

PRESS KIT

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The Company

DAS Environmental Expert GmbH headquartered in Dresden, is an environmental technology enterprise. Founded in 1991, it has become one of the leading technology and equipment providers for process waste gas abatement solutions. International leaders in the semiconductor, the TFT, LED and electronic industries as well as the solar industry, Nanotechnology and MEMS are using DAS' technology.

In a second business branch the company develops process and system solutions for the treatment of industrial wastewaters. The service portfolio of DAS EE includes not only consulting, planning, installation and start-up, but also maintenance, repair and optimization or operation of the wastewater treatment plant on behalf of the customer.

DAS Environmental Expert operates worldwide and currently has 680+ employees.

Management



René Reichardt | Chief Executive Officer

René Reichardt is Chief Executive Officer (CEO) of DAS Environmental Expert GmbH. He started his career with an apprenticeship and a subsequent employment as communication electronics technician at the company Siemens Nixdorf, a cooperation of Siemens AG.

After a four-year stay in England René Reichardt joined DAS Environmental Expert GmbH in 2005 and accepted the challenge to develop the service and sales organizations in China and Vietnam. At this stage he significantly focused on the semiconductor as well as solar industry and developed the Pollution Abatement Facility concept; a turnkey solution for thin film manufacturers, combining the waste gas and wastewater treatment.

In 2008 René Reichardt graduated as MBA at the Danube University Krems/Austria before returning to DAS headquarters in late 2009. Back in Dresden he took on the management and strategic development of the business unit wastewater treatment. In June 2016 he was appointed the managing director of DAS Environmental Expert GmbH.



Dr. Horst Reichardt | Founder & President

In 1975 Dr. Horst Reichardt completed his physics degree at the Technical University in Dresden. Since 1976 he has worked in the semiconductor industry in Dresden which was already a center for microelectronics.

In 1989 Dr. Horst Reichardt received his doctorate from the Technical University in Chemnitz, where he and his team successfully developed technologies for MOS applications in 265 KdRAM, 1 MdRAM and 4 MdRAM circuit generations. He participated in more than fifty, partly global, patents.

Dr. Horst Reichardt is the co-owner of 15 patents or patent applications, many of them worldwide. In 1991 he co-founded DAS Environmental Expert GmbH and has since been an integral part of the enterprise's strategic business development.

In 2005 he was honored with the European SEMI Award for being a "pioneer in Waste Gas Abatement Technology".

Business Unit Waste Gas Treatment

Areas of Application: Semiconductors, Photovoltaics, LED Industry, TFT/Flat Panel Industry, Nanotechnology, MEMS

Waste gas treatment basics

Many industrial and research production procedures use process gases and generate waste gases. These waste gases are toxic and/or highly flammable and very often pose a significant risk to production facilities and the environment. The semiconductor industry, for instance, uses perfluorocarbons, whose global warming potential is extremely high. Combining and transporting different gases into a fab's central waste gas system might produce highly flammable and highly explosive gaseous mixtures, which in the past has occasionally caused the total loss of entire production facilities. Particles contained within gases may also cause exhaust blockages. To eliminate these risks, process waste gases need to be treated at the "Point of Use" (POU) where harmful exhausts are abated immediately. In the early 1990's no appropriate and comprehensive technical solution had yet been available.

Since 1992 the POU equipment, developed and manufactured by DAS Environmental Expert GmbH, has mastered the task. No matter if silane, phosphine or CFC, DAS equipment can, depending on customer requirements, treat waste gases from practically all production steps in the chip industry, safely and in an environmentally compatible way. DAS equipment can be used for virtually all modern coating and etching equipment. Their efficiency reaches more than 99 % with most gases and thus exceeds the standards set forth by the TA-Luft (according to German Clean Air Regulations).

DAS technology is based on a flexible, integrated product concept, which combines process gas supply, process equipment and process waste gas abatement in one single system. The smallest equipment fits into a closet of less than a 1 square meter footprint. DAS technology is fully automated and sensor-controlled and meets the highest safety standards. In the field of waste gas treatment, DAS currently holds 9 registered patent families.

Burn/Wet Systems (ESCAPE, STYRAX, UPTIMUM, TILIA)

DAS burn/ wet systems stand for the abatement of dangerous process waste gases and their fission products through controlled combustion to harmless end products. Therefore waste gases are induced directly into the burner flame and followed by a wet scrubbing procedure. Also very stable pollutants can be abated in the hot flame with up to 1400 °C. The systems can be used with different fuel gases, such as hydrogen, natural gas or propane. Depending on the required temperature range oxygen or compressed dry air are used as oxidant.

Interfaces make it possible to remotely control the **ESCAPE** systems directly from the production facility and accurately adjusting them to current pollutant emissions. During the scrubbing process, water, lye or other fluids absorb the gaseous or solid combustion products or assimilate suspensions and cool down the gases.

The key to the **ESCAPE** technology's efficiency is the combination of the two procedures burning & scrubbing in the smallest possible space – two basic technologies that, each on their own, reliably and efficiently abate specific process waste gases, but usually exclude each other in such close proximity. Combining the two principles enables the abatement of process waste gases at very high efficiency rates and meets high security standards while offering significant economic advantages.

ESCAPE series

ESCAPE stands for Environmentally Safe Cleaning And Protection Equipment. These are burn/wet systems with the DAS basic technology, which is successful for more than 20 years. More than 3,000 systems have already been sold worldwide. They can be used for many processes of the semiconductor and photovoltaics industries and meet the highest deposition rates.

All **ESCAPE** systems can be installed directly next to each other with access to maintenance areas on the front and the back side. The system's core, the burner unit and reactor, can easily be removed without tools in a few steps, as soon as the system is turned off.

Based on the **ESCAPE** series and on customer demand, DAS Environmental Expert has developed several adaptations that are now available as separate series:

ESCAPE *INLINE* – the basic configuration with the described technology including burners, scrubbers and washing liquids adapted to the specific process gases.

ESCAPE *DUO* – features two reactors operating simultaneously, which can function as each other's back-up during maintenance or in the event of an error.

UPTIMUM and UPTIMUM PLUS

The **UPTIMUM** series was developed specifically for the treatment of large amounts of waste gases by burning and scrubbing. Comparable to the basic concept of the **ESCAPE** series, **UPTIMUM** is specifically designed to the needs of the photovoltaic industry (silicon thin film). Due to the possibility to handle high process gas flows it is also applicable to most difficult processes of microelectronics. Especially for processes where large amounts of particles are formed, the reactor design is ideal and cost effective with low maintenance.

The burner configuration as well as the selection of the washing liquid are similarly configured flexibly just like the **ESCAPE** series and precisely tailored to the customer requirements. The **UPTIMUM** series is a successful part of the DAS product range since 2007.

STYRAX - Reihe

STYRAX represents the fusion of treating high volume flow rates with the configurability of the **ESCAPE** series. **STYRAX** is a burn/wet system based on the technology of **UPTIMUM**. It is specifically designed to the requirements of CVD applications (increased capacity for CVD gases in comparison to the **ESCAPE** series).

Through the optimized design **STYRAX** systems achieve destruction and removal rates more than 99 % and long maintenance intervals. Due to its high capacity and versatile configurability there are diverse possibilities for semiconductor and photovoltaic processes.

STYRAX INLINE – basic configuration, with various burners, scrubbers and washing liquids, adjusted to the occurring process gases.

STYRAX TWICE – double system (with higher capacity) with two independent reactors, a common media supply and a common control unit.

STYRAX DUO – features two reactors operating simultaneously, which can function as each other's back-up during maintenance or in the event of an error. The uptime exceeds 99 % which results in a very low downtime for the connected process equipment.

STYRAX DUO EPI – system based on **STYRAX DUO** with optimized components for epitaxy processes, where strong corrosive waste gases with high hydrogen flows are typical. The system design includes highly resistant materials, such as special seals, and an optimized heat exchanger. The systems are equipped with special safety features and sensors.

TILIA series

TILIA is a burn/ wet system based on the technology of *UPTIMUM* and *STYRAX DUO* for challenging CVD and Etch applications. The integrated back-up function guarantees a high uptime for connected process tools.

Burner System

LARCH

LARCH is a POU waste gas abatement system without washing liquid especially designed for manufacturing processes of the LED industry (MOCVD processes). It is capable of treating large flows of hydrogen and ammonia as well as small flows of metal organics and dopants. The tool is suitable for common LED processes such as white LEDs.

Through the usage without scrubbing liquid, there are no disposal costs while the investment and operating costs are low.

Scrubber Systems (AQUABATE, SALIX)

AQUABATE series

AQUABATE stands for the treatment of process waste gases by selective wet scrubbing. The systems are designed only as a scrubber, without burner unit. The harmful gases are dissolved in one or more stages of wet scrubbing. Depending on the process the systems can wash the waste gases with acid, lye or water. They are used to abate water soluble waste gases. *AQUABATE* Series is part of the DAS product range since 2004.

AQUABATE EPI - specially designed scrubber for the handling of hydrogen, abatement of epitaxy processes and similar processes. The system is resistant to acid and has a continuously evacuated cabinet. After the wet scrubbing the hydrogen-containing gas is diluted to prevent the occurrence of explosive mixtures.

AQUABATE FLEX - modular wet scrubber with high capacity which can be flexibly adapted to different customer requirements. Both single-stage as well as two-stage scrubbing processes can thus be realized with the scrubbing liquids acid, lye or water.

AQUABATE COMBIBURN - combination of *AQUABATE EPI* and *ESCAPE PLUS* for abatement of epitaxy processes with high hydrogen amounts. Soluble substances are treated in the wet scrubber. Afterwards the hydrogen is removed by combustion.

SALIX und SALIX *MINI*

SALIX is the latest point-of-use wet scrubber from DAS especially designed for the treatment of harmful gases from wet bench applications. The system does not use dilution air. The expensive conditioned clean room air is preserved. The scrubbers can work in two independent scrubber columns with different washing liquids (acid, lye or water).

SALIX *MINI* is the derivative of the **SALIX** and requires a lower footprint while offering comparable performance.

The systems do not require dilution air, so that the cleanroom air, which has been processed at great expense, is retained in the cleanroom.

Electrostatic dust collector

EDC and EDC *PLUS*

EDC stands for the treatment of process waste gases with a high content of particles and aerosols through electrostatic precipitation. Particle- or aerosol-containing process waste gases are typical in solar cell manufacturing where they can block exhaust systems. These micro- and nanosized dust particles can be removed inadequately by conventional wet scrubbing. In the **EDC** system the dust particles are ionized by high voltage electrodes and washed in a water flow. Here the groups of columns are rinsed with water and continuously cleaned. Due to the high deposition rate of above 99 %, **EDC** will not only comply with the strict limits of the TA Luft, but also prevent blocking of the process lines.

EDC *PLUS* was developed for the treatment of particularly larger process waste gas volumes. A still higher deposition efficiency and process availability are guaranteed with four groups of columns.

In combination with burn/wet systems like **STYRAX**, the **EDC/ EDC *PLUS*** is connected downstream and can be easily coupled to the process. Thus, the dust collection is only active if dusts forming corrosive gases occur. The operating costs are sustainably optimized.

Service

DAS offers a 24/7 service for system maintenance at customers' sites. Our service teams consist of DAS employees either working at DAS branches or directly at the clients' fab depending on the size of the installed basis. That is how service work is guaranteed at all times. Sometimes also employees of a partner company or the customer are being trained by DAS to fulfill service activities. Appropriate software tools and service

network connections do allow a remote supervision of DAS systems – either at the production facility or across continents and oceans at the DAS headquarters in Dresden.

Our Service Tasks:

1. Basic support comes with all DAS waste gas treatment systems to ensure smooth operation.
2. A mix of customized support will be developed to enhance process performance aiming for best up-time results.
3. Interactive process and data analysis are used to achieve continuous improvement, long-term performance stability and progress.
4. All DAS services are transferred to a global scale for all customer sites and tools pushing equal service quality standards and cost reduction globally.

Business Unit Water Treatment

Area of Application: Food and Beverage Industry, Paper Industry, Pharmaceutical Industry, Chemical Industry, Semiconductors, Waste Management

Cardinal Utility

DAS Environmental Expert GmbH offers its customers not only waste gas disposal but versatile solutions for efficient, safe and cost-effective wastewater treatment. Many processes in chemical, pharmaceutical or food production, for instance, the pre-treatment of organically contaminated wastewaters prior to discharging them into the environment or public sewage systems. This not only prevents environmental damage, but also reduces the company's sewage charges. DAS Environmental Expert GmbH is specialized in industrial applications and therefore offers particularly robust, user-friendly solutions tailored to the respective industry.

Optimizing operational water cycles offers considerable potential: In the EU alone, 40,000 million m³ of wastewater is treated and recycled annually. But only a fraction, 964 million m³, of the treated water is re-used. DAS supports its customers in the responsible use and conservation of this resource. It specializes in industrial applications and therefore offers particularly robust, user-friendly solutions customized to the respective industry.

DAS Solutions are Complete Solutions

DAS solutions always fit – no matter if installing a single treatment step, a complete wastewater treatment plant or supplying an entire fab with water treatment systems. DAS turnkey solutions are complete solutions that can get to work immediately. The company provides all steps of the process, from planning and concept development, to tailor-made adjustments to meet individual needs and specifications, down to the equipment's installation and commissioning. After complete commissioning, the company provides comprehensive service from general maintenance to a complete operating agreement. DAS also offers owners of existing wastewater treatment plants consultation on the optimization options available to them. Sometimes, an update to the plant's automation systems is all that is needed for a significant reduction in energy requirements. As such, DAS Environmental Expert also counts building control cabinets and programming OMRON and Siemens plant control systems among its services.

Successful Applications

Since first introducing wastewater treatment solutions, DAS has relied on the principle of the trickle-flow technology that is successfully operating in Europe, South America and South East Asia. Systems are employed prior to the discharging wastewater into sewage systems or before directly discharging them into rivers or water bodies. First trials along with functioning systems prove that trickle-flow technology is not only capable of treating easily biodegradable loads, but also provides the cost-efficient reduction of slowly biodegradable compounds. For further details, we gladly refer to our published references <https://www.das-ee.com/en/wastewatertreatment/case-studies/>

Matching the Application's Purpose

The design of each system depends on the biodegradability of the wastewater. In order to correctly evaluate the wastewater at hand, DAS Environmental Expert GmbH will often require preliminary tests in the Dresden laboratory. Based on this analysis, maximum attainable output, complexity and the necessary size of the TFR bioreactor can be assessed.

Afterwards, the optimum equipment scope will be further determined by installing an on-site pilot system or by early installing and commissioning the first reactor of a large-scale system.

Technology Portfolio

DAS' environmental technology experts have a large portfolio of technologies for efficient wastewater treatment and offer customized solutions for specific requirements.

Biological Processes for Wastewater Treatment

MBBR Technology (Moving Bed Bio Reactor)

The Moving Bed Biofilm Reactor (MBBR) is a technology for biological wastewater treatment in which the required microorganisms grow as a biofilm on carrier material. The support material provides a large specific surface area for the population of microorganisms, which makes the process highly efficient and reduces the space required. The aeration system ensures continuous complete mixing and thus optimal contact of the wastewater ingredients with the microorganisms and the added air bubbles. The shear forces within the reactor as well as the wastewater ingredients determine the thickness and quality of the biofilm on the carrier material: The higher the concentration of organic substances in the wastewater, the faster the biofilm grows.

Similar to other biological processes for the degradation of organic carbon compounds, the MBBR process also produces excess sludge. However, the amount produced in the biofilm process is significantly less than in activated sludge processes of similar capacity. And, because of the microorganisms living in biofilms, the MBBR treatment process is very robust and much more stable than other biological treatment technologies. In the event of a system failure, MBBRs typically recover very quickly, making them a very resilient solution for wastewater treatment.

Membrane Bio Reactor (MBR)

The Membrane Bio Reactor (MBR) is another option to achieve the oxidation and nitrification of organic substances in wastewaters; the degradation of pollutants takes place in an aerated sludge tank with a very high sludge concentration.

Using membranes, the separation of the treated wastewater from the sludge is achieved via ultrafiltration. The membrane filter module can also be submerged and integrated into pre-existing biological treatment stages; however, a separate reactor is considerably easier to service.

The MBR process is suitable for the biological treatment of highly contaminated industrial wastewaters. In addition, it is also often used for the purification of sanitary wastewaters and for the treatment of grey, rain and surface water.

Due to the membranes' very small pore diameter, bacteria and viruses cannot pass through the membrane filter, thus, germs are withheld. The water quality of the wastewater treatment plant's effluent meets the EU Bathing Water Directive. With its compact design, the MBR system can even be designed in container form as a fully mobile solution to suit temporary applications.

TFR Technology (Trickle Flow Reactor)

The TFR process (Trickle Flow Reactor) is a technology for biological wastewater treatment, in which the necessary microorganisms grow as biofilm on carrier material. Unlike the MBBR procedure the TFR operates according to the DAS trickle-flow principle. The wastewater trickles down through a very light, small-grain carrier material covered with a highly active mixed population of bacteria. The microorganisms degrade the pollutants into clean water and clean air. Unlike commonly implemented wastewater systems and international state-of-the-art, the TFR bioreactor's carrier material bed is not located within a closed body of water and thus can easily be supplied with sufficient amounts of oxygen.

Since the system's aeration does not entail high pressure and the biomass or the carrier material does not require artificial movement, the bioreactor consumes little energy while its simple set up makes it a nearly maintenance-free system. This offers the following advantages to its users: Low operating and investment costs, small equipment volume and low maintenance efforts.

Ranges of Application

The TFR bioreactor can be applied:

- To pre-treat wastewaters (entire or partial wastewater streams prior to discharge into own or municipal wastewater treatment plant)
- For complete treatment of wastewaters (prior to discharge into rivers and water bodies)
- Treatment for water reuse and water recycling

SBR Technology (Sequenced Batch Reactor)

The Sequenced Batch Reactor (SBR) is an activated sludge technology for the treatment of wastewater based on two separate systems. A pre-treatment stage is used for mechanical retention of coarse material and also functions as a collection tank from which the contaminated wastewater advances to a biological activation or secondary sedimentation tank, the so-called SBR-tank. Within the SBR tank, the inflowing wastewater is purified through a cyclic process and the aid of activated sludge containing a high concentration of microorganisms that remove organic substances from the wastewater. In order to ensure proper mixing and oxygen supply, the wastewater is circulated in regular intervals via air supply.

The aeration phase is followed by a resting phase without aeration, which causes the activated sludge to settle at the bottom of the reactor. In the upper part of the SBR tank, however, a clear water zone is formed. Finally, the purified water, removed from this upper water zone, is discharged into a receiving tank or drainage system. The excess sludge is drained from the bottom of the reactor and re-added to the pre-treatment stage; and the process starts again.

UASB Process (Upflow-Anaerobic-Sludge-Blanket-Method)

The Upflow Anaerobic Sludge Blanket (UASB) method is often used for biological treatment of industrial wastewaters. This method removes large amounts of organic contents, dissolved sugars, proteins and fats from wastewater.

Using microorganisms in a special reactor absent of atmospheric oxygen, the pollutants are chemically transformed into biogas. Biogas is a gaseous mixture that primarily contains methane and carbon dioxide and can be used as an energy source in production, typically in a cogeneration unit, to generate power and heat.

This particular version of a biogas plant is primarily used for the treatment of wastewaters in the food-and-beverage industry, as well as in the pulp-and-paper industry.

Aeration and Mixing with Ejectors

Biological wastewater treatment plants always require an active supply of oxygen or ambient air in order for the aerobic bacteria to work. DAS Environmental Expert GmbH uses ejectors as far as possible.

The Benefits of DAS Ejectors

DAS ejectors make optimal use of oxygen by forming fine bubbles that provide a large contact area between air and water. Since the level of oxygenation is equally dependent on both the bubble size (contact area between air and water) and the regeneration of the bubbles' border layer as a result of the turbulence in the water, the permanent mixing of the water means that ejectors offer a very high level of oxygen utilisation. The force of the incident flow towards the bottom of the basin prevents deposits from forming. The oxygen supply can be regulated easily by adjusting the volumetric flow rate of the air; the contents of the basin are mixed thoroughly at all points within the control range. The ejectors do not have any moving parts, so they require no special maintenance work.

The air/water mixture is fed into the basin with a high level of turbulence, which enables the ejector to guarantee optimum oxygen supply and thorough mixing. Even when the water has a

Wastewater treatment through Chemical and Physical processes

Sorption

Adsorption is the accumulation of substances on the surface of a solid body, which is a physical process where molecules stick to boundary surfaces through the van der Waal force. If chemical bonding binds substances to the surface of a solid body, the process is called chemisorption. In contrast to adsorption, chemisorption is non-reversible.

Wastewater treatment uses frequently activated carbons to bind soluble water contents that could not be sufficiently removed with lower-priced methods such as biological wastewater treatment, precipitation and flocculation. Colorants from textile dyeing plants, for instance, often can only be completely removed through adsorption on activated carbon. Anthropogenic trace elements such as pharmaceutical residues and polar organic substances like adsorbable, organically-bound halogens (AOX) also bind to activated carbon. But there are also other special sorption materials offered by DAS EE. These are used for applications such as the removal of arsenic and heavy metals.

Precipitation

Precipitation is a chemical process that separates a previously soluble substance from a fluid. A common method is to create a precipitation reaction by adding suitable agents. Through precipitation, heavy metals, for instance, transform to not easily soluble metal hydroxides. Other situations may require precipitation to carbonates or sulfides that can be applied.

Anions can often be precipitated as calcium, iron, and aluminum salts. The separation of fluoride ions, for instance, is achieved through precipitation with milk of lime or calcium chloride. During wastewater treatment in the treatment plant, adding salts like iron(II) sulfate, iron chloride or aluminum chloride lowers the phosphate concentration. The phosphate precipitation can either be integrated as simultaneous precipitation into the biological treatment stage or added as a subsequent separate process step.

Membrane Technology

Microfiltration is employed to separate particles, bacteria and yeasts. It is also used for cold sterilization and for the separation of oil-water emulsions.

Ultrafiltration serves to separate particles, microorganisms, proteins and turbidities from the water. Ultrafiltration is also typically part of the Membrane Activation Reactor (MBR). Since the build-up of clogging deposits on the membrane can be prevented, more and more pre-existing wastewater treatment systems are being complemented with ultrafiltration as a final step. When retrofitting older wastewater treatment plants, the ultrafiltration step can be positioned directly inside or as a separate stage after the activation tank in order to replace subsequent treatment steps or to increase the treatment capacity of the biological wastewater treatment. In water reuse applications, ultrafiltration is often used as a pre-treatment stage for sensitive reverse osmosis.

Nanofiltration retains viruses, heavy metal ions, large molecules and very fine particles. The method is used for example to water softening and the treatment of potable water and special industrial applications.

Reverse Osmosis also removes dissolved substances almost completely. It is an important process to concentrate landfill wastewaters, desalinate seawater and decalcify boiler water in power plants or as the last stage in the water reuse process. This method concentrates substances that are dissolved in fluids by applying pressure through a semi-permeable membrane that reverses the process of osmosis. When the applied pressure is higher than the respective osmotic pressure, the molecules of the solvent diffuse to the side of the membrane where the dissolved substance is already less concentrated. Reverse osmosis is also used to produce ultrapure water.

Flotation

Flotation removes dispersed or suspended substances from fluids by means of very fine gas bubbles that transport the substances to the surface, and subsequently, bubbles and substances are removed with a clearing device. In wastewater treatment, the flotation processes are used to separate oils, fats and finely suspended solids and particles.

The smaller the micro-bubbles, the better the accumulation of particles or droplets function. To this end, wastewater technology often uses Dissolved Air Flotation (DAF), a method proven to be economically efficient. In addition, auxiliary agents such as collectors, frothers, controllers and pushers support flotation processes.

Neutralization

Neutralization is used in wastewater technology to adjust the pH value. In particular after processes such as precipitation and flocculation as well as for the neutralization of industrial wastewater, acids or bases are added as required.

SALVINIA

Scalable MBBR Reactors in four Standard Sizes

As specialists for the biological treatment of industrial wastewater with the MBBR process, DAS Environmental Expert GmbH uses a special carrier material. It is characterized by a very high specific surface area. This makes the process highly efficient and enables a unique compact plant design. In the new SALVINIA product group, they combine effectiveness and compactness with time and cost advantages for their customers. The MBBR reactors *SALVINIA 70*, *SALVINIA 170*, *SALVINIA 470* and *SALVINIA 1060*, which are offered in four standard sizes, are characterized by particularly fast availability and project turnaround times and offer high cost-saving potential. Depending on requirements, DAS-MBBR reactors are of course also available in individual sizes.

Energy from Industrial Wastewater

For customers who want energy-efficient, high-performance wastewater treatment, DAS Environmental Expert has come up with a new product: the self-cleaning, high-efficiency DAS E-Plate heat exchanger. This heat exchanger has especially been designed to handle the demands of heavily contaminated wastewater with high solids content. The recovered heat energy increases the efficiency of existing wastewater treatment plants, allowing customers to save up to 40 per cent on heating costs.

E-Plate Features

- Wide ring clearances (12 cm) for almost no clogging
- Continuous self-cleaning using easy-to-replace brushes
 - Service life > 2 years
 - Easy to maintain and inspect during the course of general plant repair work
 - No redundancy required ▪ Pressure loss minimized for high efficiency
- Good heat transfer thanks to high level of turbulence (rotating brushes)
- Easy to operate and handle

Combines DAS Waste Gas and Wastewater Treatment

Area of Application: Solar Industry

Generating solar energy is considered a green technology, even though the production of solar cells predominantly uses process stages that have been common practice in the semiconductor industry for many years. As in the semiconductor industry the production of solar cells employs dangerous and environmentally harmful substances, which require abatement according to legal provisions.

The production of photovoltaic cells therefore is subject to strict requirements for abatement processes. Solutions need to be easy and cost-effective. The contaminated waste waters and waste gases should, under no circumstances, endanger the health and safety of humans, lower performance, or otherwise negatively affect the availability of production facilities. The safety of the production line must be guaranteed at every step and in every operating situation.

Requirements for Abatement Solutions in the Photovoltaic Industry

The demand for so-called “grid-parity” puts the photovoltaic industry under high cost pressures. The producers of solar cells therefore have expressed a growing demand for standardized processes and facilities. Integrated abatement solutions for the photovoltaic industry are therefore characterized by equally high proficiency in treatment of contaminated waste gases as well as waste waters. At the same time, all components need to work in a harmonized and compatible way. The abatement technology must guarantee the continued compliance with all legally binding emission regulations like TA-Luft (German Clean Air Regulations). And moreover, they should be adaptable to future legal regulations without any additional investment.

Competency and Know-how

DAS Environmental Expert GmbH specializes in waste gas abatement and wastewater treatment solutions that meet the highest safety and quality standards. Abatement technology by the Dresden-based company has been successfully employed in the global semiconductor industry for more than 30 years.

As a specialist for “point of use” (POU) abatement technology, DAS not only possesses extensive know-how for abatement of contaminated waste gases, but also the technological competence to deliver answers on the topics of operating safety and equipment integration specifically for the photovoltaic industry. Our knowledge is the basis to develop and provide abatement solutions that individually meet each specific demand. DAS Environmental Expert GmbH, moreover, has many years of experience in the treatment of contaminated industrial wastewaters – specifically particlecontaining wastewaters as they occur in the solar industry.

Based on this expertise DAS Environmental Expert develops economically sensible abatement solutions that are characterized by high functionality and high operating safety. To achieve this goal, DAS does not rely on adapting equipment from other fields of use, but develops specific solutions tailored to each customer’s application.

DAS Environmental Expert GmbH products offer integrated solutions for treating waste gases, wastewaters and fine particles. This combination enables the efficient treatment of all pollutants in wastewaters and waste gases accrued by the solar industry. Depending on your DAS product the reuse of water is a possibility to significantly lower the operating costs.

Highest reliability while keeping operating costs low – this is the strength of abatement solutions made in Dresden. With its technology, DAS Environmental Expert ensures that photovoltaics will maintain its growth opportunity as a green and environmentally friendly technology and as a source of renewable energy.

Fact Sheet

Foundation	1991 in Dresden as a spin-off of Elektromat and ZMD, Dresden
Headquarters	Goppelner Strasse 44, 01219 Dresden, Germany
Employees	630+ worldwide, 50 % of them in Germany
Partners	100 per cent privately owned
Products	<ul style="list-style-type: none"> • Point-of-Use systems for treatment and abatement of process waste gases • Since early 2006, process and system solutions for the treatment of industrial wastewater
Industries	<p>Focus: solutions for waste gas abatement Semiconductors, LED, TFT, Electronics, Nanotechnology, MEMS, Photovoltaics</p> <p>Focus: solutions for wastewater treatment Food and Beverage, Chemical Industry, Paper Industry, Semiconductors, Photovoltaics, Pharmaceutical Industry, Waste Management</p>
Branches/ Partner Offices	Taiwan, China (Shanghai, Hong Kong), Singapore, Korea, USA, Argentina and Peru
Production	100 % in Dresden
Customers	Approx 200 companies and research facilities in Europe, Asia, USA and South America

Milestones

Foundation

Entry in the Commercial Register on June 15, 1991 and establishment of DAS Dünnschicht-Anlagen-Systeme GmbH in Dresden on the former ELEKTROMAT site at Dresden Airport.

1. Installation **ESCAPE** technology and product qualification at Siemens Munich and Regensburg and the resulting industrial breakthrough with the first major order from Siemens for the newly built chip factory in Dresden (1995).
2. First appearance in Asia (Taiwan) with the Siemens reference in the backpack and the local business partner SPIROX (1996). Installation of the first plant in Taiwan (1997).
3. Financial consolidation through participation of a VC group of Deutsche Bank in the company (1997).
4. Award of **ESCAPE** license to Mitsubishi Kakoki Kaisha in Kawasaki (MKK). Signing of contracts on December 5, 2000 during SEMICON in Tokyo.
5. Establishment of DAS presences in Hong Kong/China (2002) and Kuching/Malaysia (2003).
6. Deutsche Bank's VC group is triggered, MKK becomes an open shareholder in the company (2004).
7. DAS sells **ESCAPE** license to Korean partner company GST (2005). The company founder receives the European SEMI Award for "Pioneer in Waste Gas Abate-ment Technology" (2005).
8. Diversification through acquisition and integration of a novel bio-technology for the purification of organically polluted wastewater from industry, municipalities and private households (2006). New markets are also emerging in the area of waste gas. The solar industry is growing noticeably and DAS is on the market in time with appropriate solutions.
9. DAS continues to grow. DAS China, headed by René Reichardt, joins the company group (2007). At the Dresden location, the company leaves the Technology Center South after purchasing the company property Goppelner Str. 44; company name as DAS Environmental Expert GmbH, Dresden (2008).
10. Complete return of MKK's shares to DAS Environmental Expert GmbH. Introduction and application of a quality management system, certified according to ISO 9001 at the Dresden site. Sale of the first biological wastewater treatment plant to a dairy in Uruguay (South America) (2009).
11. Foundation of the DAS Environmental Expert branch in Vietnam as well as construction and handover of a turnkey wastewater treatment plant for the French customer BEL in Vietnam. Installation of the first municipal wastewater treatment plant in Germany (2010/11).
12. Worldwide market launch of **STYRAX** (burn/wet) and qualification for 450 mm. With the product launch of **SALIX** (wet), DAS offers for the first time a system for point-of-use disposal of waste gases from wet bench applications in semiconductor manufacturing (2013). DAS Taiwan expands and moves into a new office in July 2013. DAS Experto Ambiental S.R.L. is founded in Argentina.

13. Successful market expansion to America; foundation of DAS Environmental Expert USA Inc. with headquarters in Boise. At the same time, the company establishes its own branch office in Singapore.
14. Introduction and application of an environmental management system at the Dresden site, certified according to ISO 14001(2014).
15. The DAS group of companies breaks the sales barrier of 50 million EUR for the first time. Expansion investment at the Dresden site to enlarge production and office space. Re-certification according to ISO 9001 (2015).
16. 15th foundation of a subsidiary in Peru.
17. 25th company anniversary; René Reichardt becomes equal managing partner of DAS EE next to his father Dr. Horst Reichardt (2016).
18. 20th anniversary of DAS Taiwan; opening of the Service & Innovation Center in Hsinchu, Taiwan (2017)
19. Strongest year in terms of sales
20. Establishment of the new Vision 2040
21. Establishment of DAS Korea (2018)
22. Construction and opening of the site expansion on the company's property at Goppelner Str. 44 (2021)

Corporate Social Responsibility at DAS

DAS Environmental Expert is very aware of the responsibility for the sustainable use of natural resources as an environmental technology company. Clean air and clean water are DAS' commitment! With systems and solutions for waste gas abatement and wastewater treatment DAS supports manufacturing industries to achieve their sustainability goals. Since 2014 DAS Environmental Expert is certified according to ISO 14001.

Satisfied employees are of high importance for our family-owned company. In addition to a very good infrastructure, there are numerous country-specific social offers, for example

- Support for young parents through flexible working hours
- Financial support for childcare
- Company benefits for accident insurance, health and pension
- Promotion of voluntary activities of employees
- Promotion of community activities such as team sports events, excursions and hiking days

DAS employees are involved in determining which projects DAS supports financially.

The fact that our company philosophy is also lived out in our subsidiaries worldwide is confirmed, for example, by the award of DAS China as a "worker-friendly company" by the local trade union.

DAS also focuses on the environmental experts of tomorrow: DAS has been working closely with the Bürgerwiese grammar school in Dresden since 2010. In addition to financial support, the children can apply and expand their specialist knowledge, for example in internships at DAS for schoolchildren. DAS is also an important partner for the vocational and study orientation of the pupils. By equipping a student environment laboratory with state-of-the-art equipment and supporting the work with the students, we want to awaken the children's interest in the natural sciences at an early age.

DAS also participates in the "Jugend Forscht" competition for young researchers on a voluntary basis and was the state sponsor of the junior division "Schüler experimentieren" in 2018 and 2019. DAS has been a state sponsor for "Jugend Forscht" since 2020. In this way, we support school students in developing their interest in scientific topics and also in pursuing a career orientation for the future. In view of the many current problems such as climate change and the scarcity of resources, it is particularly important to work together with younger generations to promote sustainable and environmentally compatible development of our planet.

As a growing company in the field of environmental technology, DAS is always looking for foreign personalities who bring with them creativity and new insights, different ideas and perspectives. For this reason, DAS Environmental Expert GmbH is a member of the network intap - the international talent project for Dresden. intap has set itself the goal of helping young professionals with an international background to find a job in the Saxon state capital and its surroundings and to firmly root them in Dresden's companies. DAS offers its employees and co-workers language courses, meaningful work and further development of projects, training courses for calling and personal development as well as special team events (company business, wall day etc.). An internally founded company-based Nations Club also enables a multi-cultural connection and the active exchange of individual members.

Our DAS branches worldwide support aid projects in their countries, for example to help children from poorer backgrounds and to protect the environment.

We are committed to such projects also in the future.

Follow our activities on Facebook via www.facebook.com/waterandair, on Instagram via www.instagram.com/das_career/ or on LinkedIn via www.linkedin.com/company/das-environmental-expert-gmbh.