WACKER – Silicon Competence

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WACKER – Our Growth Portfolio

Sales FY 2017 €4.9bn

Our Targets: Growth and Cash

1. Extend Leverage Phase
2. Continue to Grow Above Chemical Production
3. Focus on Sustainability
4. Sustain Attractive Margins Through Economic Cycle
5. Generate Cash

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SILICONES
Key Trends and World Class Efficiency Drive Growth

Full portfolio provider with benchmark costs

Growth with focus on specialties
SILICONES

Highest Level of Integration in the Industry

Open Loop Silicones & Poly Production

Standard Processes

CS-Synthesis

Polysilicon

HCl

Waste

Müller-Rochow

Siloxane

HCl

Unique Silane-Silicone-Silica Loop

WACKER

Si

CS-Synthesis

Polysilicon

HCl

Waste

MeCl

Müller-Rochow

Siloxane

HCl

NaCl

Methanol

Fumed Silica

Chlorosilane

Organosilane

Müller-Rochow

Silica Loop

WACKER Silicon Verbund: Perfectly closed production loops

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“Verbund” Enables Highly Competitive Cost Position

“WACKER Silicon Verbund”

- Charleston (TN, USA)
  - Polysilicon
  - Fumed silica, GFO 2019

- Burghausen (Germany)
  - Siloxane
  - Polysilicon
  - Fumed silica

- Nünchritz (Germany)
  - Siloxane
  - Polysilicon
  - Fumed silica

- Zhangjiagang (China)

Joint Venture with DOW:
- Siloxane
- Fumed silica

Verbund sites
Other large production sites
SILICONES
Operational Excellence is Key

Siloxane
Index 2012 = 100%

Fumed silica
Index 2012 = 100%
SILICONES
A World of Unlimited Potential

...when other materials fail
**SILICONES**
Silicones Create Value in Many Industries

### Market structure by application

<table>
<thead>
<tr>
<th>Application</th>
<th>Market Portfolio 2017 ~ €12.6bn¹</th>
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<tbody>
<tr>
<td>Automotive</td>
<td>10%</td>
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<tr>
<td>Energy &amp; Electronics</td>
<td>10%</td>
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<tr>
<td>Mfg. Machinery</td>
<td>10%</td>
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<tr>
<td>Coatings</td>
<td>10%</td>
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<tr>
<td>Construction</td>
<td>15%</td>
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<tr>
<td>Consumer Care</td>
<td>13%</td>
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<tr>
<td>Health Care</td>
<td>5%</td>
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<tr>
<td>Advanced Processing &amp; Perform. Additives</td>
<td>5%</td>
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</tbody>
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### Market volume/shares (€bn, %)

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<thead>
<tr>
<th>Year</th>
<th>Dow</th>
<th>Shin Etsu</th>
<th>Momentive</th>
<th>Others</th>
<th>Elkem/Bluestar</th>
<th>WACKER</th>
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<tbody>
<tr>
<td>2011</td>
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<td>2017¹</td>
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<td>2022</td>
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¹ preliminary figures, Source: Freedonia 2017, Company Reports, WACKER Estimate
SILICONES

Key Trends Drive SILICONES’ Growth

- Renewable Energy / E-mobility
- Communication
- Urbanization
- Standard of Living
Product innovation

Substitution Drivers
Process efficiency & unique material properties

WACKER SilGel® for optical bonding

New Markets
High performance products for future growth markets

ELASTOSIL® R for EVs
Silicones in automotive: €600m market value in 2017

- Spark plug boots, ignition / battery cables
- Engine / radiator / intercooler / EGR: seals, gaskets
- Turbocharger hoses / radiator hoses
- Oil-system: anti-drain-back valves
- Air-circulation: flaps, gaskets
- Additional electric heater: gaskets
- Vibration dampers, buffers
- Airbag coating
- Rain sensor/camera: coupling cushion
- Sunroof profiles
- Interior: switches, cup holders, light guides
- Exhaust pipe hangers, dampers
- ABS/ESP controllers: sealing, vibration decoupling frame
- Drive shaft couplings
- PDC, radar, airbag sensors: gaskets
- Lighting: seals, lenses
- Wire harness: connector, multi-cavity seals
- Engine mounts
- Car key: keypads
- Drive shaft couplings
SILICONES
EVs: Need for New Materials with New Profile of Requirements

- **Lithium-Ion-Battery**
  - Long range
  - Quick charging cycles

- **Sensors / Infotainment**
  - New, electroactive polymers

- **Electronics**
  - Thermal Interface Materials (TIM)
  - Drives
  - High-performance electronics

- **Electrical insulation**
  - 800V-systems
  - Low weight

- **Lightweight design**
  - High-strength, lightweight materials

- **Thermal insulation**
  - Low weight
  - Low volume
**SILICONES**

Thermal Management of EV-Cell Packs Through Silicone TIMs

**Example: Thermal interface materials (TIMs)**

- Sealing of battery module
- Sealing of battery housing
- Coupling of cells / modules to active cooling
- Thermal management
- Potting of electronics in battery management system
- High voltage cables & connectors
- Sealing of battery housing
- Couple cells for vibration control (bonding)
SILICONES
Specialties Meet Increasing Performance Requirements

Coatings

Healthcare

Energy Transmission
SILICONES
A Business with High Profitable Growth Potential

WACKER SILICONES

- Global presence
- Full portfolio provider
- Leading technology, cost and environmental position
- Innovation power for emerging new technological needs
WACKER – Silicon Competence

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