global player, we will always hold true to our values as a family business. You can count on that.

I hope you enjoy reading our magazine and welcome any comments and ideas you might have.

Warm regards,
Christoph Stulz

Smart Standard

Data center and cooling system standards

When planning an air conditioning solution, the specialist engineers at STULZ always encourage customers to use the "2011 ASHRAE Thermal Guidelines for Data Processing Environments" for guidance. These guidelines should not be regarded as a universal solution to all types of data center cooling, however. Rather, the recommendations are based on precisely defined classes and ambient conditions. So, every data center operator must determine exactly to which class a data center or a particular data center segment belongs. Only then is it possible to plan a reliable air conditioning system for individual zones that suits the data center's needs.

Moreover, the global rise of energy prices and stringent compliance and availability requirements mean that today, air conditioning solutions can no longer be designed on the "one size fits all" principle. Instead, every data center must be regarded as an individual project. Here, parameters such as location, redundancy levels, hardware specifications and expected growth rates must be weighed up as accu-

rately as possible, so that efficient and reliable cooling can also be guaranteed during future operation.

The unstoppable rise of individualization

These days, customers can choose from a wide selection of different cooling systems, performance variables and manufacturers. Indeed, data center operators can find themselves confronted by an overwhelming array of potential solutions, all of which must be evaluated. For in the field of air conditioning, in particular, there is a high risk of choosing a solution that may well be sufficient for the data center's planned usage profile, but turns out to no longer be a 100 % match over time. The downside is not just unnecessarily high energy costs, but also a lack of flexibility during future expansion, or even shortcomings in operational reliability. To prevent problems like this, air conditioning solutions that come into question should be subjected to intense analysis in collaboration with the in-house IT department, consultants, manufacturers and specialist air conditioning firms far in advance of the actual project phase, to determine each type's individual

strengths and weaknesses. Then, in this open dialog, it will quickly become clear which manufacturer brings the necessary experience in data center air conditioning, and offers an appropriately broad product range to satisfy even the most individualized requirements. And you also have to bear in mind that some requirements will only arise during a data center's normal life cycle.

Climate. Customized. Our smart standard

Even if the interiors of data centers and server rooms all over the world are scarcely distinguishable from one another, the requirements for data center air conditioning are becoming increasingly individualized. Many operators face technical and planning challenges when expanding their data center, as they have to take account of numerous parameters such as local climate, spatial and room considerations, environmental and noise protection, not to mention safety requirements. For all this, STULZ offers individual, modular system solutions, which can be adapted to suit virtually every project requirement and expansion phase. From the STULZ CyberAir 3 product line alone, customers

can choose between 8 different cooling systems, 7 sizes, with upflow or downflow and optional Free Cooling. In addition, the solutions from STULZ boast a diverse range of options in terms of mechanical parts, cooling technique, heating, condensers, humidifiers, electrics and refrigerant. This wealth of individualization options enables each project to achieve the optimum balance between capital investment, operating costs and energy efficiency.

Safety first

Today, Free Cooling systems are a fundamental component of any energy efficient data center air conditioning system. Free Cooling, in particular, offers many possibilities for designing air conditioning systems precisely for a data center's requirements, by installing the appropriate Free Cooling modules. First, a choice has to be made between Indirect and Direct Free Cooling. Indirect Free Cooling is a closed system, so that no outside air gets into the data center. Direct Free Cooling, on the other hand, consists of an open system in which filtered outside air is conveyed directly into the data center and flows through the server racks. It is immediately clear

that Direct Free Cooling is not suitable for every data center. Experience has shown that Direct Free Cooling is not always desirable, even in temperate climates. Factors that are difficult to calculate, such as smog, dust or dense smoke in the vicinity of the data center, can clog filter systems within minutes and ultimately cause the Free Cooling to shut down. If the mechanical cooling system is then unable to provide suitable power reserves, this can rapidly lead to load shedding, or even unwanted downtime. For this reason, STULZ air conditioning systems with Free Cooling are always equipped with appropriate power reserves in the form of mechanical cooling units. They are capable of generating the full amount of required cooling, even if the Free Cooling currently has no cooling capacity at all.

Variety of options for your optimum air conditioning solution

The STULZ product range includes traditional room cooling, high-density cooling, chillers, container modules and air handling units with adiabatic cooling. All systems are available with Indirect Free Cooling. STULZ offers Direct Free Cooling for CRAC

systems, air handling units and modular data centers. Together with its various sizes, extensive additional options and modularity, STULZ therefore boasts a product range that is unique in the world and can make optimum air conditioning a reality for practically every data center project.

Efficient chilled water generation for envia TEL

New envia TEL data center with energy efficient air conditioning from STULZ

The new high-performance data center of telecommunications provider envia TEL in Taucha near Leipzig was officially opened on May 21, 2014. Over an area of approximately 1,000 square meters, it provides space for around 300 server cabinets belonging to companies, public institutions and local government units. Two STULZ CyberCool 2 chillers operated in parallel, with Free Cooling coils and flexible Mixed mode, ensure reliable and especially efficient air conditioning.



The customer

envia TEL GmbH belongs to the enviaM Group and is Central Germany's leading regional telecom service provider and network operator. From its base in Markkleeberg and with a workforce of around 120, the company supplies information and telecommunications services to over 5,000 business customers. With its state-of-the-art fiberglass infrastructure that extends to nearly 2900 miles (4,600 km), envia TEL covers roughly ten percent of Germany and is connected to all the major interregional and international network operators via over 600 network connection points. As well as the new data center in Taucha near Leipzig, the company has further sites in Chemnitz, Kolkwitz and Plauen.

The project

By carefully coordinating all the work involved, STULZ and envia TEL have managed to complete the installation of the precision air conditioning system in the new data center in Leipzig in just four months, despite wintry conditions. It was a prerequisite to find a suitable air conditioning concept capable of overcoming the challenges inherent in connection with the building and integration in the building services management system. Preserving the leakproof nature of the building, in particular, was vital in order to ensure correct functioning of the integrated oxygen reduction system for fire prevention. And of course, envia TEL's technical requirements and demands in terms of performance played a significant role in the planning and implementation of the air condi-

tioning system. Outstanding energy efficiency was a primary objective. Furthermore, the solution had to demonstrate important characteristics such as high availability through redundancy, modular flexibility for differing performance requirements, and scalability for the planned second expansion stage.

Implementation

To satisfy these requirements, for the construction of the Leipzig data center, STULZ and envia TEL decided to employ two STULZ CyberCool 2 chillers each with a nominal capacity of 800 kW. These highly efficient systems with Free Cooling coils have been optimized especially for the air conditioning of server environments. Both chillers supply a joint refrigeration pipe, and this redundancy ensures high availability of the air conditioning. At the same time, parallel operation permits energy-saving low load operation, with all connected components running at reduced speeds. The pipeline system in the data center was designed as a circumferential loop with supply and return distributor rings. This way, sections of the pipeline can be shut off or extended at any time, without interrupting ongoing operation. Further connections are already in place for additional air conditioning cabinets and chillers, preventing leakage from the building during future building work. In addition, thanks to its state-of-the-art open and closed-loop control technology, the air conditioning system could be fully integrated in the building services management system.

Free Cooling and load control

A speed-controlled screw compressor and a Free Cooling coil both produce chilled water for the two CyberCool 2 systems. As long as the outside temperature does not exceed 5 °C, cooling takes place using solely the energy-saving Free Cooling function. At higher temperatures, the compressor is activated in increasing stages. Thanks to this flexible mixture of Free and compressor cooling, energy-intensive compressor running times can be greatly minimized. Load-controlled screw compressors, pumps and EC fans in the condensers and air conditioning cabinets also help to reduce electricity consumption.

Intelligent control

Due to its compatibility with all common BMS protocols and through the use of individualized software specific to this project, the intelligent control system of the STULZ CyberCool 2 systems ensures easy integration in the building automation system. Moreover, it coordinates the parallel operation of the two chillers, and by regulating the speeds of all the components used—such as pumps

and EC fans—it enables especially energy-saving operation. This way, in coordination with an encapsulated compressor chamber and with the aid of specially developed fan diffuser attachments on the refrigeration condensers, the control system reduces the running noise produced by the air conditioning solution as a whole.

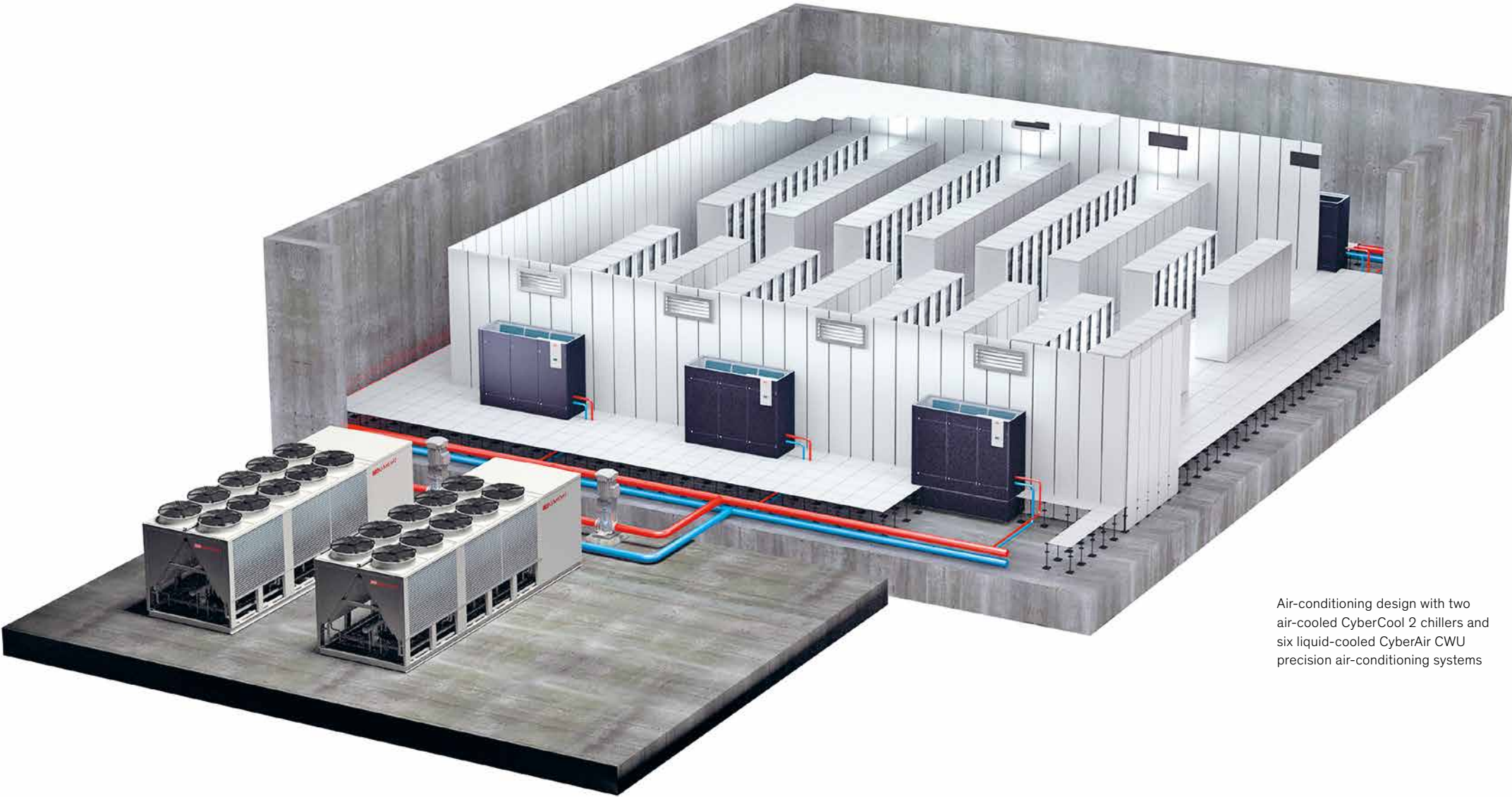
The result

Thanks to Free Cooling and flexible Mixed mode, the CyberCool 2 chillers in use here make a major contribution to the exceptionally efficient operation of the new envia TEL data center in Taucha near Leipzig. The expert planning and implementation of the air conditioning concept have already resolved the challenges of the future. The integration of the pipelines in the building, while preserving the integrity of the fire safety system and the con-



Photos from: rewa Planungsgesellschaft mbH

nection of redundant precision air conditioning units to the building services management system, guarantee maximum safety. In addition, existing, ready prepared connections for future air conditioning components ensure scalability and ideal flexibility for reacting to changing performance requirements. Simultaneously, these measures ready the data center for the planned second stage of expansion.



Air-conditioning design with two air-cooled CyberCool 2 chillers and six liquid-cooled CyberAir CWU precision air-conditioning systems

Direct Free Cooling for London's IT



Photos from: R.Nagy/Shutterstock.com

Lowering the Carbon Footprint and achieving a PUE of <1.4: STULZ Direct Free Cooling technology enhances Vtesse Data Center efficiency

The customer

Vtesse Cirrus Services Limited, founded in 2009, is a modern service company with the vision to provide a new type of commercial data center solutions. As a sister company of Vtesse Networks Limited, Vtesse Cirrus is located in Hoddesdon, just about 34 km North of the City of London. Meeting the requirements of the Tier III+ standard, the Vtesse Cirrus Data Center embodies an energy efficient, reliable and secure co-location facility on 30,000 ft². Due to the usage of top quality brands for support equipment and high standard fire detection the customer consistently experiences high levels of service availability.

The problem

The second highest operating cost of running a data center typically is the cost of air conditioning, right next to the IT servers themselves. This emphasizes the importance of installing an energy efficient cooling system—both, for competitiveness in a highly competitive market and for the environment. The goal of Vtesse Cirrus is to keep its carbon footprint as low as possible and enhance the corporate responsibility to the environment by setting a PUE (Power Usage Effectiveness) target of less than 1.4. PUE is the ratio of the total energy used by a data center facility to the energy delivered to the IT-equipment.

Requirements for a solution

Vtesse Cirrus decided a direct outside air Free Cooling system would be the technology that satisfies the needs for the data center the best. The decision was made after a comparison of the additional capital expenditure with the lower operating cost of the various technologies. In addition to that, a cooling system has to be tailored to fit the existing building. Vtesse Cirrus decided that a Free Cooling

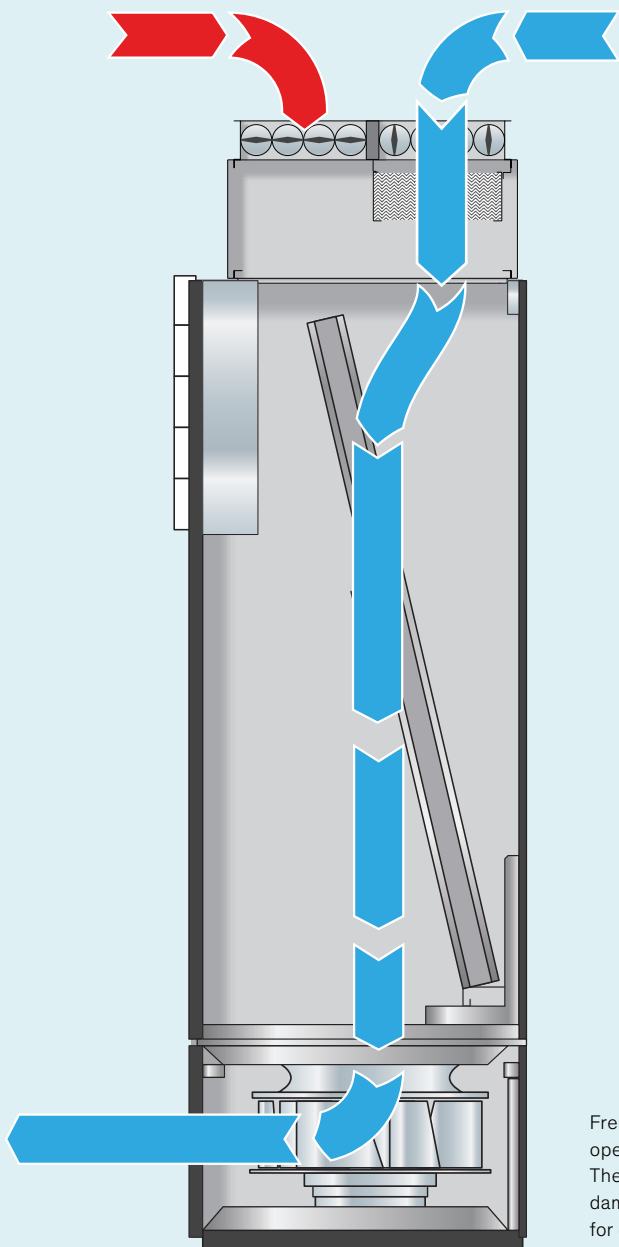
system proposed by STULZ would satisfy the cooling requirement and reduce the operating cost. The greatest challenge was to design a ductwork system, in the existing building, that was capable of handling the vast quantities of outside air and corresponding exhaust air. The requirements are met by the STULZ CyberAir 3 down-flow direct expansion (DX) computer room air conditioning with FreeCool Plenum (FCP). The CyberAir 3 in combination with the FCP automatically controls the proportions of outside air (depending on the temperature outside) to keep the inside temperature at recommended 27 °C. This allows the system to operate without the energy requiring DX compressor most of the year, saving up to 80 % of the energy consumption required for cooling the data center. For the remaining time, the compressors often work at part load since the demand for compressors generally is low due to the usage of Free Cooling outside air. The FCP has ductwork connections to outside air, supplying air with a constant temperature from beneath the servers and returning it from the ceiling void. The ductwork system is implemented in the service corridors between customer suites.

The benefits

The STULZ Free Cooling system is a major contributor to meet Vtesse Cirrus' target of achieving a PUE of less than 1.4. The low energy cooling system reduced the costs for energy, thereby reducing rates for hosting services and enhancing the company's competitiveness. Furthermore, the environment benefits through the smaller carbon footprint. This "green thought" becomes more and more important and clients can be assured that they are co-locating in an energy efficient data center.



STULZ FreeCool Plenum



Free Cooling mode, method of operation:
The FreeCool Plenum features a damper for outside air and a damper for circulating air.

Precision air conditioning put to the test



STULZ climatic test chamber

Field-based tests for optimum dimensioning

With a typical useful life of 10 to 15 years, cost considerations play a not insignificant role in the planning of precision air conditioning solutions. The continual rise in energy costs for many years now, in particular, presents data center operators with a major challenge. This makes knowing the actual energy efficiency and performance capabilities of equipment under temperature and air humidity conditions typical in the field all the more important. Increasingly therefore, manufacturers are offering their customers individual performance tests in modern test centers. The data obtained in this process gives operators greater planning security and also helps them to achieve an energy optimized configuration.

Today, air conditioning solutions for data centers must be planned and implemented meticulously and with a firm eye on the desired objectives. For large-scale projects, in particular, it is not just the investment cost of cooling solutions that have to be consid-

ered over the medium to long term. In this age of rising energy prices, running costs are becoming a matter of priority. Specialist planners and operators also face the question of how to achieve energy savings by dimensioning their systems appropriately. The latest version of the German Energy Saving Ordinance (EnEV) is one factor that is putting on the pressure. Even now, operators of air conditioning solutions are legally obliged by the EnEV to subject all systems over 12 kW to an energy inspection on initial installation, on the replacement of important components, or every ten years. Moreover, as the German government aspires to a carbon neutral building stock by 2050, the stipulations governing energy savings will become increasingly stringent in the years to come. Thus, the challenge facing specialist planners and operators is to find high-performance, efficient and therefore future-proof dimensioning for their systems.

Specific customer requirements due to regional conditions

Although manufacturers of air conditioning units ascertain the technical specifications of their equipment in accordance with DIN EN 14511, using the "test to determine total cooling output", in practice there are frequently not inconsiderable differences in cooling capacity. This is due, above all, to different environmental influences, which cannot be taken into consideration in the standard performance test. Data centers in various locations around the world have extremely varying requirements for their air conditioning units. Therefore, a system's performance is determined not just by the quality of the individual components, but also by its location. Ambient conditions such as the temperature and humidity of the return air at the unit intake or of the supply air at the unit outlet have a significant influence on the performance of the system as a whole. In practice, changes to the equipment's temperature and air humidity window may have a negative influence on its actual cooling capacity and efficiency. This affects the operating points of vital components such as pumps, fans and compressors. So, if specialist planners and operators

rely on the theoretical data provided by manufacturers, they run an increased risk of reduced capacity for cooling their data centers during future operation. The result can be incalculable additional expense as electricity costs spiral out of control and upgrades or conversions become necessary. As well as jeopardizing cost efficiency, badly planned precision air conditioning can also be detrimental to the future-proofness of a data center.

Performance tests on the rise

European countries outside Germany, in particular, have recognized early on the problem of standardized air conditioning systems that do not perform as well in the field. Instead, manufacturers in many countries now offer their customers simulations and performance tests under realistic operating conditions. In this way, specialist planners and operators gain essential data on actual performance and efficiency ratings in advance, during the planning stages of large air conditioning systems. In Britain, due to strict rules governing the accuracy of the stated performance data, tests of this kind are now standard procedure among manufacturers. In Germany, too, users are increasingly

demanding field-based information on cooling capacity and energy efficiency, so that they can remain economically competitive. For this reason, German manufacturers—such as Hamburg-based precision air conditioning specialist STULZ—now also offer individualized customer tests.

Performance tests under real conditions

STULZ originally designed its Test Center for the internal testing of prototypes in the design and development phase. Today, the company also makes its test facility available to specialist data center planners and operators. With an area of around 700 square meters, it is one of Europe's most state-of-the-art test facilities for air conditioning equipment. With the aid of four conditioning systems, air flow rates from 500 m³/h to max. 55,000 m³/h can be achieved. They supply two separate climatic chambers, in which air conditioning systems can be put through technical tests, either individually or connected via both chambers (Fig. 1). Here, different operating parameters, such as environmental influences (–20 °C to +55 °C) and return air conditions, can be set precisely to match customers' requirements, thereby simulating realistic operating

conditions. Engineers in the control room record and document the test data in real time, and analyze it if necessary. The extensive documentation from these tests can subsequently be used by specialist planners and operators as verification of cooling capacity, efficiency and sound power. It is therefore an important aid to decision-making during the planning of precision air conditioning solutions.

Standardized test procedures in tailor-made test scenarios

The Test Center conducts technical tests in accordance with DIN EN 14511 (performance of air conditioners, liquid chilling packages and heat pumps), EN 1216 (heat exchangers—forced circulation air-cooling and air-heating coils), and ISO 9614 (sound power levels). The performance tests of air conditioning units are carried out using standardized procedures. Using the air enthalpy method, system performance is ascertained by measuring the air flow rate and the associated intake and outlet conditions of the air. The calorimetric method, on the other hand, is particularly suitable for simulating partial load conditions during full load tests. Here, three important scenarios are used: firstly, conditioning mode;

secondly, the simulation of data center cooling with supplementary cold or hot aisle enclosure; thirdly, environmental simulation mode to present the effect of specific outside air conditions by connecting two climatic chambers. As all scenarios permit the variable setting of heat and air volumes, air humidity and return air temperature, the customer's specific local requirements can be simulated with great precision.

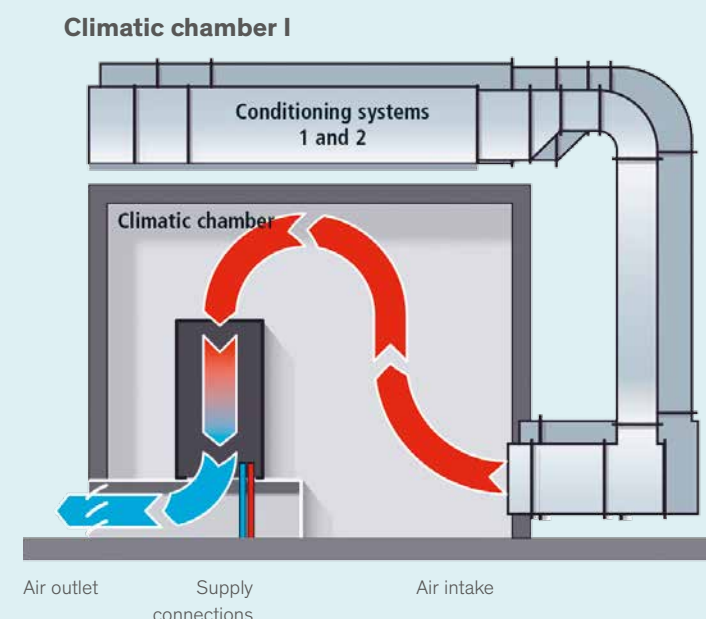


Fig. 1: Over an area of around 700 square meters, STULZ operates one of Europe's most state-of-the-art test facilities for air conditioning technology. The plant boasts two separate climatic chambers and four conditioning systems.

Test Center scenarios 1–3

Scenario 1: Conditioning mode

Fig. 2: In conditioning mode, the climatic chamber simulates a conventional raised floor closed-circuit air conditioning system with variable heat load and defined unit intake conditions.

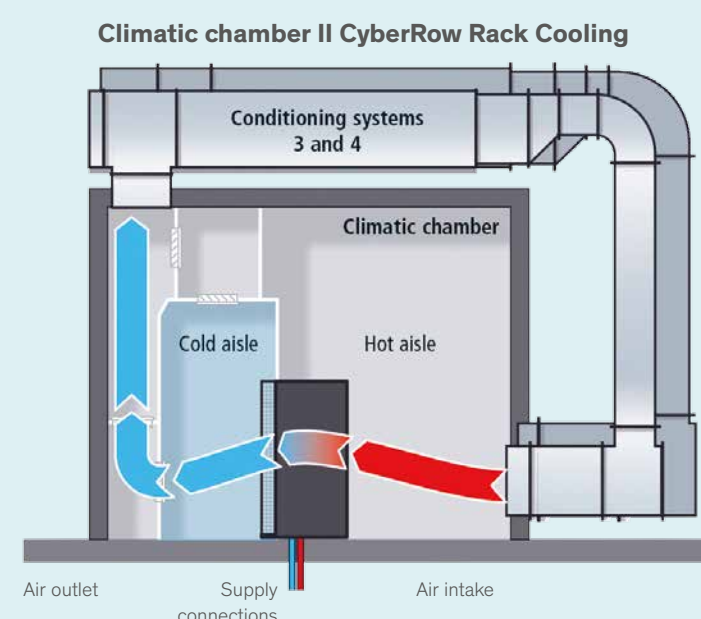


Conditioning mode is a common standard test. Here, the test scenario simulates conventional closed-circuit air conditioning, with or without raised floor. The almost unlimited choice of operating conditions enables the performance and energy efficiency of the test object to be measured.

For a great variety of applications (Fig. 2). The test records and documents all the important performance data and measured values of the air conditioning system, which can be read and analyzed by control stand personnel or by the customer at any time.

Scenario 2: Simulation of a side cooler system with cold aisle enclosure

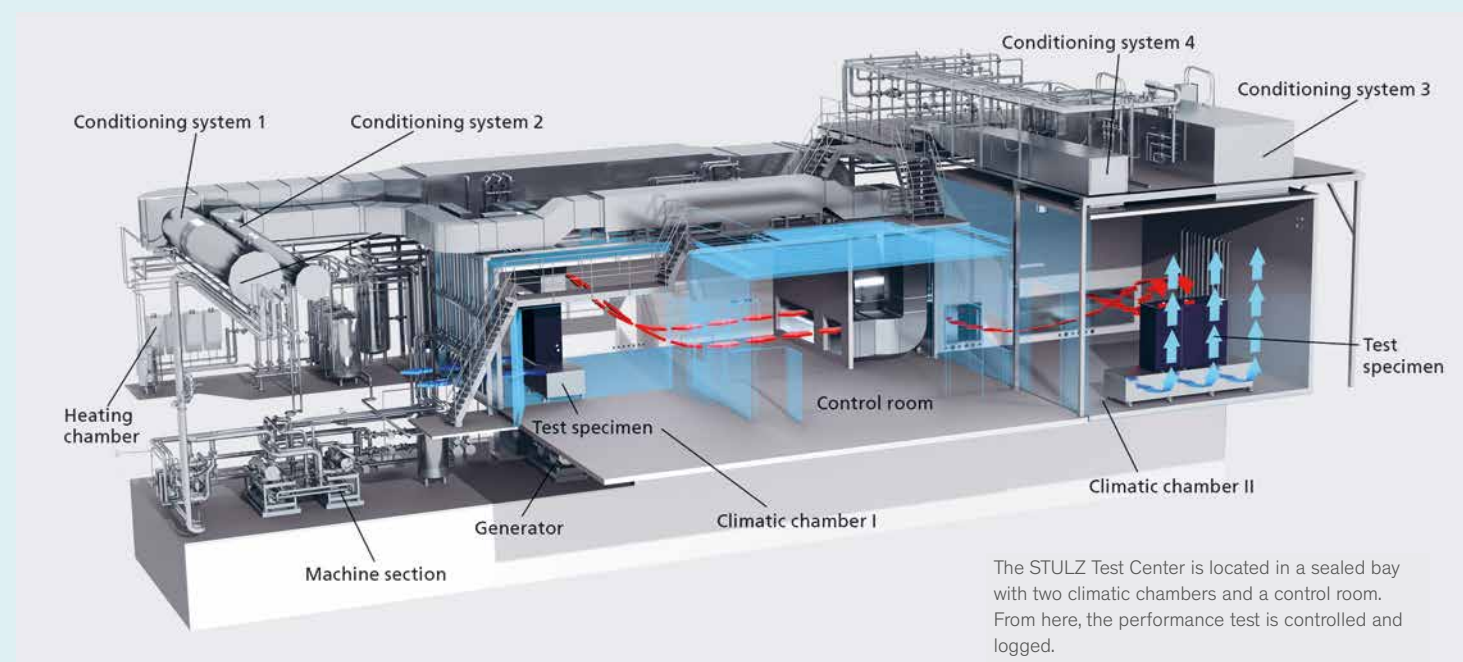
Fig. 3: Side coolers are especially suitable for small and medium-sized data centers. The meticulous separation of hot and cold air using a cold aisle enclosure enables significant energy savings.



The second test scenario simulates the side cooler method with cold aisle enclosure commonly used today in small and medium-sized data centers. By separating the cold supply air and hot server air with partition walls, this method effectively prevents chaotic air conduction. Therefore, air flows at different temperatures cannot mix, meaning that the required cooling capacity and consequently the energy consumption are considerably reduced. A further benefit of separation

is that the return air temperature can be controlled such that the air conditioning units can be kept at an ideal operating temperature from an energy efficiency perspective. These days ASHRAE, the de facto standard in data centers, recommends a server inlet temperature of up to 27 °C, for example. As a compromise, this temperature enables the especially efficient operation of cooling system components such as compressors, while simultaneously protecting the sensitive IT equipment.

Scenario 3: Testing entire air conditioning systems with indoor and outdoor units



The STULZ Test Center is located in a sealed bay with two climatic chambers and a control room. From here, the performance test is controlled and logged.

Thanks to its two separate climatic chambers, the Test Center also enables entire cooling systems to be tested in combination, along with their indoor and outdoor units. For this purpose, chambers

one and two can be connected. In the first climatic chamber, conditioning systems generate the desired heat load, which equates to the data center's expected IT load. The indoor unit under test then cools this

air down. It is worth noting that the indoor units can take the form of either compressors (DX) or liquid-cooled systems (CW). The second climatic chamber, on the other hand, simulates the country's

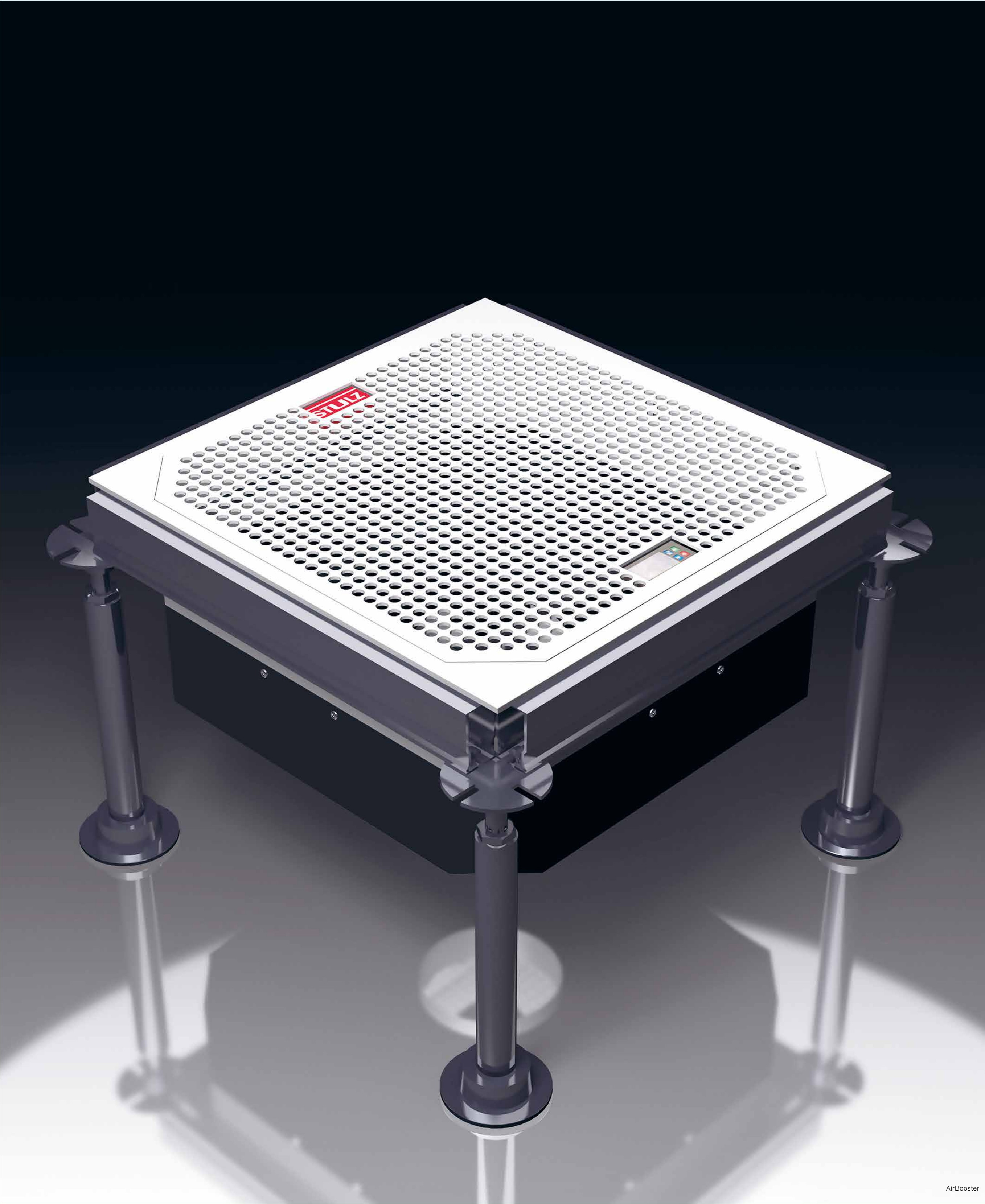
specific environmental conditions, in order to reflect heat removal via air-cooled condensers, air-cooled heat exchangers or chillers.



STULZ climatic test chamber

Test centers guarantee peace of mind for planning and design calculations

By providing test facilities, manufacturers such as STULZ are ensuring greater transparency as regards the performance data of their systems. The field-based performance and efficiency ratings ascertained in the test center give specialist planners and users the necessary peace of mind for their planning and design calculations ahead of large-scale projects. The individual test scenarios enable precisely the right dimensioning of air conditioning systems in data centers, under consideration of local environmental influences. In this way, users have full cost control as regards investment sums and expected future running and energy costs. The use of test centers offers a further advantage, however. The extensive accompanying documentation, such as calibration certificates, for example, can be used not just to verify the performance of air conditioning systems, but also as a basis for configuring the data center cooling. In conclusion, it is worthwhile for all customers of air conditioning solutions to take up services of this kind offered by manufacturers.



AirBooster

Correcting hotspots in data centers/Using AirBoosters

Once a data center starts operating the first round of hardware modifications often follow on swiftly, which among other things deals with implications for server rack cooling. This article concerns the relationships between air supply, temperatures and correction of hotspots.

Hotspot Cooling

What are hotspots?

Servers in data centers are mainly cooled using the closed-circuit cooling principle. This involves cooling down the air heated by the servers with what are known as computer room air-conditioning (CRAC) units.

The air heated by the servers is returned from the server rack to the CRAC unit, cooled to the server inlet temperature and then blown into a raised floor. The cooled air reaches the servers through perforated raised floor grilles in front of the server racks. The server fans suck in the air and blow it back out as hot air at the back of the rack. And the cycle starts over.

The thermal load that can be routed away from a server rack depends on the air flow supplied and the temperature difference between the server inlet and outlet. In the rest of the article we will refer to this temperature difference as delta T.

The permitted delta T is set by the data center operator or server manufacturer. The air

flow required for cooling is specified based on the anticipated thermal load. The relationship here is as follows: the smaller the permitted temperature difference, the larger the required air flow.

The table below shows some approximate values for routing away a thermal load of 1 kW using closed-circuit cooling:

DeltaT	Required air flow
10 K	~ 300 m³/h
15 K	~ 200 m³/h
20 K	~ 150 m³/h

The air flow available at the server rack is determined by the degree of perforation of the raised floor grille in use and the underfloor pressure. The servers suck in the air at inlet temperature, heat it by delta T and blow it out at the back of the rack.

To keep the delta T within the set limits there must be an adequate flow of air to the racks. If the air sucked in by

the server fans exceeds the cooled air supplied to the racks through the raised floor, the servers will draw in warm ambient air. This results in local hotspots which can lead to server superheating and in the worst case scenario, failure.

What causes a lack of air supply to racks?

A change in utilization
Generally speaking, for cost reasons, air conditioning is not planned based on maximum requirements. Instead, it is the application type running on the server which is taken into account in the cooling calculations. But in the era of server virtualization and cloud technologies, changing utilization is precisely the requirement that has to be addressed. For instance, a server being used for data storage in an archive needs less energy than when it is being used to run an online application and is continuously being queried, therefore transmitting large volumes of data. When the application changes, the thermal load changes with it.

Modifications to the raised floor
Cable bundles or piping which are retrofitted in a raised floor result in additional pressure drops, which in turn means that less air reaches the server.

Changeover to high density racks
A data center rack server with a low thermal load is replaced by a high density server with a significantly higher one. The existing air supply cannot keep pace with the new server and the rack is no longer supplied with enough air.

What's the solution?
Supposing that air conditioner cooling capacity is generally sufficient to cool the thermal load in the room, increasing the pressure in the raised floor by upgrading the fan speed of the CRAC units could correct hotspots by providing a higher air flow. The disadvantage of this is that all the racks that were already being supplied with enough air are then oversupplied, which means higher operating costs.

The preferred solution is to install a fan in the raised floor instead of perforated grilles. The STULZ AirBooster fan

provides exactly this solution, supplied as a complete 600 × 600 mm unit which is a perfect fit for the grid of a raised floor. The units are fitted with a speed-controlled EC fan, a controller and several temperature sensors. The sensors, which are installed direct on the server rack at various heights, measure the temperature. The controller regulates the fan speed based on the measured values and a configurable setpoint. If rack temperatures rise, the fan speed increases and ensures that the air supply is sufficient. At full capacity, the AirBooster conveys over 5,000 m³/h of air in front of the server rack. In line with

the permitted delta Ts, this means that high density racks with a thermal load of over 30 kW can be cooled without major modifications to the data center. However, for reliability reasons this maximum requirements scenario should only be used in emergencies.

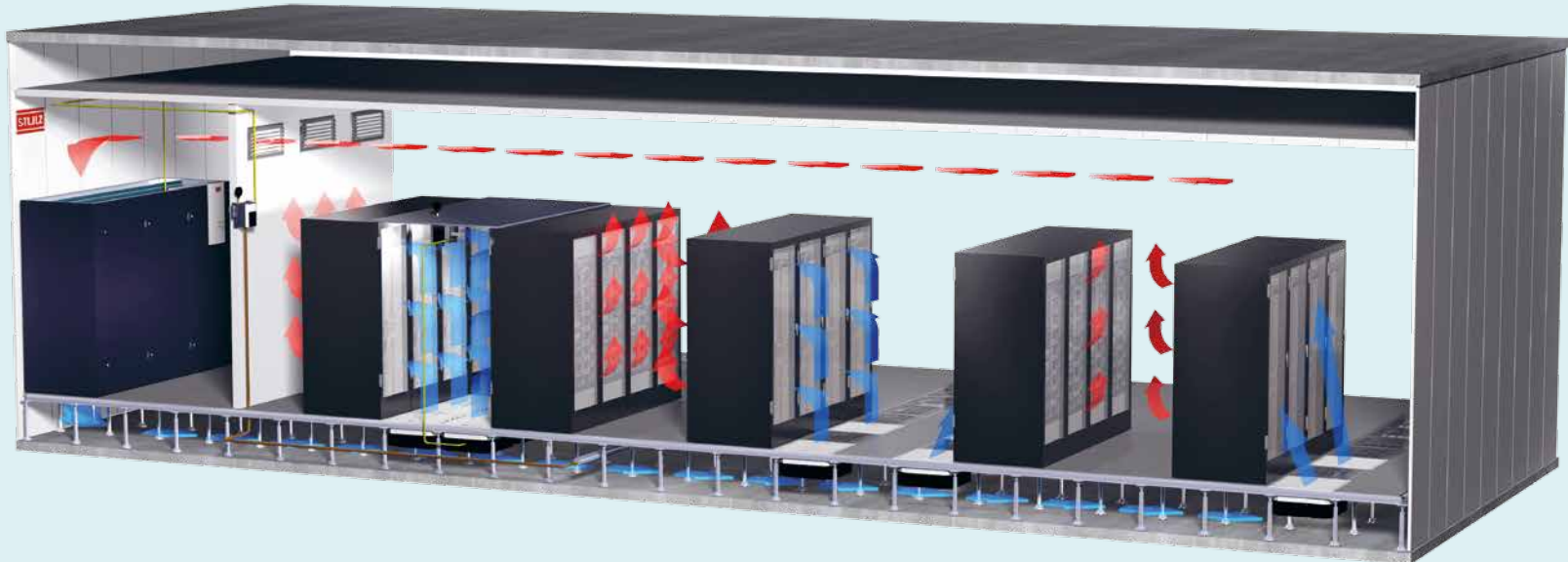
The table below shows the cooling capacities for known deltaTs at an air flow rate of 5,000 m³/h:

DeltaT	Cooling capacity at 5000 m³/h
10 K	~ 17 kW
15 K	~ 25 kW
20 K	~ 34 kW

Powerful performance, efficient operation
The air stream produced by an AirBooster EC fan can be targeted at the hottest points on the server rack by fitting air baffles designed for manual installation. EC technology ensures that the steplessly controllable fan maintains virtually the same high efficiency across its entire operating range. The EC fan used in the AirBooster has been specially developed for STULZ to a maximum performance, energy efficient specification. The performance data were selected to ensure that enough air can be conveyed to the server in an emergency. But for the most part it operates in partial load mode. The AirBooster requires an electrical power input of only 50 W to provide an air flow of 2,800 m³/h.

The AirBooster is available in two versions: one is a fully autonomous system with a controller and temperature sensors. The controller can transmit measured temperatures and AirBooster operating status to the BMS over its Modbus interface. The other version comes without an integrated controller. This means that the BMS has to provide the AirBooster with a 0–10 V signal. Suitable connection terminals are fitted on the unit for feeding back data to the BMS.

So the AirBooster, compact and easy to install, has the capability to correct hotspots and ensure that servers are able to operate reliably within their prescribed temperature limit values.



Potential applications for AirBooster, AirBooster Pro and Air Modulator



Flexible companies

Rapid decision-making and room for maneuver is what marks out owner-managed companies

The STULZ family business began in 1947 as an electro-technical equipment factory, and successfully developed and produced a variety of electronic household appliances until the end of the 1970s. By the mid-1960s it was clear that technical innovation in household appliances would be more or less exhausted within a few years. Alongside this, Germany was importing more and more appliances from Asia, making sales harder still in a market that was already virtually saturated. When things reach a point like this, entrepreneurs have to start asking themselves what strategy will secure their business's future.

So it would be logical to relocate production to a country with more favorable general conditions or even outsource it completely. STULZ didn't consider this even for a moment, because local production and customer proximity are prerequisites for a flexible business. Instead, the company began an intensive search for new products and solutions that we could integrate through production expansion. Ultimately, STULZ entered the air-conditioning business in 1966, and in 1971 it also began specializing in the development and manufacture of precision air-conditioning systems for data centers. Breaking into this future-oriented market was only possible thanks to the firm's financial independence. Our customers benefit from

this too, because it means we can maintain high quality standards and resist driving down costs at any price, which could jeopardize the quality of our products.

We pay careful attention to what our customers say, and monitor the market closely

STULZ GmbH began internationalizing in 1956 when it established its first subsidiary in the Netherlands. But it was not until we entered the data center air conditioning market that we needed to expand globally. Following the maxim "Think global, act local", we established ourselves in the countries where our customers are. Today we have 7 international production sites, 17 subsidiaries and over 140 partners worldwide.

Our growth has allowed us to build close relationships with customers and to implement a large number of projects tailored to local markets. We know from experience that every project has particular features to take into account. Usually this means adapting the product, but thanks to our extensive range of options, we have that covered. However, we are increasingly developing special, targeted, market-specific solutions in partnership with customers.



Lots of solutions doesn't necessarily mean flexibility

Nowadays there is a host of different, flexibly constructed solutions on the market which appear suitable for data center air-conditioning. This creates the impression that customers can easily find the right solution. However, take a closer look and you will see things differently: many of those products are mass-produced, or spin-offs of other cooling solutions which are not specified for data center air-conditioning and yet are still used for the purpose. But the products concerned are neither customized nor open to adaptation. STULZ's air-conditioning range offers extensive product depth, different product variants and differentiating features. It is our basic premise that the climate systems we make should provide maximum efficiency in every product group and size. For example, room cooling, high-density cooling, chillers, modular data center cooling and air-handling units from STULZ are available with optional Indirect Free Cooling. Room cooling, air-handling units and modular data center cooling are also available with Direct Free Cooling.

Customization—a major trend

These days, customers can choose from a wide selection of different cooling systems, performance variables and manufacturers. So data center operators can find themselves confronted by an overwhelming array of potential solutions, all of which must be evaluated. Because with air-conditioning in particular, there is a high risk of choosing a solution that may well be sufficient for the data center's planned usage profile, but turns out to no longer be a 100 % match over time. The payback is not just unnecessarily high energy costs, but also a lack of flexibility during future expansion, or even shortcomings in operational reliability.

We know that many operators face technical and planning challenges when expanding their data center, as they have to take account of complex parameters such as local climate, spatial and room considerations, environmental

and noise protection, not to mention safety requirements. To help meet these, STULZ offers customized, modular system solutions which can be adapted to suit virtually every project requirement and expansion phase. Even if the interiors of data centers and server rooms all over the world are scarcely distinguishable from one another, the requirements for data center air-conditioning are becoming increasingly individual. As a customer, you need to be able to entrust your business to a company that can deliver the right product for your project.

STULZ "Climate. Customized." offers you the reliability of a global player combined with the flexibility of a family-run business. With over 40 years of data center air-conditioning experience behind us, you can count on STULZ.



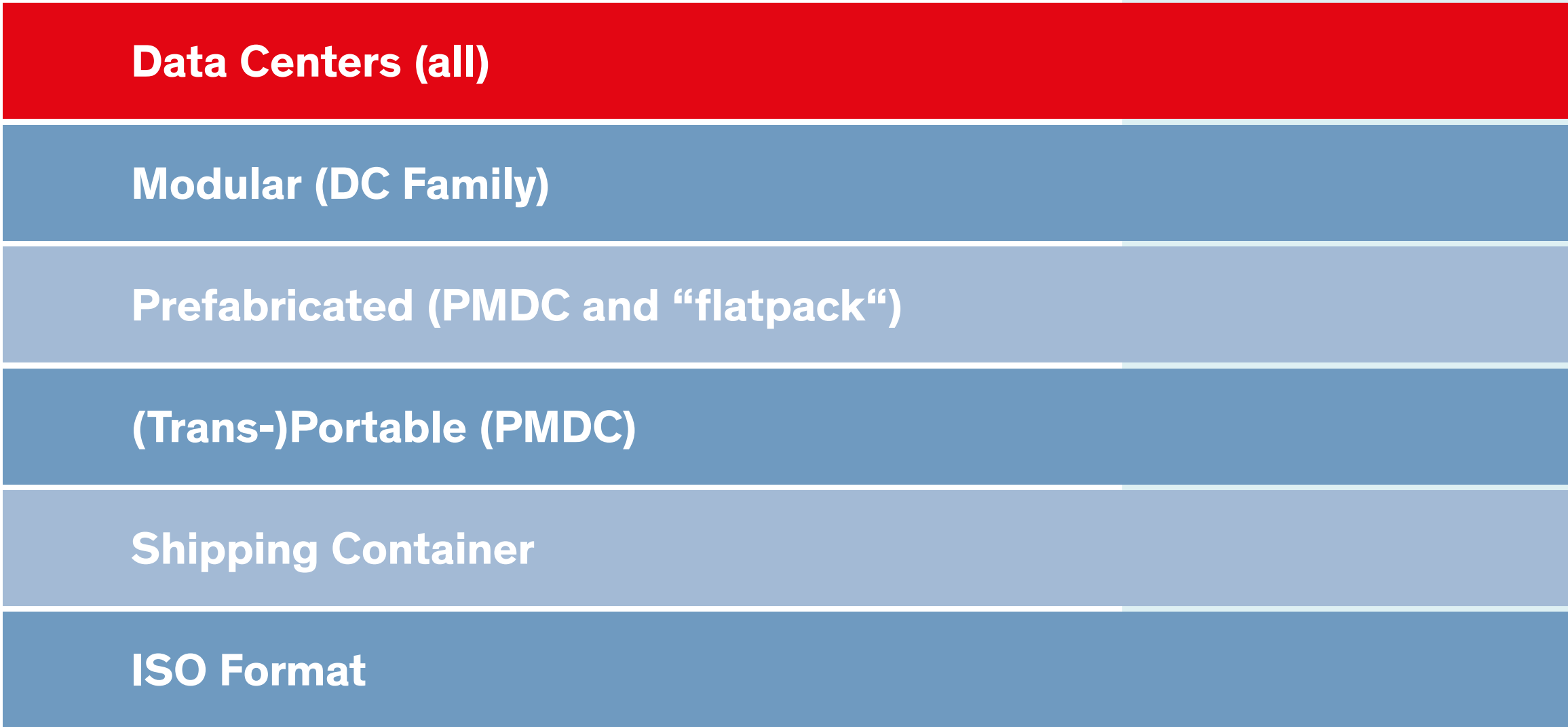
Modular Data Centers: Modularity and its bright future

These days terms such as modularity, pay-as-you-go (or in this case “grow”) and containerized data centers are widespread and are becoming a trend in the data center business. As a result, many research companies are measuring this trend and trying to use it for marketing purposes.



A press release from "MarketsandMarkets" states that the modular data center market is expected to reach \$40.41 billion by 2018 at a CAGR (compound annual growth rate) of 37.41 % between 2013 and 2018. Due to this trend, numerous different products and solutions are entering the market. Many people are talking about containerized data centers when thinking modular. But the market and manufacturers make an important distinction between the different types of modular builds.

A source at IBM sees the whole modular market as shown in this diagram, which gives a good overview of this market and clearly distinguishes all the different kinds of data centers.

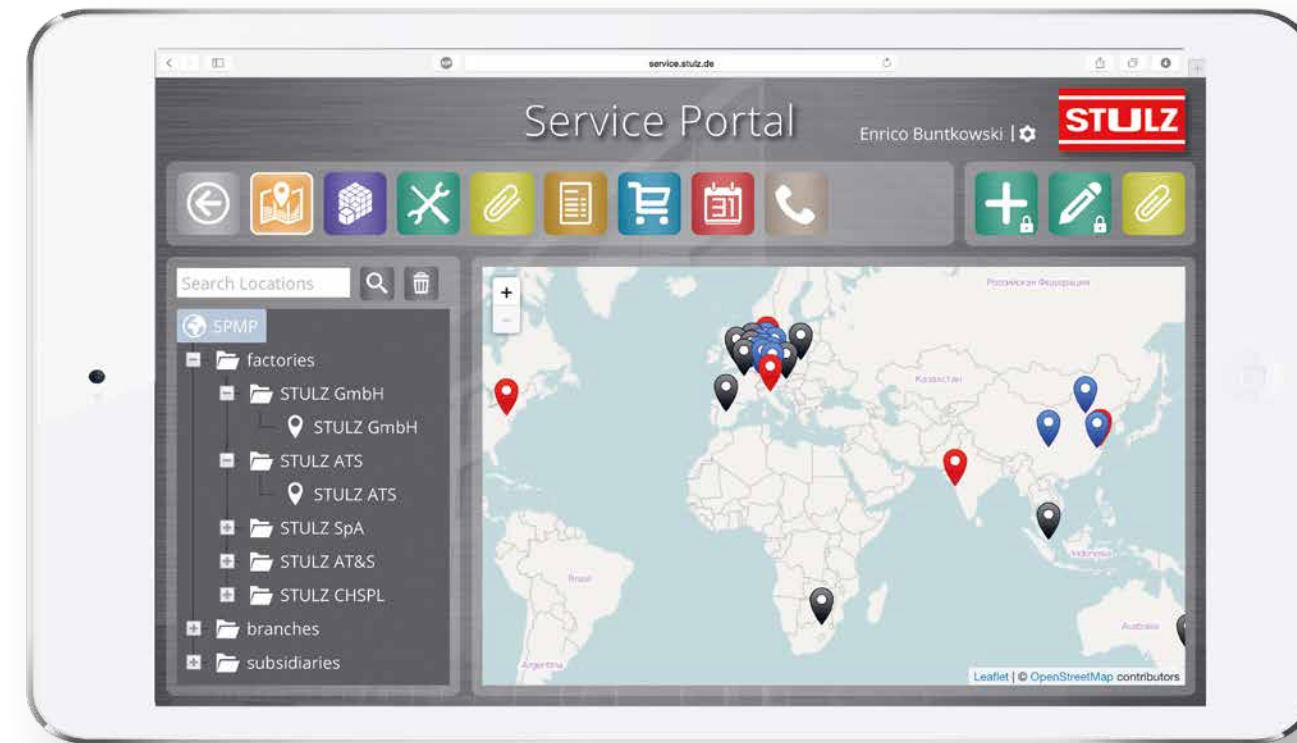
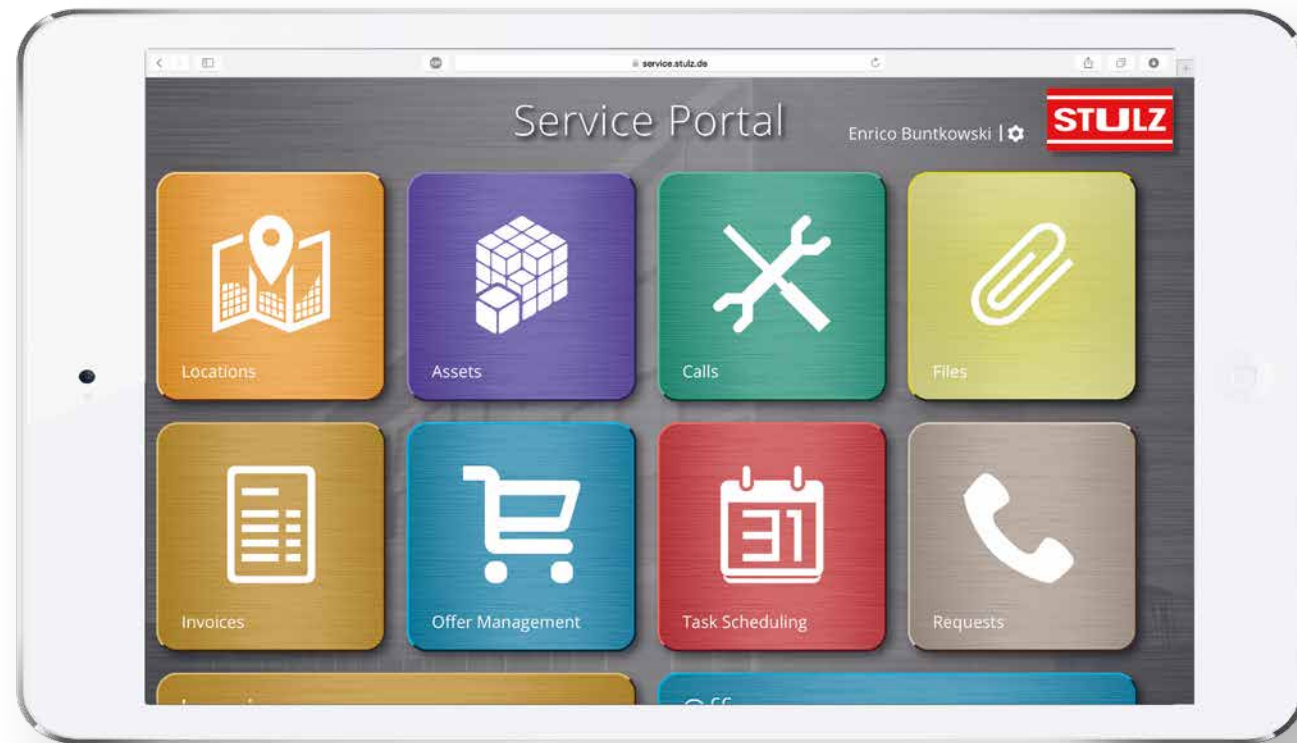


Source: IBM

In the world of data centers there is a field that involves modular solutions in general. But modular—i.e. not defined—has many distinct vantage points. And this modular approach therefore gives rise to various categories (see chart). IBM has defined these categories as follows: "Prefabricated solutions" does not mean that a solution is transportable, but that it has the advantage of providing the customer with a ready integrated solution. If this prefabricated solution needs to be transportable, IBM refers to the PMDC (prefabricated modular data center), which could be in a shipping container or a purpose-built data center "skin". This "skin" could even be a shipping container (non-ISO or ISO), if something entirely transportable and standardized is desired. Amongst all the advantages of a modular approach over a bricks and mortar building, "day 1 CAPEX" is the most interesting from the customer's perspective. As well as a quicker deployment time and

scalability, the day 1 CAPEX is especially appealing to new customers in this field. The "pay as you grow" mentality fits totally in the IT world of this decade. Nobody wants to invest more than is needed, but is willing to re-invest as soon as necessary. As so often, the car industry has led the way. The JIT (just in time) principle and standardized manufacturing processes began in the car industry in the 1970s. It may be rather abstract, but the delivery of prefabricated modules could be understood as just in time. In other words, as soon as the customer needs more computing power, the data center grows. On the other hand, standardized processes are helping to enhance the solution and provide other benefits, as described below. Much of the investment in modular data centers is generated in developing countries, due to a lack of experience. As local expertise is highly likely to be in short supply, a modular solution could be the perfect response. Especially

since almost every modular data center manufacturer offers factory tests at its manufacturing plant. STULZ has a history of working closely together with modular data center manufacturers. This experience is now put to use to meet customers' demands, with the right solution for every kind of modular build data center.



The Service Portal as the data center manager's digital assistant

A data center manager's principal responsibility is to make sure operation is as reliable and available as possible. However, he must also keep a close eye on cost efficiency.

The central role played by the data center manager makes him a vital point of contact for IT departments, management, service providers and customers. Being constantly up to date and accurately in the know about all processes is an important part of his work.

A prerequisite for reliable operation with a highly available IT landscape is an on-site technical infrastructure that is tailor-made for the specific requirements and provides redundancy. This infrastructure includes key facilities such as the power supply, air conditioning, and safety equipment such as fire protection and access control systems.

A data center's technical infrastructure requires constant maintenance. Here, quality service providers are needed. A precise understanding of the special requirements of high availability data centers is indispensable, in order that the service provider can react appropriately to emergencies and make the right decisions on all aspects of technical facility management.

Often, in the data center every minute counts. The power supply and air conditioning are the most crucial elements here: in the event of system failure, a qualified service technician needs to be at the site very quickly, at any time, day or night. For this to happen, individual processes are required to guarantee a reliable alert mechanism. One of the data center manager's main tasks is to coordinate

and manage this network of service providers. At the same time, all statutory regulations for the operation of technical systems must be complied with, and sometimes specially documented. The law places the responsibility for complete documentation firmly on the shoulders of the technical plant operator, who is generally represented by the data center manager.

The STULZ Service Portal was designed especially for these tasks, and is continually being updated in line with new requirements. The system is web-based and therefore extremely flexible. Up-to-the-minute information is available regardless of location.

The STULZ Service Portal features individually created process chains for system fault rectification, and ensures fast, error-free communication between the data center manager or security services and the appropriate technical service provider in an emergency. This considerably shortens reaction times, contributing to higher data center availability.

Thanks to the STULZ Service Portal, all documents are stored centrally in one place and can be retrieved from any location via a web browser. This facilitates administrative work and dispenses with time spent archiving files. Data security is guaranteed at all times by a multi-level security system on the server side, and by an individually adaptable user group manage-

ment system. Service reports, for example, are uploaded to the STULZ Service Portal directly via an interface, and are available as soon as a service call is completed.

All work that can be scheduled, such as maintenance, tests and site inspections, are recorded centrally in the scheduling module of the STULZ Service Portal, facilitating the coordination and management of the various service providers. Detailed status reports by service providers in real time provide the data center manager with a perfect overview of activities in the data center.

Repair and maintenance quotations from the various service providers are uploaded directly to the STULZ Service Portal, and can be contracted by the data center manager or responsible member of staff. There is no need for separate communication by e-mail. This saves time and makes every step transparent and traceable.

The STULZ Service Portal assists data center managers and operators in their everyday work, and therefore increases data center efficiency.

Product training and webinars

Training our partners and subsidiaries is an important part of our quality assurance, and for decades now we have been providing regular programs at our head office in Hamburg as well as other STULZ sites. In 2014 we set up the STULZ Academy, where we bring together product training and online webinars. The ideas behind the academy were self-evident. Firstly we wanted to distribute information faster and more flexibly and secondly, cut travel costs for our partners. We are continuing with our traditional intensive face-to-face

product training courses, which we hold on a regular basis, and supplementing them with our new online options. We have deliberately designed STULZ webinars to be brief. In just 30 minutes or so, they cover all the key points on a given topic. Obviously we then allow time for you to ask questions. This way, you take as little time as possible out of your busy working day. Without exception, everyone who has taken part in the webinars has given us positive feedback and feels that the short format is an advantage in that it allows them to pick

and choose targeted topics that are currently of particular interest. To ensure that everyone has access to the webinars, each topic is covered twice a week—once at 8 a.m. and once at 5 p.m. So all STULZ partners can conveniently participate in our online seminars in their own timezone. The webinar is always hosted by two colleagues, one of whom leads the seminar while the other acts as a moderator in the background and provides live answers to questions asked during the session.

STULZ Academy

Bullet topics:

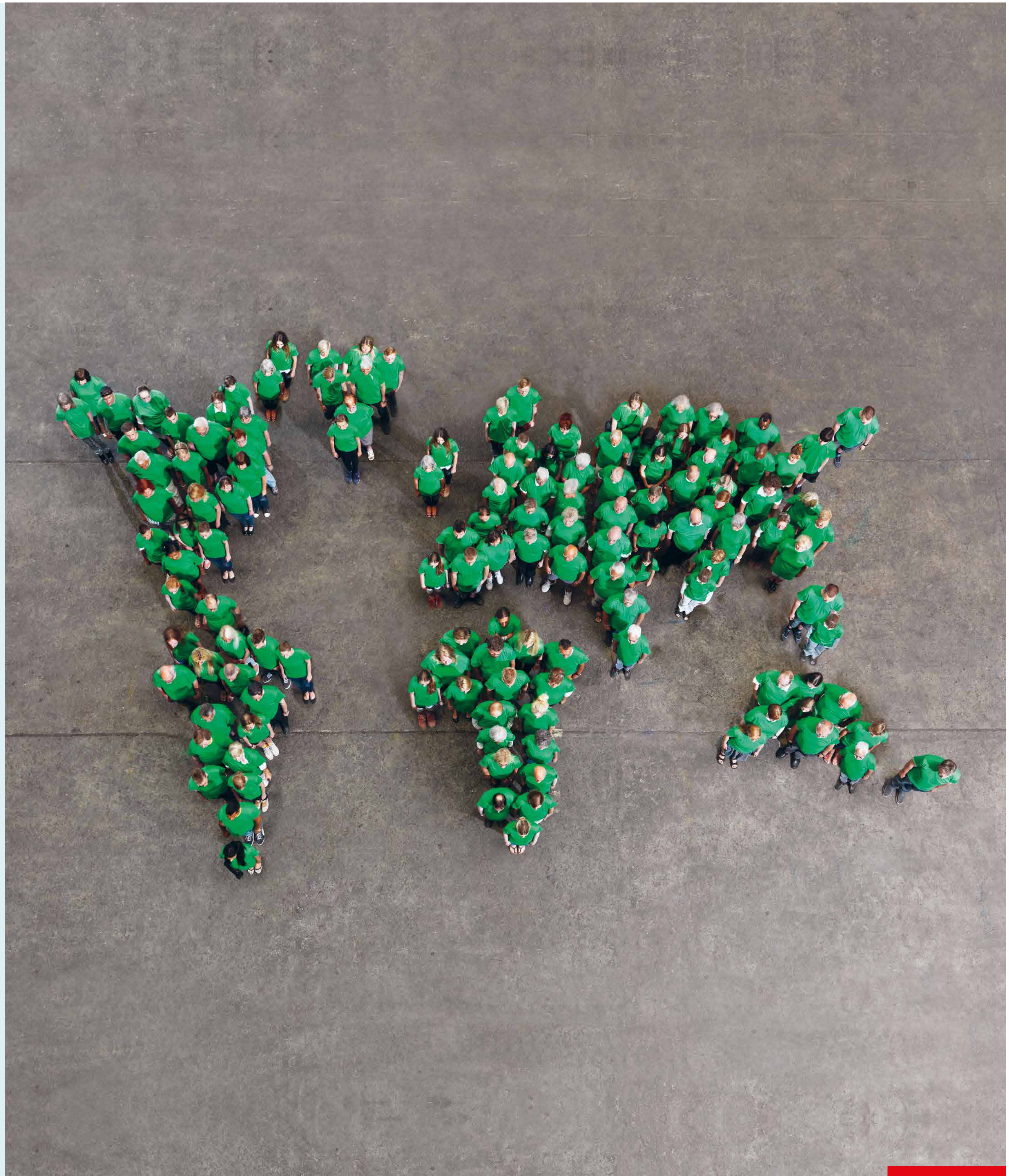
- Pressure regulation in raised floors
- How do I plan a system with Indirect Free Cooling?
- High density: causes, problems and solutions
- The basics of adiabatic cooling
- Project stories
- Air conduction in data centers
- Energy efficiency labels: ESEER, AHRI, MEPS and PUE

What are the important topics?

To help us choose webinar topics, we defined a process that takes account of both internal and external sources. Our colleagues Natascha Meyer and Robert Turkes form the STULZ Academy core team. Natascha and Robert screen relevant topics in consultation with partners, customers and colleagues. Our aim is to present hot topics that are focused on the market and on the needs of participants. Having chosen the topic we move on to putting together the content, which is prepared by various STULZ experts. The finished

webinars are presented live to an internal group from the product management and webinar teams, at which point they either get a thumbs up, or a thumbs down! In the worst case we would do a second test run if there were lots of changes, but so far it hasn't been necessary. The work that goes into this is important if we are to meet the ambitious goals we set for ourselves. If you miss a webinar, you can of course watch the PowerPoint presentation on the e-STULZ service portal after the event. Over the last 6 months we have held

26 webinars. Judging by the ever-increasing number of participants, which has been as high as 132 people in a session, we are hitting the right topics. As we have 140 partners and 16 of our own subsidiaries, that's an impressive attendance rate. We will continue expanding the topics covered by the STULZ Academy and we hope attendance will do the same.



Data center climate control in West, Central, and East Africa

Africa is the world's second-largest continent and also comes second in terms of population. It comes as no surprise, then, that the local data center market has developed strongly over recent years. This has a number of reasons. Where IT is concerned, the countries have some catching up to do—but the continent's decision-makers have recognized this and embrace new technologies with a remarkable enthusiasm. Mobile communications coverage is good or even very good, which opens up a multitude of options for using the Internet. Examples include pilot projects for using smartphones to perform medical diagnoses or to provide access to university courses in rural areas. Just as in our regions, the desire for consumer goods is a major factor driving innovation. And the course is set—after all, who needs local bank branches when you can pay for anything by cellphone? In this respect, the African population is showing us what payment will look like in future: cashless,

with a simple text-message handshake and without ATMs and the like. A further key factor is that establishment of sophisticated infrastructure is progressing ever more rapidly in many regions and that electricity supply is improving more and more. This in turn is of interest to investors who want to produce goods. Because of the continent's vastness and the connection to seaports, Africa's boom begins at its coasts and edges continuously inwards. Though this will take its time, progress in the field of IT is irreversible.

With close to thirty expertly trained partners and our own branch in South Africa, we are perfectly prepared for the African market.

This makes us the ideal partner for national and international businesses and telecommunications providers active on the continent who require climate control systems for IT and data centers.

So, what solutions are required?

Michael Jux is our man in Africa and he's always bringing back news of interesting projects from his business trips. This is proof positive that there's demand for data center climate control and IT room air conditioning. But to compete, you need to be fit. Which suits Michael just fine, since he's an Ironman contender. Of course, his many years of experience as a STULZ expert actually come in even handier. The local climate conditions pose quite a challenge. Also, there are often structural restrictions related to the architecture that preclude certain systems right away. One thing's absolutely sure: Consultation for projects in Africa requires sound preparation. How do I choose the right system, how do I plan for redundant design, what alarm and monitoring concepts do I need to put in place, what are the thermal loads, how can I save energy? These are the issues

that continue to crop up in discussions—which also shows that the people responsible are becoming more and more sensitive to the topic and that reliable operation of an IT system can only be realized in conjunction with a professionally planned climate concept. The data center market on the continent is characterized by small to medium-sized centers that support a variety of IT services. The majority of these data centers are still cooled using comfort air-conditioning units that are not designed for such use and possess poor energy ratings. In terms of regulating the climate for critical systems such as data centers, comfort air-conditioning units are the worst-possible choice. They even entail a safety risk as they are not designed for data centers and have problems with the required continuous operation. Another major drawback of comfort air-conditioning units is the lack

of their components' proportionality. The air-conditioners cannot be demand-controlled in accordance with the data center's requirements and sometimes produce too much cooling, which in turn wastes energy. One might think that climate systems in Africa need to run at full load all the time due to the constantly high temperatures—this is not the case. As any data center has times with high and times with low load, precision air-conditioning systems are the right solution.

STULZ climate systems are available with speed-controlled EC fans and EC compressors. They allow adjusting the components mentioned perfectly to the respectively required output and the cooling performance can always be set in proportion to the data center's load. With dropping load, the climate system's power consumption is reduced thanks to the EC motors' and EC compressors' infinitely variable adjustment to the demand. In addition, STULZ solutions are modular in design and can thus be added exactly as required for a data center's every development stage.



Cold aisle enclosure with STULZ CyberRow side coolers

CyberRow—A Full Success

In African data centers in particular, the classic closed-circuit air conditioning with raised floor can be implemented only in new data centers. Where the building imposes restrictions, CyberRow is the perfect solution. The units are classic side coolers with high-end details that ensure economic operation. They are set up as stand-alone solutions between the server racks. The server racks' make is irrelevant. The rack merely needs to feature a perforated front and rear door so that the cool air can be aspirated by the servers.

In terms of cooling capacity, CyberRow systems match traditional closed-circuit air-conditioning systems. Their greatest asset is their scalability: The air-conditioning can easily grow alongside the number of installed servers.

And the cooling performance can be flexibly adapted to the respective racks' output range. Furthermore, side coolers offer impressive energy efficiency: As the cold air reaches the rack via the shortest distance, virtually no cooling power is lost. Cooling performance losses can be reduced further by means of cold aisle/warm aisle configurations. And last but not least, side cooler systems also significantly reduce the required humidity control measures thanks to the units' high refrigerant vaporization temperatures, which mean that only a minimum of humidity is drawn from the air. The manifold benefits in terms of efficiency go so far that side cooler systems can be operated as economically as closed-circuit air conditioning at least for small and medium-sized data centers.

Does Free Cooling make sense for Western, Central, and Eastern Africa?

There are generally two types of Free Cooling, Direct and Indirect Free Cooling. With Direct Free Cooling, filtered outside air enters the data center and integrated compressors provide back-up for the times at which Direct Free Cooling is not possible due to the high temperatures. Indirect Free Cooling is a closed system that never allows outside air to enter the data center. The STULZ system with Indirect Free Cooling and dynamic control (DFC) features two cooling circuits: One direct evaporator circuit with internal brazed plate condenser and a free-cooling system. Both jointly utilize an external re-cooling heat exchanger while each circuit has its own heat exchanger. Data center climate systems have a service life of around 10 to 15 years and

whether or not one of the above Free Cooling methods can be used should always be checked. We can use precise weather profiles, which are available for almost any country in the world, to accurately compare the economy of different systems. Free Cooling makes sense particularly for regions that are high above sea level, during the night, and in winter.

In Addis Ababa/Ethiopia (2,400 m above sea level), we realized a few major projects for a customer that use STULZ EcoCool or DFC² (Direct Free Cooling) air-conditioners for climate control. We used a precise CapEx/OpEx calculation for a pure compressor system and a system with Direct Free Cooling and compressors as back-up to show in detail that the added expense of the free-cooling system amortizes after just

under two years. At local electricity rates of 0.120 Euros per kWh and a runtime of ten years, our customer in Ethiopia saves more than 500,000 Euros in energy costs. The project comprises eight main data centers and additional smaller IT rooms spread throughout the country. This makes it the perfect reference for large and for small data centers.

Despite the improved electricity grids in Africa, there are still longer blackouts during which the air conditioning systems shut down. To provide back-up in such cases, we equip our DFC systems with intelligent features capable of establishing redundancy during power failures. Our power supply management closely monitors the power supply. In the event of a blackout, a back-up free-cooling system comes online, which is powered by a UPS. This free-cooling system thus ensures continued operation during blackouts. In addition, the units feature rapid and reliable restart which ensures that the system comes back online directly. This means blackouts can be handled and expensive generators for ensuring compressor cooling are mostly no longer required.



STULZ CyberRow

STULZ Australia

Congratulations 10 Years Anniversary

End of April 2015, we celebrated the ten year anniversary of our STULZ company in Australia. Although the STULZ brand has been represented in Australia since 2001, it was not until 2005 that the business became a true daughter company.

Over this period, the company has grown from a "one-man band" overcoming the challenges of a competitor with local manufacturing facilities, tyranny of long shipping times and small finances to become a strong and successful 50 plus team of dedicated and committed individuals. The company is now the preferred supplier to the data center market having been successful with a vast majority of data center builds over the last three years.

For those familiar with the geography of this very large country, STULZ has sales and

service offices in Sydney (Head office), Melbourne, Brisbane, Canberra and Perth with plans to expand into the other remaining States in the coming years.

Our business in Australia and New Zealand is led by Mr John Jakovcevic who has been with the STULZ family for fifteen years. A very dedicated, dynamic and entrepreneurial individual, Mr Jakovcevic and his team have set a high standard when it comes to delivering high quality workmanship and standards across all business functions.

We must also not forget that STULZ Australia also owns its very own daughter company, STULZ New Zealand. Having formed this business in 2007, our New Zealand operations has a very special place in our hearts as it's our very first 'grand' daughter company.

Almost all industries in Australia are mature markets and the population is generally known for being early adopters of new and advanced technologies. But Australia suffers from a small population, high cost of living, high labour costs and slow internet speeds when compared to other developed countries, making it difficult for it to be competitive on the global stage. Its main city, Sydney is considered one of the three main financial hubs in Asia Pacific—others being Hong Kong and Singapore—and is home to the highest number of data centers in Australia, with all major operators having one or more facilities.

As with most globally developed markets, the growth of data centers and colocation facilities is being driven by cloud computing and outsourcing of the IT departments.

As data centers continue to grow in size and number, smaller critical facilities are on the decline. New cooling technologies from manufacturers who are not our traditional competitors are flooding the market and pushing prices down. STULZ Australia has now for several years been expanding the business into new markets and introduced new products to mitigate business risk and introduce new income streams. This of course requires a significant effort, resources, capital investment and comes at a risk, but as we all know, in not reacting to the fast changing market dynamics lies a bigger risk.



Source: Getty

CRAC market in China



From the overall sales trend of CRAC in recent years, the market continues to maintain a smooth and steady growth. In recent years, with the strong improvement in the application level of IT, the growth in the fields of telecommunications, finance, medical care, traffic, etc. was relatively rapid, thus the application level of data centers would be greatly improved, and the demands for cooling would be gradually increased accordingly.

In the field of telecommunications, with the development of 4G business, the basic telecommunication enterprises

accelerated the construction of mobile networks with the result that the number of newly-increased mobile communication base stations reached 988,000 in 2014. In the field of finance, the private banks began to step into the banking field, and in 2014, the China Banking Regulatory Commission already approved the first batch of 5 pilot private banks.

In the Government sector, with a focus on national security, the Government would pay more attention to the construction of computer rooms with safe shielding and

computer rooms for high-performance computation centers.

All these factors would promote the continuous accelerated construction of data centers in key industries and would bring a large market space to the development of CRAC/cooling solutions.



STULZ in China

STULZ is basically a one-stop cooling solution; this enables us to truly advise our clients to choose the solution that really fits their individual cooling requirement and needs and environment.

The Chinese market is important to STULZ. More and more of our customers in China understand the value of our brand, the reliability, energy efficiency saving in the long run, and superior after sales service to back it up.

In 2015, 88 types of products manufactured by STULZ were included in the Government Purchase List for Energy-saving Products, and its cooling capacity basically covered all machine models required by the Government. STULZ was valued as a candidate brand with the most types of CRAC. Among STULZ's products, CyberAir series precision air conditioners possessed advanced 3D-EC direct current step-less speed regulating fan technology, a C7000 intelligent controlling system and optimized structure, thus reducing energy consumption consid-

erably and belonging to STULZ's high-end products with excellent energy-saving performance. In addition, STULZ's CyberRow series row-based precision air conditioners were the advanced precision air conditioners tailored according to the specific cooling requirements of a cabinet, which creatively adopted the horizontal directional draught technology and greatly improved the cooling efficiency.

Since last year, we have opened the second production facility in Hangzhou. The first one is in Shanghai. This shows that we are making efforts to come up with the most energy advance cooling solutions for mission critical applications and push forward development in our industry.

CRAC product trend in China

Due to the special operating environment, CRAC needs to be operated for a long period of time and cannot be allowed to suspend or stop operations. Therefore, CRAC has relatively high require-

ments for stability and reliability. Regardless of location, whether the performance of CRAC is stable is a major factor for project evaluation. CRAC has strict requirements for tempera-

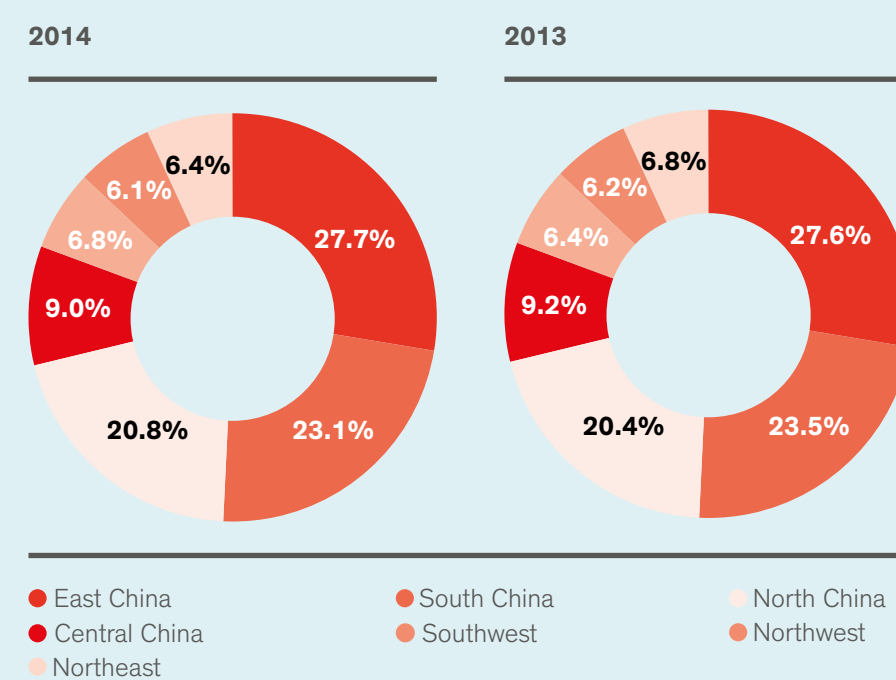
ture, humidity and cleanliness. With regard to environmental protection design, the selection of cooling systems compatible with R22 and R407C refrigerants could satisfy the user's demands to a

major extent. In terms of cooling mode, air-cooled products were still the mainstream products in the industry. However, due to the feature of environmental protection, water-cooled products devel-

oped rapidly and gradually became key products valued in the market in recent years.

Regional structure of CRAC

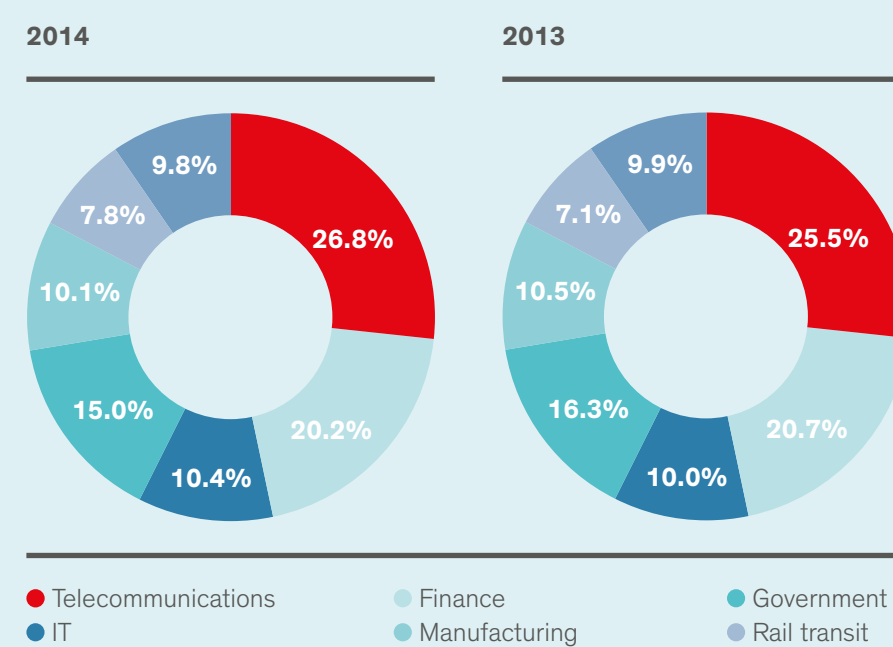
In 2014, seen from the sales regions of CRAC, the overall pattern didn't change much. East China, North China and South China were still the mainstream sales markets for CRAC. With the continuous promotion of new city construction in our country, West China is set to develop on a relatively large scale in future.



Data source: ChinaOL

Industrial market share of CRAC

In general, for the years to come, the telecommunications industry, financial industry and Government sector will still be the important applications for CRAC, especially the telecommunications industry and the financial industry. Other industries such as IT, manufacturing and rail transit industries also showed a rapid development and will become important industries for the popularization of CRAC at a later stage.



Data source: ChinaOL





Hamburg's Best Employers 2015



STULZ received the quality seal "Hamburg's Best Employers" from the Hamburg Chamber of Commerce. The award proves that we remain an attractive employer even in these times of skills shortage.

We won the accolade thanks to our high level of staff satisfaction and our motivating work atmosphere. This time the prize-giving ceremony, now in its seventh year, was held in the Albert-Schäfer-Saal conference room at the Hamburg Chamber of Com-

merce. The award was handed to Ms. Jana Seifert, HR and Social Wellbeing Manager at STULZ.

The competition for "Hamburg's Best Employers 2015" is organized by HR expert Professor Dr. Werner Sarges of the Helmut-Schmidt University in Hamburg, the Institute for Management and Economic Research (Institut für Management- und Wirtschaftsforschung, IMWF), and various media partners. The winners were selected by

analyzing staff questionnaires, which Professor Sarges made available to participating companies.

We place particular emphasis on treating employees with respect, and on good teamwork in all departments. "It is important to us that our employees feel happy and comfortable with us," says Jana Seifert. "A flat organization and the appreciation that we show our employees helps them to feel a strong sense of identification with the company."

An extensive range of promotional and further training initiatives also contributes to high satisfaction and close ties. In this way, STULZ offers its staff very good opportunities for development and long-term future prospects within the company.

CyberCool 2



Together, STULZ CyberCool 2 chillers – delivered since the product launch – generate 100 megawatts.



We will use this round number as an occasion to take a closer look at the product philosophy that has led to the success of the CyberCool 2.

- Excellent adaptability to customer-specific project requirements
- Maximum efficiency in data center air conditioning
- Reliable operation and quality "made in Germany"

Excellent adaptability to customer-specific project requirements:
8 out of 10 customers select individual, project-specific features

In a study published in July 2014, consulting firm McKinsey & Company and the VDMA (Verband Deutscher Maschinen- und Anlagenbauer e.V.) identified a demand for "customized system/integration solutions" from all industries as the No. 1 trend among German engineering

companies. We are pleased to say that with our product philosophy we have taken precisely the right approach and recognized this trend very early on. The CyberCool 2 is designed for the air conditioning of data centers, and leaves the factory already equipped with numerous features that are indispensable for data centers. Despite all these features, 8 out of 10 customers choose additional, individual options, in order to satisfy their local requirements. If a specification cannot be covered by our available options, we check—without any obligation to buy—how the unit could be modified, so that even very particular requirements can be fulfilled as well. STULZ "Climate. Customized." makes this possible.

Small selection of typical customer requirements that were not covered by our standard options:

- Different pump designs with speed regulation
- Installation of larger compressors in a unit, to make better use of available installation space on the roof of the data center
- Modified chiller base frame for precision installation to the millimeter on an existing structure
- Installation of 30 kW pumps to meet hydraulic requirements
- Electrical modifications

Maximum efficiency in data center air conditioning:

Up to 60% energy savings

Chillers for data centers are designed for continuous operation 24/7, usually over a minimum service life of ten years. Very high operating costs can arise over this period, and these have the potential for optimization. To avoid falling into the operating cost trap, a chiller with Free Cooling should be used for data center air conditioning whenever possible. This brings great advantages in terms of energy. In addition to Free Cooling mode, Mixed mode is another element with an even more positive effect on efficiency. According to temperature statistics in temperate zones, most operating hours are not purely in Free Cooling or Compressor mode, but in Mixed mode range (approx. 60%). The Mixed mode of

the CyberCool 2 uses the Free Cooling coil for pre-cooling the chilled water, and can therefore cut the power consumption of the compressors to the necessary minimum. The CyberCool 2 combines these three operating modes in a single machine. In this way, it always uses the most energy-efficient operating point, based on the outside temperature.

Reliable operation and quality "made in Germany":

Flexibility, customizing and maximum in-house manufacturing at one site

A data center is a business-critical system, the failure of which can cause major damage in a variety of areas. Moreover, a data center is in operation around the clock. These are two factors that exert a huge influence on a chiller's design. All high-quality system components of the CyberCool 2 have been adapted to work in harmony in the cooling system, and are designed for continuous operation with maximum reliability. Our pipe systems are prepared and adapted in line with customers' wishes in our own ultra-modern pipe prefabrication plant, which is equipped with state-of-the-art pipe bending machines. This increases flexibility, reduces the number of solder and weld

points, and lowers the risk of leakage. The complete CyberCool 2 series is manufactured entirely at the Hamburg site. All production processes are embedded in an ISO 9001 quality management system, with final function test. In order to satisfy STULZ quality requirements, CyberCool 2 chillers are subjected to post-production tests for performance, leakage and pressure resistance. This equipment function test is part of each production process, and is performed on our in-house test rig and rigorously documented.

Global Dates

For more information on events, visit www.stulz.de

We're looking forward to seeing you.



STULZ Company Headquarters

STULZ GmbH
Holsteiner Chaussee 283 | 22457 Hamburg
Tel.: +49 40 5585-0 | Fax: +49 40 5585 352 | products@stulz.de

STULZ Subsidiaries

STULZ Australia Pty. Ltd.
34 Bearing Road | Seven Hills NSW 21 47
Tel.: + 61 (2) 96 74 47 00 | Fax: +61 (2) 96 74 67 22 | sales@stulz.com.au

STULZ Austria GmbH
Lamezanstraße 9 | 1230 Wien
Tel.: +43 (1) 615 99 81-0 | Fax: +43 (1) 616 02 30 | info@stulz.at

STULZ Belgium BVBA
Tervurenlaan 34 | 1040 Brussels
Tel.: +32 (470) 29 20 20 | info@stulz.be

STULZ Brasil Ar Condicionado Ltda.
Rua Cancioneiro de Évora, 140 | Bairro - Santo Amaro | São Paulo-SP | CEP 04708-010
Tel.: +55 11 4163 4989 | Fax: +55 11 2389 6620 | comercial@stulzbrasil.com.br

STULZ Air Technology and Services Shanghai Co., Ltd.
Room 5505, 1486 West Nanjing Road, JingAn | Shanghai 200040 . P.R. China
Tel.: +86 (21) 3360 7133 | Fax: +86 (21) 3360 7138 | info@stulz.cn

STULZ España S.A.
Avenida de los Castillos 1034 | 28918 Leganés (Madrid)
Tel.: +34 (91) 517 83 20 | Fax: +34 (91) 517 83 21 | info@stulz.es

STULZ france S. A. R. L.
107, Chemin de Ronde | 78290 Croissy-sur-Seine
Tel.: +33 (1) 34 80 47 70 | Fax: +33 (1) 34 80 47 79 | info@stulz.fr

STULZ U. K. Ltd.
First Quarter, Blenheim Rd. | Epsom | Surrey KT 19 9 QN
Tel.: +44 (1372) 74 96 66 | Fax: +44 (1372) 73 94 44 | sales@stulz.co.uk

STULZ S.p.A.
Via Torricelli, 3 | 37067 Valeggio sul Mincio (VR)
Tel.: +39 (045) 633 16 00 | Fax: +39 (045) 633 16 35 | info@stulz.it

STULZ-CHSPL (India) Pvt. Ltd.
006, Jagruti Industrial Estate | Mogul Lane, Mahim | Mumbai - 400 016
Tel.: +91 (22) 56 66 94 46 | Fax: +91 (22) 56 66 94 48 | info@stulz.in

STULZ México S.A. de C.V.
Avda. Santa Fe No. 170 – Oficina 2-2-08 | German Centre
Delegación Alvaro Obregon | MX- 01210 México Distrito Federal
Tel.: +52 (55) 52 92 85 96 | Fax: +52 (55) 52 54 02 57 | belsaguy@stulz.com.mx

STULZ GROEP B. V.
Postbus 75 | 1180 AB Amstelveen
Tel.: +31 (20) 54 51 111 | Fax: +31 (20) 64 58 764 | stulz@stulz.nl

STULZ New Zealand Ltd.
Office 71, 300 Richmond Rd. | Grey Lynn | Auckland
Tel.: +64 (9) 360 32 32 | Fax: +64 (9) 360 21 80 | sales@stulz.co.nz

STULZ Polska SP. Z O.O.
Budynek Mistral . Al. Jerozolimskie 162 . 02 – 342 Warszawa
Tel.: +48 (22) 883 30 80 | Fax: +48 (22) 824 26 78 . info@stulz.pl

STULZ Singapore Pte Ltd.
33 Ubi Ave 3 #03-38 Vertex | Singapore 408868
Tel.: +65 6749 2738 | Fax: +65 6749 2750 | andrew.peh@stulz.sg

STULZ AIR TECHNOLOGY SYSTEMS (SATS), INC.
1572 Tilco Drive | Frederick, MD 21704
Tel.: +1 (301) 620 20 33 | Fax: +1 (301) 662 54 87 | info@stulz-ats.com

STULZ South Africa Pty. Ltd.
Unit 3, Jan Smuts Business Park | Jet Park | Boksburg | Gauteng, South Africa
Tel.: +27 (0) 11 397 2363 | Fax: +27 (0) 11 397 3945 | aftersales@stulz.co.za

Legal Information

Printed and published by:
STULZ GmbH
Holsteiner Chaussee 283
22457 Hamburg
Tel. +49 (40) 5585-0
Fax +49 (40) 5585 352
www.stulz.de, info@stulz.de

Directors with authorization to represent the company:
Jürgen Stulz (Chairman of the Board),
Dr. Ulrich Gorge,
Marc-Oliver Stulz,
Martin Zimmermann
Entry in the Commercial Register:
Hamburg District Court, HRB 16255

Executive Editor:
Mladen Majstorovic

Editorial Assistants:
Enrico Buntkowski-Reintsch,
Uwe Kudszus,
Johann Mater,
Natascha Meyer,
John Jakovcevic,
Tommy Zhan,
Ole Zinck

Design
www.dmcgroup.eu

Close to you all over the world

With specialist, competent partners in our subsidiaries and exclusive sales and service partners around the world. Our six production sites are situated in Europe, North America and Asia.

For further information, please visit our website at www.stulz.de