

# Corporate Social Responsibility

## About this report

This chapter presents our corporate social responsibility activities. Socially responsible, environmentally conscious and resource-friendly behavior, promotion of responsible product solutions, commitment to human rights and our society as well as compliance and anti-corruption standards, and the advancement of sustainable product solutions are integral parts of SGL Group’s corporate culture and objectives. They are key requirements to the long-term success of our business. The information in this chapter relates to continuing operations in these areas, including proportionately consolidated entities.

## Fundamentals

This report presents the non-financial declaration by the SGL Group according to the CSR-Richtlinie-Umsetzungsgesetz (CSR Policy Implementation Act) which came into effect on January 1, 2017. We comply with the content-related requirements according to Sections 315c in connection with 289c of the HGB, in that we present our key non-financial activities with regard to the five aspects environment, employees, social requirements, upholding human rights and combating corruption and bribery in detail and transparently in a separate, non-financial group report. We present our business model in detail in the chapter “SGL Group” (page 39) of the group management report. In preparing this separate, non-financial group report, we use the guidelines in the Global Reporting Initiative as a basis, in particular for the non-financial performance indicators presented.

The content of the separate, non-financial group report was reviewed as part of an external assurance engagement with limited security by KMPG Wirtschaftsprüfungsgesellschaft (see information on page 71).

## Key issues

In 2016 and 2017 SGL Group performed a materiality analysis based on the criteria in the Global Reporting Initiative. The aim was to identify key sustainability topics for the company, and thus to create the foundations for the non-financial report. In line with the double materiality claim, this analysis considered the economic impact that an issue has on the company, and how SGL’s business activities impact third parties.

At the start of the process, SGL questioned representatives in various corporate functions on sustainability topics. In addition, the company has set up a project group comprising officers from all central group departments. In a second step, SGL identified

which topics are particularly relevant from a stakeholder perspective. In this regard the results of an analysis of competitors and the requirements of customers, employees and CSR initiatives were evaluated. The two business units went on to evaluate sustainability topics in view of the associated economic opportunities and risks for the SGL Group. In a subsequent meeting the project group discussed the issues identified to date in view of the criteria of the double materiality requirement and agreed these topics. A total of 23 material topics were derived and prioritized in line with their importance for the understanding of the course of business, earnings, the Company’s position as well as the impact its activities have on the aspects set out above (in line with Section 289c (3) of the HGB).

The key issues thus identified for SGL are broken down into “Compliance”, “Products (social affairs)”, “Environment, Health and Safety Affairs”, “Employee affairs” and “Corporate citizenship”. The following table shows the allocation of key issues to these various areas:

Area	Key issues for SGL
Compliance	<ul style="list-style-type: none"> <li>• Compliance Management</li> <li>• Anti-corruption and bribery</li> <li>• Compliance &amp; Anti-corruption in the supply chain</li> <li>• Human Rights</li> <li>• Social standards (incl. human rights) in the supply chain</li> <li>• Lobbying / participation in political processes</li> </ul>
Products (social affairs)	<ul style="list-style-type: none"> <li>• Product quality</li> <li>• Sustainable product innovation</li> </ul>
Environment, Health and Safety Affairs	<ul style="list-style-type: none"> <li>• Product compliance</li> <li>• Environmental impact of products</li> <li>• Energy consumption</li> <li>• Greenhouse gas emissions</li> <li>• Health and safety at work and health protection</li> <li>• Process safety</li> <li>• Waste management</li> <li>• Water consumption</li> </ul>
Employee affairs	<ul style="list-style-type: none"> <li>• Diversity and equal opportunities</li> <li>• Employability and development</li> <li>• Employer attractiveness</li> <li>• Leadership</li> </ul>
Corporate citizenship	<ul style="list-style-type: none"> <li>• Local communities</li> </ul>

The different chapters described the concepts that we are pursuing, and present the results of the activities put in place to date.

### **Key risks according to Sections 315c in conjunction with 289c of the HGB**

In this separate, non-financial group report, we consider the key risks for our business activities and also risks which have a material negative impact on the affairs set out as part of the non-financial report (Sections 315c in conjunction with 289c (3) Nos. 3 and 4 of the HGB).

In this regard, key risks have been identified for the individual affairs and evaluated in view of the management activities and controls. The group's risk management department has assessed the risk estimates made for the individual affairs with regard to risks that could very probably have a major negative impact. In summary, no material risks were ascertained which could very probably have a major negative impact on the affairs.

## **Compliance**

### **Compliance Management**

As a global group, SGL Group has particular responsibility for dealing with its employees, customers, business partners, shareholders and the public. The SGL Group's Code of Conduct is an integral component of our management and corporate culture, and given this background it sets standards for responsible, legally compliant behavior. This includes our compliance with internal and external regulations and that ethical and sustainable principles govern our activities. We also attach great importance to observing human rights at our sites. As a result, we have undertaken to comply with the principles of the UN Global Compact.

SGL Group's compliance program includes the Code of Conduct as well as additional internal requirements and policies for various target groups and specific topics such as the Antitrust Compliance Policy, the Program for Export Controls, the Whistleblower Policy, the Code of Conduct for Suppliers and Subcontractors, and the Anti-corruption Program (see "Combating corruption").

Our top-level objective for compliance is that all of our employees know and respect the requisite regulations, in order to reduce the risk of breaking the law, thus avoiding possible damage for the SGL Group. As a result, our compliance policies are a fixed part of our documents for new hires, and are issued

to all of our new employees. In regular twice-yearly reporting by our Local Compliance Representatives (LCRs), we have them confirm that this process is operating correctly. In addition, the confirmation of receipt which provides written documentation that the employee is aware of the regulations in the Code of Conduct, is filed in the employee's file.

The Chief Compliance Officer is responsible for the SGL Group's compliance strategy and monitoring the structures and processes in the Compliance Management System (CMS). He reports directly to the CEO. He is supported in his work by the Group Compliance department. The organization also includes the SGL Group's Compliance Network, which comprises Regional and Local Compliance representatives.

The effectiveness and efficiency of the CMS is constantly reviewed, and this enables the SGL Group to react in a reasonable manner to new statutory requirements and changes in its business environment. In this regard and in agreement with the Compliance Committee, the Group Compliance department identifies and defines any action that may be required and measurable objectives approved by the Board of Management. The results and the resulting downstream activities are summarized as part of an annual review.

Regular risk assessments form part of an effective compliance management system. The topics that Group Compliance defined as being core compliance risks (antitrust law, anticorruption, export control and customs and protecting business secrets) are regularly reassessed together with the business units' management, and the suitability of the existing compliance program is reviewed. The compliance risk assessment for core risks performed in the second half of 2016 together with the business units was completed in 2017 together with selected Corporate Functions. For further information on the compliance risk assessment and the material risks for the SGL Group please refer to the Corporate Governance and Compliance Report and the Opportunity and Risk Report.

Compliance topics are regularly documented by the Local (LCR) and business unit (BU) Compliance Representatives as part of our compliance reporting process. Semi-annual and annual LCR/BU questionnaires allow us to confirm that the compliance program is being implemented at our local sites and within the business units. The results from the evaluation of the questionnaires are discussed with the Board of Management, as well as the Supervisory Board's Audit Committee and Governance and Ethics Committee, and also form the basis for the reorientation of compliance activities.

The SGL Group aims to create an environment in which all compliance matters can be discussed in an open manner. As a result, our employees are encouraged to discuss all issues concerning integrity with their superior, the Compliance department or a member of the Compliance Network. In addition, over and above the existing communication and reporting channels, we also have a whistleblower system in the form of the Compliance Helpdesk. This allows employees to transfer information on potential compliance infringements confidentially according to our Whistleblowing policy; the Whistleblowing policy also regulates binding protection for the whistleblower.

Group Compliance reviews reported compliance-relevant issues as part of the internal compliance review. In doing so it ensures that non-compliant actions and violations are prevented and recognized in good time, that our company's activities comply with the applicable laws and statutory provisions, and that potential for improving our internal business activities is identified.

During the period under review SGL Group dealt with all of the notifications of potential violations with regard to anti-trust law, anticorruption, export controls and customers, protecting trade secrets, and anti-fraud which could result in financial damage or damage to the Group's reputation. These were all processed without exception in order to be able to derive and implement concrete activities if required. We are convinced that the components of compliance management presented as well as our monitoring processes are also suitable for ensuring behavior in line with the law in all of the SGL Group's areas in future.

Our transparent compliance culture is an integral part of our corporate culture. We promote this using target-oriented compliance training sessions. Our employees participate regularly in mandatory training sessions on the Code of Conduct which are offered by Group Legal & Compliance as face-to-face and e-learning sessions. Our employees also have access to all of the group-wide policies and training documents relevant for compliance, the Code of Conduct which was revised in 2017 and which is available in 9 languages, information on the Compliance Network as well as additional materials in the intranet.

As part of the Compliance Days, it was possible to further strengthen compliance awareness with the motto "Do it right - do it compliant" last year, reinforcing the compliance culture as part of our corporate culture. The training activities offered at all of SGL's sites are geared to all of our employees and included both information on the updated Code of Conduct and also on central compliance-related topics. During the reporting period so far 31 of 32 sites successfully participated in the initiative. In the offered trainings with our Code of Conduct as a core topic 1,347 out of 1,746 white collar employees participated on a voluntary basis. In addition, team meetings were conducted where supervisors trained their employees to the respective topic. Furthermore training sessions were offered for blue collar employees and so far 81% of the employees participated <sup>1)</sup>.

In addition to the activities described above, we have been performing a voluntary, group-wide employee survey on compliance topics since 2016. The survey is initially geared to employees around the world who have a company e-mail address.

This allows us to gain valuable feedback on the structure of our compliance program and compliance activities. The next survey is scheduled for 2018 and will include employees from all over the world.

### **Anti-corruption and bribery**

SGL attaches great importance to its excellent relationships with customers and suppliers. We demand and promote transparent, legal processing of all of our company's transactions. We do this to create trust and secure business relationships over the long term.

Our principles for fighting bribery and corruption are defined in our Code of Conduct, which applies throughout the entire group, in our Anti-corruption training concept and in our Policy for Gifts and Entertainment (G&E Policy). Our G&E Policy stipulates, for example, that tangible and intangible benefits which are made to a person or which are received by a person, must be in line with our policy and respect our business partners' rules and regulations. As already presented above in the Compliance section, our top-level objective also applies here - that all

<sup>1)</sup> At 4 sites, the compliance days in the production area had not been completed at the time of reporting. The location numbers were not included in the survey.

employees must be informed about all key policies and also uphold these.

SGL Group has a group-wide Business Partner Compliance Process (BPC) to monitor the risks and control of the work flows when dealing with intermediaries. This process includes having the new intermediaries go through a multi-stage check prior to signing the agreement. In addition to new intermediaries, existing intermediaries are also subject to regular reviews depending on risk category. This allows the BPC to ensure and increase transparency when working with intermediaries. Our BPC process and its implementation were subject to a regular audit last year.

In view of the constantly further developing underlying statutory conditions, SGL Group continuously optimizes its training content and constantly identifies training requirements. Anti-corruption was also a focus topic, which was addressed and communicated as part of the compliance days (see Compliance, page 14). In the subject-specific brief training sessions 1,318 out of 1,594 employees participated representing 83% of the target group. Especially employees from sales, purchasing and marketing functions are part of the target group. As part of the regular training plan for 2017 further trainings were conducted at selected sites as well as during regional meetings of business units and Corporate Functions. During these trainings 192 employees were trained.

The introduction of the e-Learning Anti-corruption program will be completed in 2018. All employees in defined areas of the SGL Group have to participate in this training. In addition, we also plan to expand our Business Partner Compliance program and to implement additional compliance controls as part of our internal control system (ICS).

### **Responsibility for the supply chain**

As one of the leading companies on the market, the SGL Group produces and sells its products all over the world and has a wide variety of business relationships. We expect that our business partners also undertake to behave legally, ethically and sustainably to the same extent as is the case for the SGL Group for the duration of the cooperation. In order to guarantee this, we have introduced a Code of Conduct for Suppliers and Sub-contractors (Supplier Code of Conduct). In addition to conduct rules which must be upheld with regard to integrity, combating corruption among suppliers as well as social and environmental standards, it also includes requirements for dealing with so-called conflict materials and a binding acceptance of the UN Global Compact principles.

Global Purchasing is responsible for implementing and applying the Supplier Code of Conduct which was introduced in 2015 and is anchored in SGL Group's general purchasing conditions. As part of the successive roll-out, the code was issued to risk-relevant target groups which had been defined in advance based on their proportion of the annual purchasing volume. We also request new suppliers who are stored in the SGL Group's system, to sign the code and our purchasing policy as part of the contractual documents, or to present equivalent compliance standards. In future, as part of the supplier selection process, compliance with ecological and social standards will play a more important role. The supplier assessments we have performed to date focused on process quality, risk, delivery stoppages and availability, economic stability, protection of expertise, as well as the management systems in place, and these criteria will be expanded in 2018 to cover corresponding social and environmental standards as part of our revision of our supplier management. During the period under review two subsidiaries and thus both business units in the SGL Group participated in a Together for Sustainability audit (TFS), an initiative by leading chemicals companies and which also reviews the activities implemented within the SGL supply chain.

The SGL Group has production facilities in a large number of countries, and delivers products to customers all over the world, which is why avoiding risks connected with trade activities and customs regulations is of major importance. These risks comprise potential limitations regarding deliverability, tax evasion, customs and other duties as well as fines and delinquencies. We aim for our compliance processes to ensure that the exchange of goods and technology and the use of services correspond to the respective internal and external requirements. This principle is reflected in the Global Trade Policy, which applies throughout the group, and also in the SGL Group's process instructions for the preparation, optimization and execution of all trade activities, for control mechanisms and also for the management and monitoring of risks and responsibilities.

Our export executives and export control delegates are responsible for export controls in our companies and units. Our compliance program for export control has been working with an IT-based compliance module since 2009. This supports the efficient monitoring of export transactions. Our export control processes are also a key component of the Compliance Risk Assessment (see Compliance, page 14). We aim to thus ensure that international treaties and national laws are always upheld for international transactions and inter-company transfers. In addition, our employees must make themselves aware of the

local laws and regulations on export controls and customs before embarking on any business travel.

What is more, we ensure that our employees are aware of all of the relevant export compliance regulations and that they regularly undergo additional training. Binding face-to-face training sessions and workshops are held in this regard every year. In addition, in 2017 the SGL Group updated its existing e-Learning program for export controls and added additional global and regional aspects.

Please refer to the section on Compliance on page 14 for information on the SGL Group's anticorruption activities and on doing business in line with regulations.

## Products (social affairs)

The SGL Group places very high demands on its products. This relates to both quality and also innovation. We believe that both of these aspects form the foundations for our current and, in particular, also the long-term success of our company.

### Product quality

The SGL Group aims to achieve a high level of customer satisfaction by delivering constant good product and service quality as basis for long-term business relationships. We try to completely avoid customer complaints as far as possible. In order to achieve this, we strive to recognize and remove deviations from the defined product quality in an early stage with appropriate inspections as well as constantly improving our production processes.

Our claim to product quality is anchored in our corporate mission statement. The business unit (BU) Graphite Materials & Systems (GMS) quality philosophy offers additional orientation for the BU GMS. Our definition of quality goes beyond pure product quality and also includes the quality of processes, information, communication and the organization. The focus is on customers and internal customer/supplier relationships. We foster an open and constructive handling of mistakes to counter in the future in the best possible way.

In order to measure our product quality performance, based on our different businesses and products we have set up individual product and site-specific KPIs. In addition, the global KPI Costs of Poor Quality (COPQ)/manufacturing costs is recorded in the BU GMS. This comprises the internal costs for scrap, rework and devaluation as well as complaint costs from all sites in relation to the manufacturing costs. The BU GMS aims to keep the entire

COPQ as low as possible and thus to have a positive impact on customer satisfaction by consistently improving product quality.

There are business processes in place for all sites to ensure high product quality. Some of these processes are global, some have been locally defined. They form the basis for a well-functioning quality management system according to ISO 9001. This comprises consistent incoming inspection of raw materials and purchased parts, complete planning of production processes as well as the machines and equipment used including their maintenance, ongoing inspections during production up to final inspection of products, consistent monitoring and control of relevant process parameters.

If there are still complaints in spite of this, however, the SGL Group aims to ensure direct, open and constructive dialogue with customers. This means consistently working through customer complaints and internal quality deviations, and then implementing corrective and preventive actions. We have put monthly reporting in place based on the local and global quality indicators. The management of BU GMS monitors the COPQ introduced in this business unit on a monthly basis, and reports major differences even to the Board of Management.

In 2017 the SGL Group performed various need-oriented and site-based individual activities in order to improve the quality of its products. In addition, in GMS we initiated a global Quality Initiative in the second half of 2017, which will run through 2018 and 2019. This initiative strives, in particular, to stronger sensitize employees and thus to sustainably increase quality awareness. Over the medium to long term this also aims to substantially reduce the COPQ.

In 2017, we introduced in the BU Composites – Fibers & Materials (CFM) a comprehensive Operations Management System to standardize processes and work out a common understanding in the production. This will be rolled out in the sites in 2018 and 2019. In the BU GMS, the introduction did also start in the second half of 2017. It will also be implemented in the GMS sites in 2018 and 2019.

Almost all of the sites in the SGL Group are certified according to the ISO 9001 Quality Management standard. In addition, in line with site-specific and overall requirements, there are also certifications according to ISO 14001 (Environmental Management), ISO 50001 (Energy Management), OHSAS 18001 (Occupational Health and Safety Assessment Series), AS 9100 (Quality Management for aerospace industry) and IATF 16949 (Quality Management in the automotive industry).

The customer satisfaction analysis performed in 2016/2017 confirms that we were able to achieve a high level of customer satisfaction in both our business units CFM and GMS in 2017. We were able to reduce the global indicator COPQ in the BU GMS to 2.20% based on manufacturing costs.

### Sustainable product innovation

The majority of product developments in the SGL Group are in the fields of mobility, energy and digitization. For example, in the mobility sector our light-weight construction products based on carbon fibers allow energy consumption in the automotive and aviation industries to be cut still further, and thus contributes to cutting CO<sub>2</sub> emissions. In the energy sector, our newly developed materials, such as graphites for Li-Ion batteries or components for fuel cells help to accelerate the transition from combustion engines to electromobility.

It only makes sense to evaluate our products with regard to their energy balance and consumption of resources across the entire value chain through to the full end product such as the car. As a result, instead of evaluating individual components or materials, the SGL Group participates in analyses which cover the entire value chain. This is performed together with partners in projects such as MAI Enviro: In this publicly subsidized project as part of the leading-edge cluster MAI Carbon, the entire value chain is analyzed - from production of the carbon fibers and their pre-product through to the automotive and its operation. In so doing, the advantages of using carbon fiber-based materials is worked out, and additional potential for improving the total energy balance is evaluated.

In addition to product innovations we also work constantly to improve the energy efficiency and environmental impact of our production processes. For example, last year we introduced battery graphite, which consumes a significantly lower amount of energy in production, to series production. We are developing studies and projects on new types of technology with reduced energy consumption when producing carbon fibers. Increasing material efficiency and thus minimizing the consumption of resources plays a key role in our future-proof 3D printing area. As part of the OEKOBAT project we are investigating the replacement of binder materials, which are required when graphite is used in lithium-ion batteries, with next-generation water-based and thus environmentally-friendly systems.

All of our innovation projects are phase-controlled. In so doing, our projects are checked for security and environmental requirements in each phase, if necessary activities are already put in place during the development process.

## Environment, Health & Safety Affairs

Responsibility for the environment as well as our employees' health and safety is a key component of the SGL Group's corporate culture. High standards in these areas are prerequisites for our company's sustainable economic success. SGL undertakes to create secure and healthy working conditions for its employees, and to minimize the impact its business activities have on the environment. The company has set this out in binding terms in its internal Code of Conduct and the EHSA policy (Environment, Health & Safety Affairs). A Code of Conduct for Suppliers and Sub-contractors has also been in place since 2015. According to this Code they are obliged to behave legally, ethically and sustainably.

The central corporate EHSA organization coordinates all group-wide activities for environmental protection and health and safety at work, sets uniform standards and audits the progress in cooperation with local EHSA representatives. It reports to the SGL Group's Board of Management once per quarter, informing it of the current developments.

In view of the EU directive to register, evaluate, authorize and restrict chemical substances (REACH), exchanging information on the use of substances is an integral part of SGL Group's collaboration with suppliers and customers. As a result, in line with statutory requirements, information on minimizing risk is exchanged with customers and suppliers. In this regard, we provide our customers with relevant product information such as safety data sheets for all substances and products produced by SGL Group in an internal standardized global web-based system.

We have further developed the company's set of values with the fundamental reorientation of the SGL Group, which will be published at the end of May 2018. Particular highlights are the environmental impact of our products, which we have identified as being a key issue as part of our materiality analysis. We plan to increasingly focus on this issue in future.

### Energy consumption and CO<sub>2</sub> emissions

The manufacture of carbon fibers and specialty graphites requires a large amount of energy. This is due, in particular to the use of special high-temperature technologies, which give the products their special material characteristics. In some process stages temperatures of up to 3,000 degrees Celsius are required. The bulk of the SGL Group's energy consumption is thus due to creating heat and also includes the thermal cleaning of emissions. As a company using a high amount of energy SGL has

special responsibilities with regard to climate change and the environment. Consuming energy is directly linked to emissions of greenhouse gases, in particular CO<sub>2</sub>. The SGL Group's CO<sub>2</sub> emissions are primarily scope-1 emissions which are created during combustion processes, and scope-2 emissions which are due to the company's electricity consumption. SGL pays attention to ensure that its processes are becoming increasingly energy efficient for economic reasons. Energy costs account for a large proportion of production costs. Fluctuations in the price of energy can have both a positive or a negative impact on earnings.

The top-level target for energy management is to use energy efficiently and to thus ensure constant improvements. The objective spans all types of energy and focuses on energy-efficient equipment and processes. It is set out in the EHSA guideline for energy management. This underscores the company's particular undertaking to take responsibility for protecting the environment and implement sustainability activities. The policy was passed in 2015 and applies for all locations worldwide. SGL also undertakes to constantly improve its energy efficiency in its Code of Conduct.

Since December 2015 all of the relevant European locations in the SGL Group have had an Energy Management System (EnMS) according to ISO 50001. Certification was performed by DQS GmbH and DEKRA. The non-European location in Moses Lake has also been certified to ISO 50001. Introduction is planned in 2019 for the locations in Gardena and Arkadelphia. Each location plans projects to save energy and improve energy-related performance, and implements these. The projects are evaluated in regular internal and external audits and also in the annual management review. Local energy management policies and activities also consider country-specific laws.

The EHSA Steering Committee is responsible for controlling and monitoring energy management at all locations. The individual production locations and business units are responsible for concrete implementation of the activities and controlling their success. For this purpose, each location has an energy officer, who reports to the location's managers or management at least once per year. Quarterly reports are performed at the location in Meitingen. Progress in reducing energy consumption is controlled once per year as part of inter-company tests. These tasks are performed by correspondingly trained internal auditors from other SGL locations. External audits are performed at least once every three years by an accredited certification institution.

As a result of the wide variety and complexity of the product range, SGL has only defined specific quantity-based targets for its energy management at select locations. In future, SGL also wants to form product families at additional sites, and add annual energy targets. Furthermore, SGL will also derive targets for reducing CO<sub>2</sub> emissions.

In order to constantly reduce energy consumption, SGL implements various measures, and over the past few years it has constantly invested in equipment with BAT technology (Best Available Technology). These maximum standards were created together with the ECGA (European Carbon and Graphite Association). Investments focus on regenerative thermal oxidization. As part of this technology, exhaust gases are thermally cleansed of hazardous substances and the energy required in this regard is regained from the exhaust gas to a certain extent. An additional activity is purchasing green electricity. At the Wackersdorf site, we procured our energy from renewable sources in 2017.

SGL also works together with external partners as part of its energy management. One example of this is the energy efficiency networks at our locations in Meitingen and Bonn. These are based on an initiative by the federal government, and serve the voluntary, systematic, and target-oriented exchange of experience among companies from one region or industry. For example, in Meitingen in 2017, SGL brought an energy project to life with the local municipality and additional partners. In so doing, the company undertook to provide a local new housing area with low-temperature waste heat for their home heating free of charge for 20 years. This heat is created in the plant when equipment and high-temperature furnaces are cooled. Thanks to this project, the local community can avoid emissions, and thus saves using primary energy by using the waste heat instead.

SGL would like its employees to become aware of energy as an issue, and to develop competences that they can actively use to reduce energy consumption. The company offered training activities for this purpose in 2017, and implemented internal communication campaigns. For example, all the parties in Bonn were trained on energy management as part of their annual security instructions. In addition, four so-called EnMS meetings are held there each year. At these meetings, employees from various departments meet, and discuss current issues for energy management. Employees at our Meitingen location received information on heating offices to save energy as part of a poster campaign in 2017. In addition, at our locations in Bonn and Meitingen, SGL distributed flyers from the Deutsche Energie Agentur (German Energy Agency). These flyers included tips for

efficient office lighting, and using devices such as computers and printers in a manner that saves energy.

Environmental data <sup>1)</sup>	2017	2016	Change
<b>Energy consumption</b>			
in gigawatt hours (GWh)	1,310	1,193	10%
thereof oil and gas	466	423	10%
thereof electricity	546	466	17%
thereof steam <sup>4)</sup>	298	304	-2%
in relation to economic output (MWh per €1,000 in sales revenue) <sup>2)</sup>	1.45	1.50	-3%
<b>CO<sub>2</sub>-emissions <sup>3) 4)</sup></b>			
in thousands of tons (kt)	368	338	9%
thereof direct	86	78	10%
thereof indirect	282	260	8%
in relation to economic output (t per €1,000 in sales revenue) <sup>2)</sup>	0.41	0.43	-5%

<sup>1)</sup> Data include pro-rata consolidated entities

<sup>2)</sup> Adjusted sales revenue (excluding price and currency effects); base year 2016

<sup>3)</sup> The calculation of CO<sub>2</sub>-emissions is based on "Greenhouse gas reporting - conversion factors 2017" of the Department for Business, Energy & Industrial Strategy, Gov. UK for direct emissions (Scope 1) and steam (Scope 2) as well as on "2017 CO<sub>2</sub> Emissions from Fuel Combustion online data service" of the International Energy Agency (IEA) for indirect emissions (electricity Scope 2).

<sup>4)</sup> Data collection was expanded by the category steam

### Health and safety at work and health protection

The SGL Group relies on having a highly performing workforce for its entrepreneurial success. As a result, our employees' health and safety is a central issue for our company. This is set out in the Code of Business Conduct and Ethics as well as the EHSA policy which applies worldwide.

SGL has set itself the target of consistently preventing work-related injuries and illnesses. Laws and internal guidelines are to be upheld without exception in all production processes and for all products. It is the responsibility of the Company's management and each individual employee to ensure safe working conditions. The aim is also to permanently improve the existing safety precautions. In 2017 the target frequency for accidents was 2.25 accidents per million working hours. This target was slightly exceeded with an actual result of 2.5. However, the frequency of accidents was once again very low. Global activities are to be put in place in 2018, such as the Safety Pledge Program, in order to keep accidents at a low level or to reduce this rate still further. The focus is to be placed on the two locations taken over from the joint-venture Benteler SGL, Ried and Ort in Austria. The accident frequency at these locations is currently higher than in the SGL Group.

The EHSA unit supports the business units in setting up management systems and process security, and further developing these. Concrete implementation is carried out by the respective business unit and management at that location. The EHSA Steering Committee meets four times per year, and is responsible for managing and supervising the health and safety at work activities. The committee comprises the Operations heads of the business units. It is managed by SGL's CEO Jürgen Köhler personally. In addition, SGL has a global EHSA network comprising the EHSA organization and the local EHS managers. It exchanges information on top-level issues and aims to ensure that all of the statutory regulations are upheld and that corresponding systems are put in place at the respective locations. All of the executives also must ensure that the employees in their area of responsibility receive training and support for safety issues.

SGL also uses various incentive systems to actively include its employees in preventing accidents, and considers their ideas for combating the risk of accidents. The issue of health and safety at work is anchored in the annual targets at the Meitingen facility. This location runs a campaign once per year. In 2017 this was a campaign on work and transport safety.

If an accident at work does happen, this is recorded in the group-wide Incident Management System. The cause of the incident is identified in a systematic process, and proposals for improvement are derived. In so doing, we take into account which methods have already worked in preventing accidents. In addition, the EHSA organization issues a safety report and relevant statistics to the Board of Management, managers of the business units, and the locations as well as the EHS managers once per month. In so doing, it reviews compliance with the EHSA policy, and in the case of negative developments it implements countermeasures immediately.

A key activity in attaining the objectives is the Safety Pledge Program. As part of this initiative, SGL asks its employees to make their own suggestions, irrespective of their hierarchy level, as to how their personal safety at their place of work could be improved. Participation is voluntary. The respective team's superior collect all of the proposals from his employees and reviews these. If required, he supports his employees in implementing these. One year later they both meet again. Then they exchange information on the extent to which the employee has been able to realize his own suggestion, and what has improved. This initiative was initially introduced in the USA in 2015, and has now taken place for the second time there. It has been in place in China since 2016, and in Europe since 2017. During



the period under review, 75% of production employees in China participated in this initiative.

SGL also holds regular employee training sessions as an additional activity. The company aims to increase its employees' awareness of safety relevant issues, and actively prevent accidents. At present, no information is collected on the number of training sessions and the number of participants.

During the period under review various activities were implemented at the facility in Meitingen on the subject of transport safety. In so doing, SGL aims to sensitize its employees for risks on the way to work. The training offered by the company also included a one-day driving safety training session for employees.

Health and safety at work and health protection are of great importance, not only at SGL itself. The company attaches great value to the corresponding standards at its business partners, and considers health and safety at work aspects when selecting suppliers. The code of content for suppliers and subcontractors stipulates that these must ensure their employees' health and safety at all of their workstations, and set up a management system for constant improvement.

### Process safety

Safe production processes are a material factor in preventing events such as accidents, fires or explosions. People and the environment can be substantially damaged as a result of such events. At SGL this could result in possible extended periods of production downtime and lower quality. In addition, the company would be responsible for the resulting damage, and have to rectify this. As a result SGL pursues the target of establishing safe production processes and constantly improving its safety culture.

As part of its entrepreneurial duty of care, the SGL Group has a global Process Safety Management Policy in place since 2017. As part of the policy, SGL aims to introduce a management system for process safety at all of its locations. The system includes various elements such as process safety analyses, a training program for operators and contracted employees, investigating accidents and the control of counter-measures. The EHSA unit supports the business units in setting up management systems for process security, and further developing these. Its task is also to monitor compliance with the policy and implementing corresponding counter-measures in the event of violations. Process safety is also an issue at the quarterly meetings of the

EHSA Steering Committee (see Health and safety at work and health protection).

In addition, SGL uses an Incident Management System for workplace and process safety (see Health and safety at work and health protection). As a result, each accident is precisely categorized. This ensures that the company can identify whether the incident was due to problems with workplace safety or process safety.

Since 2002 SGL has been using a group-wide uniform Risk Management System (RMS) in order to minimize risks in its production processes. In so doing, the company analyzes the extent and risk potential of crisis incidents. In addition, it calculates the economic consequences of these incidents such as the costs of rectifying environmental damage or lost sales as a result of production downtime. SGL implemented a total of 30 activities from 2016 to 2017 in order to improve process safety. These were mostly technical activities for repairs and maintenance, and also organizational improvements.

SGL Group performs annual audits in cooperation with the insurance company FM Global, which include a safety analysis of all processes and systems and simulation of stress scenarios. The results are evaluated and documented. If required, concrete activity plans are put in place. In 2017, as a result of the analysis, SGL introduced weekly tours at the Verdello facility in order to prevent damage. The company has installed a shut-off system in the main gas line in Gardena. A total of 14 facilities were audited in 2017. 11 of these facilities were awarded the Highly Protected Risk status - the highest possible safety level. In 2017 a total of nine accidents and serious near misses connected with process safety were registered at all of the facilities around the world. There were 11 in the previous year.

### Resource management (waste and water)

As part of SGL's business activities, waste products from carbon and residual materials are produced. Both carbon and also the residual materials produced in most of the production processes are highly recyclable. The company primarily uses water to cool production equipment.

SGL complies with all of the relevant statutory requirements when using resources and disposing of waste. In addition, company pursues the objective of using resources efficiently, and avoiding impacting the environment as far as possible. In this way, water consumption and the production of waste should be constantly reduced. Regarding waste, the SGL Group's principle is: avoidance is better than recycling and recycling is

better than disposal. Waste that cannot be prevented can often be reused in other products or at other locations. For example, recycled carbon fibers can be used as fleece textiles for automotive production. SGL uses water carefully, and uses secondary circuits and cooling equipment wherever this makes economic sense. As water generally does not come directly into contact with production, it is not contaminated, and can be discharged into rivers after use in some cases.

SGL has set out how it deals with resources in the EHSA policy and the policy on EHSA training. The Code of Conduct for suppliers and subcontractors also includes information on this issue. It obliges its recipients to obtain the requisite licenses, to recycle, and to avoid waste and emissions of hazardous substances into the environment. Once per month, together with the local EHS officer, the EHSA organization collects data at all of the facilities which shows the use of resources and generation of waste. Water consumption is stated for each water source, and a distinction is made between hazardous and nonhazardous waste.

SGL performed local activities and initiatives at various locations in 2017 in order to sensitize its employees for dealing with resources and waste responsibly. For example, in Meitingen SGL used posters to provide information on paper waste, and urged its employees to actively contribute to reducing this waste.

Environmental data <sup>1)</sup>	2017	2016	Change
<b>Water requirement</b>			
Total (millions m <sup>3</sup> )	9.08	8.72	4%
thereof from Company wells	49%	57%	-14%
thereof from rivers	31%	25%	24%
thereof from public water supply	20%	18%	11%
in relation to economic output (m <sup>3</sup> per €1,000 in sales revenue) <sup>2)</sup>	10.0	11.0	-9%
<b>Waste volume</b>			
in thousands of tons (kt)	19.2	19.3	-1%
thereof hazardous waste	3.2	4.2	-24%
in relation to economic output (kg per €1,000 in sales revenue) <sup>2)</sup>	21.2	24.3	-13%

<sup>1)</sup> Data include pro-rata consolidated entities

<sup>2)</sup> Adjusted sales revenue (excluding price and currency effects); base year 2016

## Employee affairs

SGL Group has a total of 4,193<sup>1)</sup> employees at more than 30 facilities in Europe, Asia and America. Their dedication, competence and performance are critical factors for the company's success. As a result, SGL aims to acquire the best talent for the company, and to specifically further develop its employees and enhance their loyalty to the company. In addition to the large number of opportunities for training and continuing professional development, SGL also employs a varied, fair and respectful working and management culture. The company offers all its employees the possibility to develop their full potential. This is set out in the Code of Conduct as well as the SGL Competency Model.

At SGL, the role of Human Resources is understood according to the so-called HR-Business Partner Model, that is to say as a strategic partner for the business units and an advisor for executives. HR activities span inclusion in strategic entrepreneurial decisions through to operational HR processes, which is reflected, in organizational terms, in the fact that there are HR Business Partners at various levels - globally for the business units, the central R&D department, and the Corporate Functions, and locally for the individual plants.

HR management with this structure is responsible for a large number of different tasks:

- Managing IT-assisted HR processes such as hiring and personnel administration, including questions concerning labor law
- Qualifying, coaching and training management and employees
- Defining remuneration programs for senior management based on market standards and performance
- Coordinating international employee assignments
- HR-related reporting to the company's management
- Contact for the Company's management for questions of personnel planning and covering these requirements
- Positioning the SGL Group as an attractive employer on the market
- Efficiently managing the HR impact of change processes

<sup>1)</sup> This figure shows the number of employees with non-limited term employment contracts. The number of employees for 2017 including limited-term employees is 4,734.

HR reports regularly to the Board of Management. The Head of HR meets personally with the CEO once every two weeks. As a result, top management is very aware of HR issues.

SGL keeps a keen eye on potential HR risks. This also includes the strategic importance of recruiting resulting from the increasing dearth of specialists. This also applies to the Group's efforts to increase employee loyalty serving to combat high employee fluctuation. The Group's forward looking competency management also plays a key role. This identifies the competencies which will be required in future and promotes these. In addition, unforeseeable risks can also result from employees' changing requirements and wishes. SGL uses an external advisor to record these for Germany. There is also a risk from adjustments to the remuneration system for middle and upper management, which is now geared more to performance.

### Diversity and equal opportunities

The variety of its workforce constitutes a strategic advantage for SGL: The employees' different competencies and perspectives reinforce the company's ability to innovate, and enhance its position as an attractive employer. This variety helps SGL Group to beat the competition for highly qualified specialists. It also allows it to combat the challenges resulting from demographic change. SGL also allows a valuable knowledge transfer by exchanging its employees internationally. This can bring about new potential solutions and allow synergy potential.

SGL aims to establish a non-discriminatory work and management culture in which all employees contribute their personal and specialist expertise, and make sure they have equal opportunities for career success and fair pay - irrespective of their sex, age, origins, religion, sexual orientation or health issues. SGL's Code of Conduct is a key pillar in its commitment to diversity and equal opportunities. In its Code of Conduct, the company backs a diverse and integrated working environment, characterized by trust, openness and respect. Disadvantages as a result of age, religion or origins will not be tolerated. "Valuing diversity" is also anchored in the SGL Competency Model as one of six components. The model includes vital, globally valid behavior requirements for middle and upper management. SGL always uses local collective agreement systems or similar systems for remuneration, which is why non-discriminatory remuneration can be assumed. In areas not covered by collective agreements, the recognized analytical job evaluation method according to Hay applied. SGL will take the new statutory requirements from the Entgelttransparenzgesetz (German Remuneration Transparency Act) into account in 2018.

In order to promote international exchange and knowledge transfer within the company, SGL deploys single employees to different locations worldwide. These international assignments are generally from one to five years. In 2017 the Group employed expatriates in China, Malaysia and Portugal.

Percentage of women	2017	2016
Total workforce	18%	16%
thereof Europe	18%	16%
thereof North America	16%	18%
thereof Asia	18%	19%
Senior management	14%	14%
Middle management	16%	15%
Talent pool	23%	15%

Age structure	2017	2016
< 30 years	15%	11%
30 to 50 years	54%	58%
> 50 years	31%	31%

Internationality	2017	2016
Total workforce	4,193	3,942
thereof Germany	1,817	1,789
thereof rest of Europe	1,243	1,014
thereof North America	704	711
thereof Asia	429	428
Number of expatriates	8	14

### Employability and development

In competition for the best talent top-quality for training and continuing professional development is of key importance. This type of offering not only helps to acquire junior staff and specifically further developing them. It is also the key to enhancing loyalty to the company for experienced employees and to keeping their knowledge in the Company for its long-term success.

The SGL Group aims to maintain its employees employability and to promote their professional and private development. Consistent personnel development is a fixed part of the Company's philosophy. It reinforces the company's competitive ability, taking over responsibility for its employees.

Vocational training has always played an important role at SGL Group. The company's vocational training offering spans 13 technical, commercial and IT professions in Germany as well as six dual study programs. SGL takes current developments such as increasing digitalization into account. For example, today, technical apprentices learn how to use 3-D-printers. In both Meitingen and Bonn in 2017 one apprentice in each case received an award as the best in his profession from the responsible chamber. In Meitingen a student was honored as being the best in her dual study program. The Bonn plant (SGL Carbon GmbH) received a certificate for the best training performance for the respective chamber.

In order to enthuse school pupils for technical professions, SGL has been a member of the Initiative Junge Forscherinnen und Forscher e.V. since 2010 as one of its founding members. The company supported this association to the tune of €10,000 in 2017 and also provided a great deal of personnel support. For example, the Head of HR at the Meitingen site is in the advisory council of the association's board.

SGL offers its employees opportunities for their personal and professional development throughout their entire career. This includes training and continued professional development, expanding tasks and responsibilities within a specific position, as well as changes of position. The SGL Competency Model forms the basis for HR work in this regard. It is used in particular in the SGL Dialog. This is a uniform, global, IT-assisted performance management instrument for middle and upper management. The manager agrees objectives with the employee in regular talks, and provides feedback on their performance. In addition, as part of this framework, they both agree on concrete individual development activities such as training sessions, coaching or special tasks.

The company links in to the results of the SGL Dialog to allow specialists and managers to participate in the Corporate Training Framework. The training offering passes on knowledge for communication, employee management, project management, sales proficiency and self-management.

In its Leadership@Work program SGL specifically prepares leaders and experts for further-reaching management tasks. The program is the key element in SGL's internal management development activities. It is characterized by the systematic use of self-reflection and feedback - for example from the use of 360° feedback, based on the SGL Competency Model. In addition, this series is very close to the real challenges faced in management work. This is achieved using so-called action-learning elements,

however in particular also by using mentors. These are select top managers at SGL which support the groups as co-trainers and coaches. More than 1000 employees have already participated since Leadership@Work was introduced in 2001.

The activities are supplemented with regular potential analyses. As part of the annual talent management process, SGL identifies and promotes talented staff. In so doing, the employees' management potential is assessed. In the second instance, SGL also evaluates potential for a specialist career. If necessary, the HR managers also discuss concrete target positions with the respective managers and employees, and plan corresponding development purposes.

A framework concept for expert careers was developed in 2017, in particular for the target group of experts who do not aim for a traditional management career. The Board of Management has approved this and it will be implemented from 2018.

<b>Apprenticeships and dual degree programs</b>	<b>2017</b>	2016
Total apprentices	102	108
- Site Meitingen	64%	61%
- Site Bonn	30%	33%
- Site Limburg	4%	4%
- Site Willich	2%	2%
Number of professions for apprentices	13	15
Number of apprentices hired as employees in Meitingen	19	14
Number of dual degree programs	6	4

<b>Personnel development and talent management (Key talents)</b>	<b>2017</b>	2016
Number of participants in the qualification portfolio "Corporate Training Framework"	175	84
Number of participants in the management development program "Leadership@Work"	20	66
Ghost rate in the talent pool (percentage of talent with no job change for six years)	7%	5%
Talents who left the company	6%	11%

### Attractiveness as an employer

It is becoming increasingly important for companies to be perceived as an attractive employer. This is due to factors including the lack of specialist staff. This is making it increasingly difficult to hire suitable employees. A wide variety of factors play a role in making an employer attractive. These include interesting opportunities for entering the company and careers, financial incentives, family-friendly working hours, as well as an appreciative leadership and corporate culture.

SGL has been using its own employer brand successfully since 2008. The company aims to retain its attractiveness as an employer, and to further expand on this. SGL plans to thus acquire experts and talent and to ensure long-term employee loyalty. This is one of the reasons why the Board of Management decided to perform a group-wide employee survey in 2017. This will be implemented for the first time in 2018 and is expected to be repeated every few years. It will show the progress that has been made in further developing the SGL culture.

A large number of additional activities and instruments also play a role in making SGL an attractive employer: from end to end personnel recruitment, reasonable remuneration, through to a personnel policy which allows employees to reconcile job and family.

SGL uses the slogan "Passion for Carbon" to position itself when looking for new employees - in job adverts, on its own careers page, at trade fairs and in brochures. As part of its university marketing, SGL specifically addresses universities and colleges and offers students various opportunities for entering the company - including internships, working as a student, and theses. The central Research & Development department "SGL Innovation" plays a key role in this regard. During the period under review, this department employed a total of 46 students from eight different countries, and around 28% of this figure were female. In addition, this department supported 16 bachelor and master's theses in 2017.

In its recruiting work, since 2017 SGL has also been approaching potential applicants in social networks. The recruiting process is already mostly standardized in Germany, the USA and China thanks to IT support. The medium-term target is to standardize the process all over the world as far as this is possible considering the legal and cultural framework conditions in the individual countries.

In addition to recruitment a further key issue is that the remuneration system is structured so that this is performance-

oriented and in line with the market, and consistently geared to the corporate strategy. In a top-down approach, over the past few years SGL initially adjusted the remuneration of its Board of Management, followed by its executives, and finally middle-tier specialists and managers. Local pension regulations were also changed. SGL Group offers its employees in Germany a company pension scheme as a voluntary component. This offers additional financial protection for the duration of their pension. These changes have been accompanied by various communication activities, which made them transparent.

In order to allow employees to better combine their careers and private lives, the overall works agreement "Alternating Teleworking" was passed for Germany in 2017. In future, this agreement will allow employees to work from home for up to 40% of their working hours. SGL tested flexible teleworking in Meitingen, Bonn and Wiesbaden in 2015 and 2016 with positive results. This is an additional activity to remain competitive in an international environment, reinforcing its attractiveness as an employer.

In particularly challenging professional or private situations, SGL employees in Germany can also benefit from external advice. The "Employee Assistance Program" (EAP) offers free, and if requested anonymous help with issues such as caring for dependents, childcare, finances, careers and health, 24/7. Employees can use this service in person, by phone or online. This offering was relaunched in 2017. It also includes newly designed information leaflets and posters at all of the German locations. A works meeting was held at the largest plant in Meitingen with a talk on EAP.

With regard to company healthcare management, employees in Germany can use a large number of offerings decentrally, i.e. at an individual plant level. In Meitingen there were, for example, training sessions for managers on how to reduce periods of absence, or preventing addictions in 2017. Employees were able to benefit from sports offerings such as spinal fitness or fascia training, and attend training on stopping smoking. Employees can eat healthily in the canteen. In addition this facility hosted a blood donation during the period under review.

Number of staff	2017	2016
Number of employees	4,193	5,384
Number of new hires (worldwide) <sup>1)</sup>	303	204
- thereof men	82%	81%
- thereof women	18%	19%
Fluctuation rate (worldwide) <sup>2)</sup>	8.5%	11.4%
- Europe	6.7%	8.3%
- North America	14.8%	22.8%
- Asia	10.8%	15.1%

<sup>1)</sup> Exclusively includes "real" new hires for employees with non-limited term contracts, i.e. not taking over temporary employees or removing limited terms on employment contracts.

<sup>2)</sup> Based on the average headcount, includes employees leaving the company voluntarily and involuntarily. The figures for 2016 include discontinued operations.

Part-time employment and reconciliation of work and family	2017	2016
Percentage of part-time employees in Germany <sup>1)</sup>	4.6%	5.0%
Male part-time employees (Germany)	1.4%	1.6%
Female part-time employees (Germany)	19.1%	20.4%
Number of employees who used the advice service (EAP) <sup>2)</sup>	2.4%	1.3%

<sup>1)</sup> The percentages of part-time employees for 2016 include discontinued operations

<sup>2)</sup> The usage rates for both fiscal years include discontinued operations.

## Corporate citizenship

Sponsoring and donations as well as active involvement of our employees are the components of corporate citizenship at SGL Group. As a so-called corporate citizen and a company acting responsibly, we aim to ensure that our charitable activities pursue transparent and uniform principles. We have set a standard which applies throughout the group in this regard with our policy for sponsoring and donations. This prohibits, for example, supporting any political activities by individuals or groups, and also any form of lobbying. It applies to all employees of the SGL Group, its subsidiaries, business partners and shareholders, as well as the members of its Board of Management.

The policy was revised in 2017 and forms the basis for the SGL Group's local involvement. In line with our management approach, we pursue the target of promoting, in particular, projects which are linked to the SGL Group in terms of their location or issues, in order to present the company as a corporate citizen in the regions surrounding our facilities. The policy

stipulates that charitable institutions, initiatives and projects that are dedicated to improving the quality of life should primarily be supported. The respective management teams at our various locations can decide to promote specific projects, initiatives, institutions or associations for up to €5,000. Sponsoring and donations for larger amounts must be approved by the Board of Management and the Corporate Communications and Marketing department must be made aware of these. The policy also includes concrete award criteria as well as instructions for the operational implementation of donation projects which regulate the approach to be taken by employees at the locations. Proper implementation of the policy is reviewed with the help of an annual survey of CSR activities. There were no violations of the policy in the year under review.

The Corporate Communications and Marketing department is responsible for performing and monitoring the sponsoring/donation activities. As part of the annual survey, expenses for CSR activities at all of the SGL Group's locations are systematically recorded, reviewed and summarized in an internal report.

The SGL Group has production facilities on three different continents: Europa, North America and Asia. This results in different circumstances, which are clear to see simply in the languages and cultures. The community activities we are involved in are equally diverse and often characterized by a strong personal commitment from our local employees. The activities range from community involvement, such as in the area of education, to supporting the local economy to fostering sports and cultural institutions.

In 2017 a little less than €90,000 was donated to more than 80 projects. The primary focus at more than 60% was on social activities, followed by education (19%) and sports (14%).

A further key issue last year was once again promoting scientific research. Activities in this area are controlled by our global group research. We award a number of prizes to provide scientists with incentives and to promote the discovery of new applications for carbon. During the period under review, the SGL Group Award was issued for the best thesis at the faculty of engineering at the Technical University of Munich, the Swabian Scientific Prize in Augsburg and the bi-annual Utz-Hellmuth-Felcht-Award for excellent scientific and technical developments for carbon and ceramic materials.

As a co-founder of the "Initiative Junge Forscherinnen und Forscher e.V." (IJF – Initiative for young researchers), SGL Group also

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offers comprehensive support for scientific education – from nursery schools through to universities. In 2017, SGL employees again supported the initiative with donations and active participation in the form of excursions. Promoting university education is also a key issue for SGL. For example, last year we once again supported different universities, for example the Technical University in Munich, the Technical University Nanyang in Singapore and the Scientific-Technical University in Krakow.