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The Business Model
Successful transformation of SGL Carbon.
Carbon and graphite for Megatrends
New SGL Carbon.
Focus on two innovative businesses

Focus on CFM and GMS improves the balance between markets and industries, and thus reduces volatility in our business.
New SGL Carbon.
Specialized on carbon- and graphite-based solutions

- Mobility
- Energy
- Digitization
- Industrial Applications
- Chemical
- Textile Fibers

31 Production sites

80+ Countries

~5,000 Employees

>€1bn Revenue in 2018
Global presence.
SGL Carbon worldwide sites
## Group market segmentation.

**Stronger orientation to customer and growth markets**

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Sales(^1) € million</th>
<th>Mobility(^2)</th>
<th>Energy(^3)</th>
<th>Digitization(^4)</th>
<th>Industrial Applications</th>
<th>Chemical</th>
<th>Textile Fibers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>1048</td>
<td>29%</td>
<td>16%</td>
<td>7%</td>
<td>26%</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>2017</td>
<td>860</td>
<td>19 %</td>
<td>22 %</td>
<td>5 %</td>
<td>29 %</td>
<td>14 %</td>
<td>11 %</td>
</tr>
</tbody>
</table>

\(^1\) Figures in 2017 do not reflect full consolidation of SGL ACF and Benteler SGL as well as disposal of SGL Kümpers

\(^2\) comprises automotive, aerospace and transport markets

\(^3\) comprises battery, solar, wind and other energy markets

\(^4\) comprises LED and semiconductor markets
Commanding entire value chain in carbon and graphite. Advantages in cost, quality and differentiation

Control over the entire value chain enables product customization to customer requirements.

Customers receive tailor made solutions from every step of the value chain.

Forward integration in finishing technologies (GMS) and CFRP-components (CFM) including application knowledge are essential for differentiation.

<table>
<thead>
<tr>
<th>Raw materials</th>
<th>Intermediate stages</th>
<th>Semi finished products</th>
<th>Solutions/components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cokes, pitches, natural graphites</td>
<td>Synthetic fine grain graphite blocks, expanded natural graphite</td>
<td>Machining, finishing, coatings (e.g. SiC), assembly</td>
<td>Heaters, anode materials for lithium-ion batteries, sealings, felts, process equipment and solutions</td>
</tr>
</tbody>
</table>

CFM
- Acrylonitrile, Polyacrylonitrile (PAN)
- Acrylic fibers, oxidized fibers, carbon fibers
- Preforms, prepregs, multiaxial fabrics, braidings, textile products
- Composite components, carbon ceramic brake discs, leaf springs

GMS
- Raw materials
- Intermediate stages
- Semi finished products
- Solutions/components

Customers
ROCE. Remains key management principle for managing the business

In 2014, we, the new Board of Management, introduced ROCE as new key management principle, replacing ROS.

As a result we implemented the ROCE target in all senior management layers, aligning their incentive system with ours.

We started reporting ROCE on Group and BU levels on a quarterly basis, so that our progress can be tracked.

While we are not yet there, we have made substantial progress toward our targeted ROCE$^1$

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$^1$ ROCE defined as EBIT/Capital employed; historical data adjusted to reflect “new” Group structure.
Growth & profitability targets. We increased our mid-term targets in December 2018 to reflect new growth opportunities.

Driver for ROCE improvement: Top line growth, higher margin products, efficiency improvements

Note: EBIT always refers to EBIT before non-recurring items

Additional 2022 targets:
- Net profit margin ~ 6–7%
- Free cash flow margin ~ 5%

Business Unit 2022 targets:
- $ROS_{EBIT} \geq 12\%$

Impact of new growth program on previous sales and EBIT targets for 2022:
- Higher sales and unchanged margin targets add low double digit million € amount to our EBIT target for 2022

Over the entire guidance period:
- Equity ratio $\geq 30\%$
- Leverage ratio $\leq 2.5$
- Gearing (except 2019-2020) $\leq 0.5$
Levers to further profitability improvement.

Sales:
Focus on higher margin innovative Megatrend markets (digitization, energy, mobility)
Increase in share of higher margin downstream businesses

Increase utilization of existing capacities (CFM) and capacity extensions (GMS)

Commercial Excellence: margin and KPI steered sales organization with focus on price increases, improved product mix, high margin and high growth areas

Costs:
Automation
Digitization
Global standardized and efficient processes: e.g. Operations Management System
Fully utilize Shared Service Center and transfer further transactional tasks

Portfolio:
Lightweight and Application Center will support market penetration in automotive industry by closing the gap between materials and applications

Battery laboratory: continuous build-up of own competencies to develop next generation material

Strategic and KPI-driven CAPEX planning and improved execution
SGL Carbon – our sales growth paths.
Different mid-term growth patterns expected in GMS and CFM

- Well developed material
- Well established markets and businesses
- "Linear" growth expected

GMS

CFM

- Young material
- Breakthrough in composites today
- We have to develop our markets
- Project-driven growth expected, back-end loaded

Graphs for illustrative purposes; not to scale
Business Unit
Composites- Fibers & Materials (CFM)
Reporting Segment.
Composites – Fibers & Materials (CFM)

Activities
- Carbon Fibers
- Composite Materials
- Composite Components
- Ceramic Brake Discs (JV with Brembo)

Key industries served
- Automotive
- Aerospace
- Energy
- Industrial Applications
- Textile fibers

Group sales 2018
- CFM 42%
- Total: €1,048m

Characteristics
- New applications in automotive, energy, industrial
- High earnings improvement potential
- Complete value chain in house

Strategic priorities
- Strengthen capabilities to safeguard globally leading position
- Develop products and production technologies for innovative customer solutions
- Exploit synergies across the value chain
Carbon fiber composites industry still in its infancy.

### Aluminum industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Industry</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1936</td>
<td>Aerospace</td>
<td>Douglas DC-3</td>
</tr>
<tr>
<td>1959</td>
<td>Industrial Applications</td>
<td>Introduction of aluminum cans</td>
</tr>
<tr>
<td>1961</td>
<td>Automotive</td>
<td>Land Rover V8 engine blocks</td>
</tr>
<tr>
<td>1994</td>
<td>Automotive</td>
<td>Audi Space Frame</td>
</tr>
<tr>
<td>2015</td>
<td>Automotive</td>
<td>Ford F-150</td>
</tr>
</tbody>
</table>

### Carbon fiber industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Industry</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late 1960s</td>
<td>PAN-based carbon fibers</td>
<td>First high-performance carbon fibers</td>
</tr>
<tr>
<td>1980s</td>
<td>Aerospace</td>
<td>US military aircraft</td>
</tr>
<tr>
<td>2009/13</td>
<td>Aerospace</td>
<td>Boeing 787, Airbus A350</td>
</tr>
<tr>
<td>2013/15</td>
<td>Automotive</td>
<td>BMW i3 and 7 series</td>
</tr>
</tbody>
</table>

- It took the aluminum industry 40 to 50 years from selected use in aerospace to serial use in automotive.
- Carbon fiber industry trails 30 years behind aluminum.
- Driven by environmental legislation, serial use of carbon fibers and composites in general just begins.
CFM growth strategy is based on commanding the entire value chain

**Upstream Area**
- Precursor
- Carbon fiber

**Downstream Area**
- Textile (dry material)
- Prepreg (impregnated material)
- Parts/Components
- OEM

- Security of raw material supply
- Quality control (precursor)
- Cost competitive Panox and carbon fiber

- Certified/qualified materials
- Cost control of intermediate production stages
- Elimination of interfaces

- OEMs* request part/component solutions from their suppliers
- Provide “one-stop shopping”
- Customer value creation

Demonstration of technology, development and series production competence along entire value chain is key

* In particular, the automotive industry, but also the aerospace sector
Our unique value chain and engineered solutions set us apart from competitors.

Our differentiators

- Engineered solutions
- Leading composites serial production
- Unique value chain from carbon fibers to components
- Industrial carbon fiber competence

Competitors

- Carbon fiber producers focused on providing materials, not components
- Focused on expensive carbon fiber not suitable for automated production processes
- Component producers not backward integrated
- Geared to expensive, time consuming and not scalable hand lay-up
Carbon fibers and composite materials. Strong demand growth anticipated

Global Carbon Fiber Reinforced Plastics (CFRP) Demand [in thousand mt p.a.]

Source: CCeV (November 2018)
CFM expected to grow ...

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Automotive</th>
<th>Aerospace</th>
<th>Wind Energy</th>
<th>Industrial Applications</th>
<th>Acrylic Fibers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales 2017</td>
<td>30%¹</td>
<td>6%</td>
<td>12%²</td>
<td>23%</td>
<td>29%</td>
</tr>
<tr>
<td>Sales 2018</td>
<td>53%</td>
<td>5%</td>
<td>2%</td>
<td>17%</td>
<td>23%</td>
</tr>
</tbody>
</table>

¹ Automotive sales in 2017 before effect from full consolidation of joint ventures with Benteler and BMW
² Wind energy sales in 2017 including full consolidation of SGL Kümpers, sold end of 2017
Automotive

SGL Carbon acts as full service and solution supplier to the automotive industry by offering engineering, prototyping and large-scale serial production for materials and components. Together with our global customers we develop new and innovative composite automotive applications, hence transforming the existing material world into a more dynamic one and introducing flexible ways of using high-tech composite materials for diverse customer needs.
Materials and components are suitable for various automotive parts.

Source: SGL Carbon, based on Volvo XC 90 chassis model
SGL Carbon is already well-positioned in the automotive industry.

Existing projects in different automotive vehicle segments

- Rear bench for performance sports cars
- Structural components for electric vehicles (EV)
- Leaf springs for light commercial vehicles and passenger car suspension systems
- Hybrid designs for large series passenger vehicles
- Friction materials for modern gear boxes

Source: Audi AG, BMW AG, Volkswagen AG, Volvo CC, SGL Carbon
CO₂ targets drive lightweight construction in the automotive industry.

OEM fleet target development (EU)\(^1\)
(in g CO₂/km)

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Expected targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>120</td>
<td>100</td>
</tr>
<tr>
<td>2021</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>2030</td>
<td>60</td>
<td>37.5%</td>
</tr>
</tbody>
</table>

New target EU 2018
-20%
-37.5%

Relative component weight\(^2\)
(in %)

<table>
<thead>
<tr>
<th>Material</th>
<th>2016</th>
<th>2021</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>120</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Aluminum</td>
<td>100</td>
<td>60</td>
<td>37.5%</td>
</tr>
<tr>
<td>CFRP quasi-isotropic</td>
<td>60</td>
<td>37.5%</td>
<td>20%</td>
</tr>
<tr>
<td>CFRP uni-directional</td>
<td>60</td>
<td>37.5%</td>
<td>20%</td>
</tr>
</tbody>
</table>

\(1\)status as of 17/12/2018
\(2\)with same functionality
Source: ICCT, SGL estimates
Automotive: By 2030 most cars expected to have fiber-reinforced polymer (FRP) parts.

- Racing/Super sports car
  - Monocoques

- Small series
  - “Class A” Carbon
  - Roofs
  - Mirror caps

- Serial production
  - “Life Cell”
  - Pillars
  - Roofs
  - Rear benches
  - etc.

- Serial production
  - “Carbon Core”
  - Multi-material mix
  - Center roof rail
  - Windshield frames
  - Etc.

- Industrial standard
  - Local FRP reinforcement
  - Thermoplastic components
  - Hybrid materials for battery enclosures
  - Leaf springs

Source: RedBull F1, Daimler AG, Audi AG, BMW Group
Automotive growth is expected to be driven by …

Local reinforcements
- A- and B-pillar reinforcements
- Roof rail

Leaf springs for passenger cars
- Pick-up trucks, SUVs, Vans
- New BEV vehicle concepts

Thermoplastic components
- Structural parts
- Easy to integrate into OEM assembly plants

Battery cases for BEVs
- Hybrid material solutions
Automotive: Current CFM project pipeline.
Since the beginning of 2018 nominated for 13 new serial products

<table>
<thead>
<tr>
<th>SOP*</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newly awarded projects**</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Start of production; **Status: March 27, 2019

- Leaf springs
- Trunk lids
- Stiffening elements
- Battery housings
- Preforms
Aerospace

Materials and components must be reliable and safe under extreme conditions. Fuel consumption must be reduced through lightweight design. These demands can be met with our carbon fiber reinforced composites. We offer the right solutions for primary and secondary structures, sub-systems or internal fittings.
The high production volume of narrow body commercial aircrafts requires serial production competency.

**Airbus monthly production volume forecast**

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>A350 (wide body)</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>A320 (narrow body)</td>
<td>46</td>
<td>60+</td>
</tr>
</tbody>
</table>

**Boeing monthly production volume forecast**

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>B787 (wide body)</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>B737 (narrow body)</td>
<td>42</td>
<td>58</td>
</tr>
</tbody>
</table>

Remark: “Narrow body” typically describes single aisle aircrafts, “wide body” aircrafts with double aisles.
Source: Airbus, Boeing
Aerospace: Composites market will continue to grow. Focus on operating cost efficiency

- Airline industry extremely competitive, constant battle over **cost reduction**
- Composites address this key customer requirement as lightweight construction reduces **fuel consumption**
- Strong commercial aircraft **CFRP market growth (CAGR > 8%)**\(^1\) driven by aircraft programs (e.g. A350, B787, B777X)
- Additionally, other commercial aircraft aerospace markets are accelerating – launcher, UAV, etc.
- Clear incentive to use composites, as customers are willing to pay for **reduced weight**

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\(^1\)Source: CompositesWorld, JEC, MarketsandMarkets.com, internal analysis

Source: SGL Carbon
Composite materials and components for commercial aircraft parts.

Source: SGL Carbon
Aerospace growth expected to be driven by …

Non-crimp fabrics for primary structures
• Automated textile preforming processes based on lay-up technologies
• Liquid resin infusion and out-of-autoclave curing

High-performance insulation
• Spare parts business for aero-engines, e.g. thrust reverser heat shield
• Fuselage insulation components

TowPreg materials in combination with fiber placement processes
• Fast curing pre-impregnated carbon fiber tow materials
• Automated material deposition by fiber placement processes

Next generation aircraft brakes
• 3D carbon fiber based preforms
• Dedicated carbon fiber for dry friction applications
Energy

Energy companies must ensure a reliable, flexible supply of energy to consumers. At the same time, cost pressures are increasing, and so are greater demands on efficiency. Genuinely high-performance materials are needed – in different sectors of the energy industry.
Wind energy is the key driver for the energy segment.

Key benefits of composites in the wind energy industry:
- Corrosion resistance
- Strength-to-weight ratio

Efficiency requirement for rotor blade design leads to potential for composites:
- The growing demand of efficient wind energy plants has led to new developments in wind turbine designs
- Plants with a large number of wind turbines with short rotor blades are being upgraded with a smaller number of wind turbines with longer rotor blades
- The requirement of longer rotor blades has resulted in a huge potential for composite use in rotor blade construction

1Source: Globaldata
Energy growth expected to be driven by ...

Supply of carbon fiber to growing pultrusion market
• Technology change from prepreg/textile to pultruded profiles
• Pultrusion provides better mechanical properties

Increasing carbon fiber need for on- and offshore wind turbines
• Increased blade length possible
• Reduced levelized cost of energy by using longer blades

Political driven need to reduce CO$_2$ emission
• Countermeasure against global warning
Industrial Applications

SGL Group is the only company to master all types of production processes, manufacturing everything from carbon fibers to composites. Our unique expertise allows us to tap the full potential of new materials. We offer solutions that fully meet our customers’ expectations in many different industrial sectors.
Industrial Applications growth expected to be driven by …

**Industrial grade carbon fiber for civil engineering**
- Carbon fiber materials to be used e.g. for infrastructure repairs
- Usage for concrete reinforcement in renovation and new buildings

**Fiber intermediates for compounding applications**
- Chopped carbon fibers within applications for consumer electronics
- Milled carbon fibers as anti-static coatings

**Tailor-made pre-impregnated materials for component manufacturing**
- Material basis for professional sports gear

**Small series components for engineering solutions**
- Lightweight applications within machining/tooling parts
- Customized parts for highly stressed applications
Levers to further profitability improvement.
CFM by value chain

**Precursor + Carbon Fibers**
- Develop advanced carbon fibers; e.g. aerospace, energy
- Sales growth will lead to increased capacity utilization of carbon fiber lines
- Conversion of low profitability textile fiber lines to precursor lines and increase efficiency of precursor production
- Leverage own precursor production and improve properties
- Develop higher margin acrylic fiber products

**Materials**
- Develop new materials and enhance production know-how, leveraging expertise of Lightweight and Application Center
- Broaden competencies in materials for energy and civil engineering market

**Components**
- Leverage series manufacturing capabilities (former Benteler SGL)
- Expand manufacturing footprint to USA and China
- Develop further products/technical capabilities

* including Textile Fibers
Levers to further profitability improvement.

CFM by market segments

Indicative/targeted sales

Overall:
Leverage Lightweight and Application Center: Gain know-how, provide tailor made products and win customer projects

Automotive:
- Full integration of SGL ACF and Benteler SGL post acquiring of remaining JV interests
- Increase presence in regions outside Europe
- Important projects won: significant German OEM project (SOP 2021)
- Numerous projects with OEMs and tier 1 (for leafspring, battery cases, components)

Aerospace:
- Expand product portfolio based on own precursor and sell products across entire value chain
- Extension of contract with Elbe Flugzeugwerke (Airbus) for A350 floor panels
- Product development with large aircraft manufacturers for adoption of SGL (50k) fiber in structural components (SOP beyond 2022)
- Planned increase in vertical integration with aerospace supplier for secondary structural parts (SOP beyond 2022)

Energy:
- Temporary sales decline by divestment of Kümpers joint venture
- Development of pultrusion know-how and capacities
- Significant order with additional wind energy customer won for deliveries from 2019 onwards

Industrial Applications:
- Increase market penetration through leveraging sales agent network
- Increase presence in regions outside Europe
- Develop materials for civil engineering market

Textile Fibers:
- Improve profitability by operational improvements & development of higher margin products (pigmented fibers and flame resistant fibers)
Business Unit
Graphite Materials & Systems (GMS)
Reporting Segment.
Graphite Materials & Systems (GMS)

**Activities**
- Anode materials
- Isostatic graphite
- Fiber materials
- Extruded graphite
- Die molded
- Expanded graphite
- Process technology

**Key industries served**
- Lithium-Ion Battery
- Solar
- Semiconductor
- LED
- Chemical
- Automotive & transport
- Industrial applications

**Group sales 2018**
- GMS 58%  
- €1,048m

**Characteristics**
- Higher value-added products enabling customer innovations
- Specialized, partially tailor-made, products for differentiated customers
- Innovation driven business
- Engineered products & solutions for customers from > 35 industries – some with high growth potential

**GMS sales 2018**
- Battery and other energy 19%
- Solar 8%
- LED 6%
- Chemical 23%
- Automotive & transport 8%
- Industrial applications 31%
- Automotive & transport 8%

**Strategic priorities**
- Focus on forward integration and innovation
- Combine material know-how and engineering competence
- Advanced material, equipment, and process solutions in cooperation with customers
- Global competence and presence
- Improve cost competitiveness
- Target new market segments

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1 e.g. electric discharge machining (EDM), oil and gas, glass, high temperature applications, metallurgy
GMS – the hidden champion.
Active in very attractive market segments

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Battery &amp; other Energy</th>
<th>Solar</th>
<th>LED</th>
<th>Semi-conductor</th>
<th>Automotive &amp; Transport</th>
<th>Chemical</th>
<th>Industrial Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>19%</td>
<td>8%</td>
<td>6%</td>
<td>6%</td>
<td>8%</td>
<td>23%</td>
<td>31%</td>
</tr>
<tr>
<td>2017</td>
<td>19%</td>
<td>10%</td>
<td>4%</td>
<td>5%</td>
<td>7%</td>
<td>24%</td>
<td>31%</td>
</tr>
<tr>
<td>Mid-term targeted CAGR in %</td>
<td>High single digit</td>
<td>Mid single digit</td>
<td>Double digit</td>
<td>Double digit</td>
<td>High single digit</td>
<td>Mid single digit</td>
<td>GDP-like</td>
</tr>
</tbody>
</table>

GMS positioning in high growth markets contribute to SGL Carbon’s 8-9% CAGR
Market segment Battery & other Energy
Our products for energy storage.

Fields of application and product examples

<table>
<thead>
<tr>
<th>Lithium-ion batteries</th>
<th>Flow and advanced batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialty graphite for lithium-ion battery anodes</td>
<td>Porous electrodes made from SIGRACELL® battery felt</td>
</tr>
<tr>
<td></td>
<td>SIGRACELL® bipolar plates made of expanded graphite compounds</td>
</tr>
<tr>
<td></td>
<td>SIGRACELL® graphite foils</td>
</tr>
</tbody>
</table>
Graphite is essential for lithium-ion batteries (LiB).
Graphite based anodes expected to remain dominant at least until 2030.

Source: Roadmap Nationale Plattform Elektromobilität and GMS assumptions

1SiO_x or carbon-silicon blended with major share of graphite; 2carbon-silicon: graphite blend ~ 1:1 3Si-dominant carbon silicon anode with graphite as additive
SGL opportunity supported by the regional shift of EV and cell production.

**EV LiB demand by region (in GWh)**

<table>
<thead>
<tr>
<th>Year</th>
<th>EUR</th>
<th>NA</th>
<th>Asia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>18</td>
<td>44</td>
<td>13</td>
<td>75</td>
</tr>
<tr>
<td>2019</td>
<td>20</td>
<td>44</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>2021</td>
<td>20</td>
<td>44</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>2023</td>
<td>107</td>
<td>44</td>
<td>13</td>
<td>121</td>
</tr>
<tr>
<td>2025</td>
<td>140</td>
<td>44</td>
<td>13</td>
<td>242</td>
</tr>
</tbody>
</table>

**CAGR 2017–2025**

- Total CAGR '17–'25: ~ 36%
- 2017–2023: 29%
- 2023–2025: 49%

**Market Details**

- LiB-cell mass production will be established in Europe and America
- Center of cell production will continue to be in Asia
- Announced cell production capacity for Europe: ~100 GWh
- Opportunity for SGL to participate in European supply chain for European cell manufacturing sites
- Comparable situation and opportunity for SGL in North America

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1. IHS Markit (BEV, PHEV, Full-Hybrid, only LIB) + own research
2. IHS Markit Data max forecast until 2023: CAGR 2023–2025: 25% (own estimate)
SGL supplies artificial graphite as key component into LiB supply chain.

Value chain

- Coke
- Pitch
- Natural graphite
- Silicon carbide

**Raw materials**

**Artificial graphite**
- Value chain to produce „bricks“:
  - Green (various recipes)
  - Baking
  - Graphitization

**Anode material**
- Crushing and milling
- Post-treatment (coating and/or annealing)

**LiB cells & packs**
- Cell production (cathode, electrolyte, separator and anode)
- Assembly of battery pack (located in Tesla’s giga factory)

**End use (OEM)**
- Automotive OEMs
- Electronic devices
- Power tools
- ...

SGL/HCC cooperation
Market segment Semiconductors
Our solutions and products for the semiconductor industry.

Fields of application and product examples

<table>
<thead>
<tr>
<th>Polysilicon production</th>
<th>Silicon single crystal growth</th>
<th>Silicon epitaxy</th>
<th>Compound semiconductor epitaxy (in MOCVDs&lt;sup&gt;2&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGRAFINE&lt;sup&gt;®&lt;/sup&gt; electrodes for Siemens reactors</td>
<td>SIGRAFINE&lt;sup&gt;®&lt;/sup&gt; meander heater for CZ&lt;sup&gt;1&lt;/sup&gt; units</td>
<td>SIGRAFINE&lt;sup&gt;®&lt;/sup&gt; SiC coated susceptors for silicon epitaxy reactors</td>
<td>SIGRAFINE&lt;sup&gt;®&lt;/sup&gt; SiC coated wafer carrier for compound semi&lt;sup&gt;3&lt;/sup&gt; wafer production</td>
</tr>
</tbody>
</table>

<sup>1</sup>Czochralski process; <sup>2</sup>MOCVD: Metal Organic Chemical Vapor Deposition reactor in which; <sup>3</sup>compound semiconductors are built by a thermo-chemical reaction of two or more semiconductor elements in gas-form
Semiconductor industry in super cycle supports base growth for years to come.

**Semiconductor – Silicon wafer shipments**
(in 1000 x MSI\(^1\)/a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Silicon wafer shipments (in 1000 x MSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>11.8</td>
</tr>
<tr>
<td>2018</td>
<td>12.7</td>
</tr>
<tr>
<td>2019</td>
<td>13.5</td>
</tr>
<tr>
<td>2021</td>
<td>14.8</td>
</tr>
<tr>
<td>2023</td>
<td>16.1</td>
</tr>
<tr>
<td>2025</td>
<td>17.6</td>
</tr>
</tbody>
</table>

**Market details**

- Silicon wafer shipments are proportional to graphite demand
- Semi is in a super-cycle with main drivers being AI\(^2\), IoT\(^3\), 5G, automotive and China 2025
- Memory for mobile and computing drive 300mm silicon wafer demand
- Power electronics and MEMS\(^4\) for automotive and mobile drive demand for ≤ 200mm Si wafers
- Wafer supply expected to remain short until 2020
  - Wafer prices continue to rise
  - Key players cautiously expand wafer capacity
- Increasing performance requirements

**Source:** SEMI, GMS estimates based on Gartner, Credit Suisse; \(^1\) MSI: mio square inch; \(^2\) AI: Artificial Intelligence; \(^3\) IoT: Internet of Things; \(^4\) MEMS: Sensors
Our expected double digit growth is fueled by high power applications, based on SiC\(^1\) and GaN\(^2\) semiconductors.

SiC and GaN power device market (in $m)

Market Details

- Wide Band Gap semiconductors offer new options where silicon reaches its limits
- Especially in power electronics, SiC and to some extent GaN are expected to establish themselves
  - PV inverters and power supply (as existing markets)
  - Electric vehicles, supposed to reach 40–50\% of the SiC device market
  - Rail and industrial motor drives
- GMS is well positioned to meet high customer demands

\(^1\)Silicon Carbide; \(^2\)Gallium Nitride
Source: Yole Development. IHS Market
Graphite solutions are mainly required along the entire silicon-based semiconductor value chain.

**Graphite products**
- Metallurgical silicon
  - Heaters
  - Heat shields
  - Reactor internals
  - Small electrodes
- Polysilicon
  - Heaters
  - Crucibles
  - Cones
  - Insulation
- Si crystal growing
  - Susceptors
  - Liners
- Epitaxy wafer
  - Arc slits
  - Etch electrodes
- Wafer processing
- (Chip) Packaging

**Materials**
- Extruded
- Iso
- SiC coating
- CFRC\(^1\), felts
- CFRC, felts

\(^1\)Carbon fiber reinforced carbon
Market segment LED
Our solutions for the LED industry.

Fields of application and product examples

<table>
<thead>
<tr>
<th>Field of Application</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal growth</td>
<td>SIGRAFINE® meander heater for crystal growth furnaces</td>
</tr>
<tr>
<td>Crystal growth</td>
<td>SIGRATHERM® rigid felt insulation cylinder</td>
</tr>
<tr>
<td>LED (MOCVD)</td>
<td>SIGRAFINE® SiC coated wafer carrier for LED wafer production in MOCVD reactors</td>
</tr>
</tbody>
</table>
LED market expected to more than double by 2025.
Driven by general lighting, specialty LEDs and micro LEDs in the long-term

Demand for packed LEDs (in bn units/a)

- General lighting remains the LED volume driver
- LED markets are diversifying
  - LED technologies open up numerous applications
  - Specialty LEDs (e.g. IR, UV, horticultural) are booming
- China plays a key role in both supply and demand, driven by government subsidies

Sources: Strategies Unlimited; Yole Development; Merrill Lynch; GMS estimates
LED production requires graphite solutions mainly upstream, in sapphire crystal growth and especially in the MOCVD\(^1\) process.

**Graphite products in the LED value chain**

<table>
<thead>
<tr>
<th>Crystal(^2) growth</th>
<th>Substrate wafers(^2)</th>
<th>LED-wafers (MOCVD)</th>
<th>LED chips/dies</th>
<th>LED module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sapphire boules(^3)</td>
<td>Sapphire ingots &amp; wafers(^3)</td>
<td>AIX G5+ C Planetary Reactor(^4)</td>
<td></td>
<td>LED lamp(^5)</td>
</tr>
</tbody>
</table>

**Graphite products**
- Heating elements
- Heat shields
- Insulation
- Wafer carriers
- Planetary susceptors
- Satellite discs
- Ceilings

**Materials**
- Iso
- Extruded
- SiC-coating
- GMS business

\(^1\)MOCVD: Metal Organic Chemical Vapor Deposition; key equipment for the production of LED wafers; \(^2\)\(^2\) 90% of LEDs are based on sapphire substrates; \(^3\)images with courtesy of Monocrystal; \(^4\)image with courtesy of AIXTRON SE; \(^5\)ID 52110090 © Yana Bardichevska | Dreamstime.com
Market segment Solar
Our products and solutions for the photovoltaic industry.

Fields of application and product examples

- **Polysilicon production**
  - SIGRAFINE® electrodes for Siemens reactors

- **Silicon mono crystal pulling**
  - Support crucible made from SIGRABOND® CFRC

- **Production of multi-crystalline silicon**
  - SIGRATHERM® MFA graphite rigid felt sheet

- **Anti-reflection coating**
  - SIGRABOND® CFRC carrier frame for solar wafers
2018 likely to see dip in PV demand but long-term growth path intact. Mono PV technology is set to dominate the growth

Global PV installations (in GW/a)

Market details:

- China subsidy cut in May 2018 leading to a temporary market decline
- Replacement demand for graphite unaffected
- History proved PV demand to be highly price elastic, thus growth expected to continue
- Switch from multi to mono technology impacts the full PV value chain and is beneficial for graphite consumption

Graphite is required along the entire photovoltaic value chain.

Graphite products in the photovoltaic value chain

<table>
<thead>
<tr>
<th>Graphite Products</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heating elements• Heat shields• Poly chucks</td>
<td>CFRC(^1)</td>
</tr>
<tr>
<td></td>
<td>Felts</td>
</tr>
<tr>
<td></td>
<td>Extruded/Vibro</td>
</tr>
<tr>
<td></td>
<td>Iso</td>
</tr>
<tr>
<td></td>
<td>SiC/PyC(^2) coating</td>
</tr>
</tbody>
</table>

\(^1\)Carbon fiber reinforced carbon; \(^2\)Pyrolytic carbon-coating
Market segment Automotive & Transport
Our solutions for the automotive industry.

### Fields of application and product examples

<table>
<thead>
<tr>
<th>Vacuum pumps</th>
<th>Fuel and water pumps</th>
<th>Sealings and gaskets</th>
<th>Exhaust gas recirculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGRAFINE® PTS rotor with vanes for brake assist pumps</td>
<td>SIGRAFINE® PTS bearings made from carbon graphite</td>
<td>SIGRAFLEX® expanded graphite foil for cylinder head and recirculation gaskets</td>
<td>SIGRAFINE® graphite bearings for exhaust gas recirculation valves</td>
</tr>
</tbody>
</table>
Automotive industry is forecasted to grow. GMS offers solutions for both EV and internal combustion engine (ICE) powertrains

Automotive global sales (in million units/a)

Market details
- Environmental legislation/CO₂ reduction targets
- Strong growth of e-mobility
- Market shifts towards Asia

Significance for SGL
- ICE: CO₂ reduction enabled by SGL products
- EV: Significant opportunities for SGL solutions in electric water pumps for cooling and in brake assistant pumps

Sources: Diverse sources and own calculations (2017/2018)
Market segment Chemicals
Our solutions for the chemical industry.

Selected product examples

<table>
<thead>
<tr>
<th>Heat exchanger</th>
<th>Columns</th>
<th>Pumps</th>
<th>HCl synthesis</th>
<th>Sealing materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIABON® graphite block heat exchanger</td>
<td>POLYFLURON® PTFE lined column</td>
<td>DIABON® centrifugal pump group in graphite for hot corrosive fluids</td>
<td>Bottom burner section of HCl synthesis unit</td>
<td>SIGRAFLEX® graphite sheet for gaskets</td>
</tr>
</tbody>
</table>
Global chemicals market grows with global GDP. With high dependence on China

Global chemicals demand (in €bn)

Market details

- New entrants, mainly from China, with the effect of overcapacities and price pressure
- Volatility in exchange rates, raw material prices and margins
- Consolidation ongoing especially in the area of commodities
- High dependence on Chinese growth

Source: Marketline, own calculations
SGL solutions enable many technologies and applications along various chemical value chains.

**Chemicals – General description of typical corrosive chemical processes**

<table>
<thead>
<tr>
<th>Intermediates</th>
<th>Chemical process</th>
<th>Chemical products</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Process technologies & systems**

- Acid production, e.g. hydrochloric or phosphoric
- MDI/TDI\(^1\) production
- VCM\(^2\) production
- Various technologies, e.g. leaching, concentration, dilution, purification, desorption, absorption, distillation
- Polyurethane production
- PVC production
- Phosphoric acid purification
- Variety of end products of chemical industry, e.g. plastics, food additives, fertilizer, pigments

**Sealing technologies**

- Corrosive and high temperature processes

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1. Methylene diphenyl diisocyanate/toluene diisocyanate
2. Vinyl chloride monomer

---

GMS business
Market segment Industrial Applications
Market segment Industrial Applications.

**Our solutions for high temperature furnaces**

- Heating elements and systems
- Thermal insulation
- Heat shields and insulation protection
- Charging systems and elements

**Our solutions for electrical discharge machining in toolmaking**

- Standard ready-to-run electrode
- Detail electrode for precise geometries
- Rib electrode
- Electrode for turbine blade production
Market segment Industrial Applications.

Our solutions for the metal industry

- Continuous casting
- Pressure sintering
- Powder metal industry
- Gas injection and distribution systems

Our solutions for the glass and refractory industries

- Container glass
- Float glass
Mid term innovation. New markets for our graphite based solutions are continuously developing

Glass bending
- Graphite needed as molds for bending of glass
- Today’s applications: smart phones
- Tomorrow: automotive displays

Optical fiber
- Ever increasing data quantities require more fibers
- Products: heating elements, insulation & CFRC support high temperature customer processes
The importance of the value chain
Specialty graphites come into play where other materials fail.

**Specialty graphite**

- **Machinability**: Machining speed not limited by material.
- **Machining speed**:
  - Increases with temperature, peaks at 2,400 °C.
- **Mechanical strength**:
  - Thermal shock resistance.
  - Thermal stability in vacuum over 3,000 °C.
- **Resistance to high temperatures**.
- **Corrosion resistance**:
  - Resistant to acids, molten glass & metals.
- **Purity**:
  - Finished part ash content <5 ppm.
- **Resistant to acids, molten glass & metals**.
- **Mechanical strength**:
  - Furnace parts & insulation.

**Other applications**:

- **EDM electrode**:
  - Vacuum pump.
  - Barrel susceptor.
  - Crucibles.

**Additional properties**:

- **Vacuum pump**:
  - Resistance to high temperatures.
  - Thermal stability in vacuum over 3,000 °C.
  - Furnace parts & insulation.

1 Electrical Discharge Machining
Fine grain graphite manufacturing is complex and know-how intensive with long production times.

Manufacturing process of fine grain graphite

- Coke & graphite
- Grinding
- Mixing
- Binder pitch
- Shaping (Isostatic pressing, vibration/die molding, extruding)
- Carbonizing (800–1,200 °C)
- Graphitizing (2,500–3,000 °C)
- Pitch impregnating
- Purifying (≥1,200 °C)
- SiC coating
- Finishing (Machining ≥2,700 °C)

4–5 months

2–12 weeks
GMS can offer tailored solutions for customer applications due to broadest portfolio and capabilities in the industry.

<table>
<thead>
<tr>
<th>Fine grain graphite</th>
<th>Expanded natural graphite</th>
<th>Carbon fiber-reinforced carbon and felts</th>
<th>Value-add process capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Isostatic</td>
<td>• Foils &amp; Sheets</td>
<td>• CFRC(^1)</td>
<td>• Base machining</td>
</tr>
<tr>
<td>• Extruded</td>
<td>• Yarns</td>
<td>• Rigid felt</td>
<td>• Advanced machining</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Purification</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• SiC Coating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Vibro molded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Die molded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Panels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Additives</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)CFRC: carbon fiber reinforced carbon
SiC coating is an example for high-value-add applications, offering premium sales prices and margins in the respective markets.

- Full leverage of GMS value chain
- Difficult to replicate by new-entrants:
  - Special iso grades applied and highly precise machining needed
  - High degree of innovation, technological expertise & process stability required
- High level of technological differentiation vs. competition
- Applications in fast growing LED and semiconductor industries
- Business opportunities with OEMs as well as aftermarket sales
Graphite materials enable innovation.

Examples:

- Advanced graphite anode materials for lithium-ion batteries
- Graphite foils and felts for stationary energy storage
- Additives for advanced lead acid batteries
- Advanced silicon carbide coated carriers for LED and semiconductors
- CFRC charging racks carriers for high-temperature applications
- Extra large reactors for polysilicon production
- CFRC column internals for chemical processes
- Special graphite grades for glass bending
- Graphite felts for fuel cell applications

Target approx. 1/3 of sales based on new products introduced over the last 4 years
Graphite Materials & Systems.  
Leading market shares in major end markets

Global markets shares 2017

<table>
<thead>
<tr>
<th>Market</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td>30%</td>
</tr>
<tr>
<td>Batteries &amp; other energy</td>
<td>20%</td>
</tr>
<tr>
<td>LED</td>
<td>20%</td>
</tr>
<tr>
<td>Solar</td>
<td>15%</td>
</tr>
<tr>
<td>Semiconductor</td>
<td>15%</td>
</tr>
<tr>
<td>Automotive &amp; transportation</td>
<td>15%</td>
</tr>
<tr>
<td>Industrial applications</td>
<td>10%-50%</td>
</tr>
</tbody>
</table>

Source: SGL Group’s own estimates
GMS already achieves sales growth and EBIT margin targets but expected to grow further. GMS by value chain

- Operational improvements (energy efficiency, de-bottlenecking, portfolio optimization)
- Sourcing excellence

- Strong growth in energy markets driven by expansion of product and customer portfolio
- Organic growth with investments (following customers – production in the region for the region)

- Strong growth in high margin digitization market (LED, semiconductor)
- Leverage ability to provide one-stop shop solutions based on the industry’s most comprehensive product portfolio
- Focus on total cost of ownership
- Participate in the fast changing mobility market
- Customize graphite anode materials for electric vehicles
- Components for solutions reducing CO₂ emissions (e.g. vacuum pumps, water pumps) serving automotive industry
- Technical competence close to the customer to strengthen position as solution partner
- Focus high labor cost activities in low cost countries (Poland, China)
- Automation
Levers to further profitability improvement.
GMS by market segments

Indicative/targeted sales

Overall:
• Efficiency gains in operations improve profitability

Battery & other energy:
• Expand capacities to grow with existing and new customers
• Investment into battery laboratory: develop next generation material
• “Economies of scale” and operational improvements compensate potential pressure on prices

Semiconductor & LED:
• Strongly growing and attractive market
• Utilize capacity in St. Marys and further expansion in other regions (China)
• Invest into technology & know-how

Automotive:
• Major customer projects won (e.g.: Bosch: parts for diagnosis tank leakage module pumps, Pierburg: parts for brake assistant pump)
• Focus high labor cost activities in low cost countries (Poland)

Solar
• Grow with market while improving profitability
Capex projects 2019-2021 in GMS.
Fully modular in nature

Battery and other Energy
- Capacity expansion for graphite anode materials for lithium-ion batteries
- Modular expansion strategy at low-cost location in Poland

LED and Semiconductor
- Expansion of SiC coating capacities in the US
- Establishment of a 2nd production outside the USA to better serve Asian customers

Automotive & Transport
- After investments in Bonn (Germany), expansion of our production site in Poland
- Solutions for brake assistant pumps, cooling water pumps, exhaust gas applications, etc.
SGL Innovation.
Focused on future growth markets

- Graphite anode materials for lithium-ion batteries
- Isostatic and extruded graphite
- Coated graphite for semiconductors
- Carbon and graphite felts
- Thermal management solutions
- Sealing materials
- Equipment for chemical industry
- Die molded materials for automotive

- Strategic scouting
- Advanced & future carbon fibers
- Future composites
- Future coatings
- 3D printed materials
- Next generation materials for lithium-ion batteries
- C/SiC\(^1\) ceramics
- Gas diffusion layers for fuel cells

- Textile and carbon fibers
- Textile materials
- Pre-impregnated materials
- Thermoplastic materials
- Wet friction materials
- Lightweight solutions & prototypes

\(^1\) C/SiC: Carbon fiber reinforced Silicon Carbide
SGL Central Innovation – Future Growth Areas.
From research and development to profitable business

**Startups:** Develop business with profitable growth

**Development:** Products & technology in cooperation with customers and partners

**Future growth areas:** Defined by analysis of markets and Megatrends in technology

- **Startup GDL**\(^1\) for fuel cell
- **C/SiC ceramics**
- **3D printing**
- **Nano Si/C for next generation lithium-ion batteries**
- **Future carbon fibers & textiles**
- **Future composites**
- **Future coatings**
- **Scouting: Medtec, water treatment, etc.**

\(^1\)GDL: Gas diffusion layer; \(^2\)C/SiC: Carbon/Silicon carbide; \(^3\)Si/C: Silicon/Carbon
SGL Central Innovation – Future Growth Areas.
SGL Carbon – A Pioneer in 3D Printing of Carbon Materials

**Base Process**
3D printing of carbon/SiC materials

**Post Treatment**
- Metal impregnation
- Polymer impregnation
- Siliconization

**Trademarks**
- CARBO-PRINT C®
- CARBO-PRINT M®
- CARBO-PRINT P®
- CARBO-PRINT Si®
- SICA-PRINT P®
- SICA-PRINT Si®

**Prototypes**

**Customers Advantage**
- Degree of freedom
  - Arbitrary design
- Individualization
  - Prototypes & small series
- High flexibility
  - Fast set up
- Cost reduction
  - Avoid/reduce machining

⇒ Developing prototypes with customers,
First products sold into real application

* Developed in cooperation with ExOne, Crosslicenced; ** SGL Group patents pending
Gas Diffusion Layers are a non substitutable component in all major fuel cell types. The typical GDL raw material is carbon fiber paper.

SGL Group has 20 years experience in development, production and sales of GDL material.

SGL is a quality leader for GDL materials.

Fuel cell market has grown with high double digit annual growth rates during last years.

SGL Group delivers more than 50 customers in all continents.

In 2017 we signed a long term supply contract with Hyundai Motor Corporation, one of the leading fuel cell car OEMs.
Summary
The new SGL Carbon.
In a nutshell:

- Material competence based on carbon\(^1\) and high temperature processes
- Commands entire carbon fiber and graphite value chain
- High tech carbon fiber & graphite based engineered solutions
- Diversified customer base – servicing more than 35 industries
- Sales growth fueled by the megatrends energy, mobility and digitization
- Targeting earnings growth more than proportionate to sales growth

---
\(^1\) Carbon refers to the chemical element – graphite and carbon fiber are forms of carbon
Thank you for your attention !
Backup
Outlook for fiscal year 2019
Reporting segment outlook 2019. 
CFM – guidance unchanged from outlook in March 2019

- Mid single digit **increase** in **sales** expected
  - Mainly driven by higher volumes
  - Sales in market segment **Aerospace** expected on prior year level and **Automotive** close to prior year level
  - Slight increase in sales anticipated for **Industrial Applications** and **Textile Fibers**, with the latter also depending on the development of raw material costs
  - Substantial growth anticipated in the market segment **Wind Energy**, albeit from a very low base as the prior year was impacted by the sale of SGL Kümpers and very low customer demand

- **Note**: in contrast to prior years, recurring EBIT in Q1/2019 expected to be the weakest in this fiscal year
  - Mainly due to **rapid and strong price decline of acrylonitrile** (ACN, raw material for textile fibers) at the end of last year, which resulted in reduced selling prices. We already experienced temporary margin contraction in Q4/2018 based on higher priced inventory of ACN. This trend continued into Q1/2019. The inventory of higher prices ACN is worked through in Q1/2019 and we are starting to see the margin pressure easing.
  - In the further course of the year we expect the lower raw material prices to have a **positive impact** on our earnings
  - **Project billing pattern** distributed differently in 2019 compared to 2018 – first quarter 2018 exceptionally strong due to high capacity utilization and high shipment levels related to particular projects – in 2019, we expect certain projects to be billed particularly in Q2 through to Q4

- **Therefore we confirm full year 2019 guidance for recurring EBIT to remain on prior year level**
Reporting segment outlook 2019.
GMS – guidance unchanged from outlook in March 2019

- **Sales** expected on prior year level which was boosted by initial adoption of IFRS 15
  - Higher **price** and **volume** effects likely to be offset by negative **currency** effects
  - Despite a temporarily weaker industry outlook, we expect our sales in the market segments **LED** and **Semiconductors** to increase substantially as we anticipate to increase our market share based on our technology leadership
  - Double-digit increase in sales also expected in the market segment **Automotive**
  - Market segments **Chemicals**, and **Industrial Applications** expected on prior year level
  - Close to stable development in **Battery & other Energy** to be viewed in context of positive IFRS15 effects in prior year
  - As in the previous year, sales in the market segment **Solar** likely to be limited to below the prior year level to prioritize the **LED** and **Semiconductors** market segment

- **Note:** in contrast to prior years, **EBIT** in Q1/ 2019 expected to be the strongest in this fiscal year
  - Approx. mid single digit €m positive IFRS 15 effect one-time in Q1/2019
  - High earnings level due mainly to an optimal combination of very good product mix, high utilization and low costs - unlikely to be sustainable at this very high level
  - Overall, shipment levels are skewed to H1/19, somewhat lower shipments planned for H2/19

- Therefore **FY 2019 EBIT expected on prior year level** which was boosted by initial adoption of IFRS 15
- **ROS**<sub>EBIT</sub> target of 12% should again be exceeded in this business unit and thus **stability of GMS’ business model** proven in a weaker overall economic environment
Reporting segment outlook 2019.
Corporate – guidance unchanged from outlook in March 2019

• **Recurring EBIT** anticipated close to prior year level
• Prior year included a €4 million **one-time impact** from a land sale in Q1/2018
Group outlook 2019. Guidance unchanged from outlook in March 2019

• Full year **Group sales** expected to increase mid single-digit mainly driven by volume increases
  – Despite weakening of overall economic environment
  – Prior year boosted by high effects from initial adoption of IFRS 15

• **Group recurring EBIT** expected around prior year level which was boosted by positive IFRS 15 effects
  – Adjusted for effects from initial adoption of IFRS 15, Group EBIT in 2019 is growing even faster than in 2018 and is approximately on the same level as previously expected

\[
\begin{array}{ccc}
\text{2017} & \text{2018} & \text{2019} \\
\€40.1m & \€47.2m & \sim\€65m \\
\end{array}
\]
Group outlook 2019. Guidance unchanged from outlook in March 2019

• **Net result – continued operations** expected to break even (2018: €41m)
  – Prior year included a high positive one-time effect of €28m from the full consolidation of SGL ACF
  – In addition, we expect substantially higher interest cost in net financial results mainly from the corporate bond issue in April 2019 to refinance existing debt

• **Capex** 2019 to increase compared to prior year to approx. €100m resulting from the new 5-year plan to capture additional sales and earnings potential from 2022 onwards
  – Mainly driven by higher capex in **Automotive & Transport, LED, Semiconductors**, as well as **Battery & other Energy**
  – Note: our capex projects are modular in nature and could be stretched out or postponed if required

• Substantial improvement in negative **free cash flow** from continued operations expected to a low double-digit m€ amount mainly due to working capital improvement and despite higher capex and higher interest costs – i.e. we are already **free cash flow positive** on normalized capex levels

• **Net debt** at end 2019 to increase by a mid double-digit m€ amount

• **Balance sheet targets** expected to continue to be met - **leverage ratio** at or below 2.5; as previously communicated, **gearing** target at or below 0.5 could temporarily be exceeded due to additional capex in the years 2019-2021
Latest financials Q1/2019
Composites – Fibers & Materials.

- **Sales revenue** in Q1/2019 stable (currency adjusted minus 2%)
  - Strong growth in market segment **Wind Energy** (albeit from a very low base) offset by market segment **Industrial Applications**
  - Remaining market segments **Aerospace, Automotive** and **Textile Fibers** approximately on prior year level

- As expected, recurring **EBIT** reached break even and thus on level of Q4/2018
  - Mainly due to temporary margin contraction in **Textile Fibers** from inventory of relatively high cost ACN and lower selling prices – pressure on margins have eased slightly in March
  - Lower earnings contribution also from **Wind Energy** despite higher sales due to temporary unfavorable product mix
  - Remaining market segments **Automotive, Aerospace**, and **Industrial Applications** approximately on prior year level

### Financials Q1/2019 vs Q1/2018

<table>
<thead>
<tr>
<th></th>
<th>Q1/2019</th>
<th>Q1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>115.0</td>
<td>115.0</td>
</tr>
<tr>
<td>EBITDA¹</td>
<td>9.0</td>
<td>17.9</td>
</tr>
<tr>
<td>EBIT¹</td>
<td>0.4</td>
<td>9.3</td>
</tr>
<tr>
<td>EBIT-Margin¹ (in %)</td>
<td>0.3</td>
<td>8.1</td>
</tr>
<tr>
<td>ROCE_{EBIT} (in %)</td>
<td>1.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

¹ before non-recurring items of minus €2.4 million in Q1/2019 and €26.7 million in Q1/2018
Graphite Materials & Systems.

Sales revenue in Q1/2019 up 17% (currency adjusted by 14%)
- Substantially more than 50% growth in market segments **Semiconductors** and **LED**, more than 40% in **Automotive & Transport**
  - Strong demand increase also in **Industrial Applications**; slight sales growth in **Chemicals**
  - **Battery & other Energy** on prior year level as expected
  - Sales to market segment **Solar** again limited to below prior year level as supply to **LED** and **Semiconductor** industries again prioritized

EBIT in Q1/2019 increased substantially more than proportionately to sales by 54% reaching a new record level
- Due to improvements in most market segments
- **Chemicals** and **Solar** remained on prior year level
- Despite strong increase in sales, **Automotive & Transport** below prior year level due to customary ramp-up costs for new projects

<table>
<thead>
<tr>
<th>in € million</th>
<th>Q1/2019</th>
<th>Q1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>164.2</td>
<td>140.1</td>
</tr>
<tr>
<td>EBITDA</td>
<td>32.2</td>
<td>22.5</td>
</tr>
<tr>
<td>EBIT</td>
<td>25.9</td>
<td>16.8</td>
</tr>
<tr>
<td>EBIT-Margin (in %)</td>
<td>15.8</td>
<td>12.0</td>
</tr>
<tr>
<td>ROCE_{EBIT} (in %)</td>
<td>17.4</td>
<td>13.4</td>
</tr>
</tbody>
</table>
Corporate.

Result slightly below prior year level as expected

<table>
<thead>
<tr>
<th>in € million</th>
<th>2018</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>35.1</td>
<td>18.0</td>
</tr>
<tr>
<td>EBITDA(^1)</td>
<td>-25.9</td>
<td>-24.3</td>
</tr>
<tr>
<td>EBIT(^1)</td>
<td>-32.2</td>
<td>-30.4</td>
</tr>
<tr>
<td>- of which for Central Innovation(^2)</td>
<td>-8.0</td>
<td>-9.4</td>
</tr>
</tbody>
</table>

- **Sales revenue** nearly doubled due to the disposal of our former PP activities. Services to PP now recorded as sales to third parties
- Recurring **EBIT** slightly below prior year level as planned
  - Earnings contributions of approx. €4 million from a land sale in Canada and slightly decreased **Central Innovation** expenses (due to higher subsidies for the Air Carbon III project)
  - Slightly more than offset by higher expenses related to the implementation of the Operations Management System (OMS) and other central projects, and the end of cost pass through to former PP activities, which were sold in 2017

\(^1\)before non-recurring items of minus €0.1 million in 2018 and €6.2 million in 2017; \(^2\)Groupwide R&D expense in 2018 amounted to €33 million
Higher sales revenue resulting primarily from stronger demand in the market segment **Energy** relating to parts for fuel cell customers supplied by our central research and development department (Central Innovation)

**EBIT** declined by €2 million from minus €5.6 million in Q1/2018 to minus €7.6 million in Q1/2019 only due to a €3.9 million one-time gain from a land sale in the prior year period - excluding this effect, EBIT would have improved due to
- Lower expenses following the implementation of the Operations Management System (OMS) in the prior year
- Central Innovation expenses of €1.7 million below prior year of €2.1 million due to higher earnings contribution from business with parts for fuel cells

<table>
<thead>
<tr>
<th></th>
<th>Q1/2019</th>
<th>Q1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>9.6</td>
<td>8.3</td>
</tr>
<tr>
<td>EBITDA</td>
<td>-4.9</td>
<td>-4.3</td>
</tr>
<tr>
<td>EBIT</td>
<td>-7.6</td>
<td>-5.6</td>
</tr>
</tbody>
</table>
Recurring EBIT declined by 9% to €18.7 million due to gain from a land sale in prior year period (impact of €3.9 million in Q1/2018). Excluding this effect in the prior year period, EBIT would have been €2.1 million higher in Q1/2019 due to higher earnings contribution from GMS and lower expenses in Corporate more than compensating for lower CFM contribution.

Net financing result improved due to positive currency effects on intercompany loans which more than compensated for higher interest expenses from new convertible bond issued in September 2018 as well as from the first time adoption of IFRS 16.

Lower net result due mainly to non-recurrence of positive non-recurring items of approximately €28 million from the full consolidation of former JV with BMW (SGL ACF) in the prior year period.

<table>
<thead>
<tr>
<th></th>
<th>Q1/2019</th>
<th>Q1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>288.8</td>
<td>263.4</td>
</tr>
<tr>
<td>EBITDA before non-recurring items</td>
<td>36.3</td>
<td>36.1</td>
</tr>
<tr>
<td>EBIT before non-recurring items</td>
<td>18.7</td>
<td>20.5</td>
</tr>
<tr>
<td>ROCE(_{EBIT}) (in %)</td>
<td>5.0</td>
<td>5.2</td>
</tr>
<tr>
<td>Non-recurring items</td>
<td>-2.4</td>
<td>26.7</td>
</tr>
<tr>
<td>EBIT</td>
<td>16.3</td>
<td>47.2</td>
</tr>
<tr>
<td>Net financing result</td>
<td>-6.2</td>
<td>-7.0</td>
</tr>
<tr>
<td>Results from continuing operations before income taxes</td>
<td>10.1</td>
<td>40.2</td>
</tr>
<tr>
<td>Income tax expense and non controlling interests</td>
<td>-1.2</td>
<td>-3.8</td>
</tr>
<tr>
<td>Result from discontinued operations, net of income taxes</td>
<td>0.0</td>
<td>-4.2</td>
</tr>
<tr>
<td>Consolidated net result attributable to shareholders of parent company</td>
<td>8.9</td>
<td>32.2</td>
</tr>
</tbody>
</table>
Free cash flow.

in € million (continuing operations)

<table>
<thead>
<tr>
<th></th>
<th>Q1/2019</th>
<th>Q1/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow from operating activities</td>
<td>4.1</td>
<td>-15.3</td>
</tr>
<tr>
<td>• Capital expenditures in property, plant, equipment and intangible assets</td>
<td>-15.4</td>
<td>-8.2</td>
</tr>
<tr>
<td>• Cash flow from other investing activities¹</td>
<td>7.6</td>
<td>-16.8</td>
</tr>
<tr>
<td>Cash flow from investing activities</td>
<td>-7.8</td>
<td>-25.0</td>
</tr>
<tr>
<td>Free cash flow</td>
<td>-3.7</td>
<td>-40.3</td>
</tr>
<tr>
<td>Free cash flow from discontinued operations</td>
<td>-10.5</td>
<td>62.6</td>
</tr>
</tbody>
</table>

• **Cash flow from operating activities** improved significantly to €4.1 million from minus €15.3 million due to lower increase in working capital

• **Free cash flow** also improved significantly to close to break even level due to
  – Improvement in operating cash flow and
  – Lower cash outflow from investing activities despite significantly higher capex as prior year period included payment for German part of SGL ACF (Wackersdorf site)

• **Free cash flow from discontinued operations** included
  – Cash outflow relating to final settlement payments to the buyer of HITCO Aerostructures in the reporting period
  – Cash inflow from the final outstanding payments for the sale of former PP activities in the prior year

¹ dividends received, payments for capital contributions in investments accounted for At-Equity and other financial assets, payments for acquiring remaining stakes in our joint ventures, proceeds from sale of intangible assets and property, plant and equipment
Balance sheet.

<table>
<thead>
<tr>
<th>in € million</th>
<th>31.03.2019</th>
<th>31.12.2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity ratio (in %)</td>
<td>33.0</td>
<td>33.5</td>
</tr>
<tr>
<td>Total liquidity</td>
<td>161.4</td>
<td>181.6</td>
</tr>
<tr>
<td>Net financial debt</td>
<td>263.6</td>
<td>242.2</td>
</tr>
<tr>
<td>Gearing (net debt/equity)</td>
<td>0.49</td>
<td>0.46</td>
</tr>
<tr>
<td>Leverage ratio (net debt/EBITDA)</td>
<td>2.1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

- Despite slightly higher equity, **equity ratio** decreased slightly due to increase in total assets
  - Equity increased slightly due to net result and positive currency effects, partially offset by adverse effect from adoption of lower interest rates on pension liabilities
  - Increased total assets resulting from initial adoption of IFRS 16

- Higher **net financial debt** primarily reflects final settlement payments to the buyer of HITCO Aerostructures
Appendix
**Capex investments at a glance**  
Capex projects are modular and can be stretched/postponed if required

<table>
<thead>
<tr>
<th>Major investment projects</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GMS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Battery &amp; other Energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– LED/Semiconductors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Automotive &amp; Transport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CFM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Automotive (components)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Conversion of acrylic fiber lines to precursor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other smaller investments</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance capex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€30-40m</td>
<td>€30-40m</td>
<td>€30-40m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total planned capex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Approx. €100m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The transformation of SGL Group.
We have implemented the announced strategy

- Disposal of the PP business to concentrate our resources on the growth areas CFM and GMS
- Focus on CFM and GMS improves the balance between markets and industries, and thus reduces volatility in our business
# Regional Sales Distribution.

## Sales by destination

<table>
<thead>
<tr>
<th>Sales</th>
<th>Germany</th>
<th>Europe outside Germany</th>
<th>North America</th>
<th>Asia</th>
<th>Rest of World</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>34 %</td>
<td>18 %</td>
<td>16 %</td>
<td>28 %</td>
<td>4 %</td>
</tr>
<tr>
<td>2017</td>
<td>26 %</td>
<td>22 %</td>
<td>19 %</td>
<td>28 %</td>
<td>6 %</td>
</tr>
</tbody>
</table>

## Sales by origin

<table>
<thead>
<tr>
<th>Sales</th>
<th>Germany</th>
<th>Europe outside Germany</th>
<th>North America</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>39 %</td>
<td>31 %</td>
<td>23 %</td>
<td>7 %</td>
</tr>
<tr>
<td>2017</td>
<td>41 %</td>
<td>32 %</td>
<td>21 %</td>
<td>6 %</td>
</tr>
</tbody>
</table>
Shares in issue and shareholder structure.

### Basic shares

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Security Identification Number</td>
<td>723530</td>
</tr>
<tr>
<td>ISIN Number</td>
<td>DE0007235301</td>
</tr>
<tr>
<td>Cusip Number</td>
<td>784 188 203</td>
</tr>
<tr>
<td>Number of Shares (as at April 30, 2019)</td>
<td>122,341,478</td>
</tr>
<tr>
<td>Free float</td>
<td>~ 46%</td>
</tr>
</tbody>
</table>

### Reported shareholdings according to §§ 21 f. WpHG and other notifications

<table>
<thead>
<tr>
<th>Company</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKion GmbH</td>
<td>28.5%</td>
</tr>
<tr>
<td>BMW AG</td>
<td>18.4%</td>
</tr>
<tr>
<td>Volkswagen AG</td>
<td>7.4%</td>
</tr>
</tbody>
</table>
## Debt market instruments.

### Convertible notes 2015/2020
*principal and interest put into escrow*  
| ISIN-Number: | DE000A168YY5 |
| Coupon | 3.5% |
| Principal Amount | € 167 million |
| Adjusted Conversion Price | € 17.0732 |
| Conversion Right (as at April 30, 2019) | 9.78 million shares |
| Issue Date | 14 September 2015 |
| Date of Maturity | 30 September 2020 |

*cash to redeem principal and accrued interest until maturity put into escrow from part of the proceeds of the 2019/2024 corporate bond*

### Convertible notes 2018/2023
| ISIN-Number: | DE000A2G8VX7 |
| Coupon | 3.0% |
| Principal Amount | € 159.3 million |
| Initial Conversion Price | € 13.0220 |
| Conversion Right | 12.234 million shares |
| Issue Date | 20 September 2018 |
| Date of Maturity | 20 September 2023 |

### Corporate bond 2019/2024
| ISIN-Number: | XS1945271952 |
| Coupon | 4.625% |
| Principal Amount | € 250 million |
| Issue Date | 10 April 2019 |
| Date of Maturity | 30 September 2024 |
## Financial calendar/contact details.

### Financial calendar 2019

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 27, 2019</td>
<td>Annual Report 2018</td>
</tr>
<tr>
<td>May 7, 2019</td>
<td>Report on the first quarter 2019</td>
</tr>
<tr>
<td>May 10, 2019</td>
<td>Annual General Meeting</td>
</tr>
<tr>
<td>August 6, 2019</td>
<td>Report on the first half year 2019</td>
</tr>
<tr>
<td>November 5, 2019</td>
<td>Report on the nine months 2019</td>
</tr>
</tbody>
</table>

### Contact

**SGL Carbon SE**  
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65201 Wiesbaden  
Germany  
Phone +49 (0) 611 - 6029 - 103  
Fax +49 (0) 611 - 6029 - 101  
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www.sglcarbon.com
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Due to rounding, numbers presented throughout this and other documents may not add up precisely to the totals provided and percentages may not precisely reflect the absolute figures.