Capital Markets Day 2017
Horst Binnig, CEO Automotive

Rheinmetall AG, 21 November 2017
REVIEW 2016/17
Look back CMD 2016 in Düsseldorf:
Last Chart: Rheinmetall Automotive is well prepared

Markets and Customers:
• We expect a stable market with lower growth rates
• China will be the growth driver, Europe and NAFTA might weaken
• Brazil seems to have touched bottom line

Performance and Products:
• Mechatronics will be the growth driver in the next years
• Hardparts will streamline the global footprint to optimize assets and cost structure
• Aftermarket will return to former profitability after ramp up own production facilities

New Mobility Concepts:
• Hybrid cars and e-cars are offering chances for new products and higher content per car
• We have to refocus our R&D spendings to enlarge the product portfolio
• The product pipelines are filled for every type of power trains within the next years
Automotive in a ten year view
Achieving and maintaining the target margin level

Passion for performance drives us!

Operational margin in % of sales

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Highlights Rheinmetall Automotive Q3 2017
Market outperformed, margin improved

- **Q3: Sales rose** by 6% to €684 m, FX adjusted 7.3%
  (9M: Sales rose by 8% to €2.150 m, FX adjusted 7.5%)

- **Q3: Operating result grew** by 12% to €57 m
  (9M: Operating result grew by 14% to €186 m)

- **Q3: Operating margin increased** by 40bp to 8.3%
  (9M: Operating margin increased by 50bp to 8.7%)

- **Q3: Quarterly free cash flow improved** by €34 m to €81 m
  (9M: Free cash flow improved by €73 m to €32 m)
Operational leverage
Mechatronics and Hardparts drive the third quarter

Sales Automotive in EUR million

<table>
<thead>
<tr>
<th></th>
<th>Q3 2016</th>
<th>Q3 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechatronics</td>
<td>355</td>
<td>382</td>
</tr>
<tr>
<td>Hardparts</td>
<td>225</td>
<td>232</td>
</tr>
<tr>
<td>Operating</td>
<td>82</td>
<td>95</td>
</tr>
<tr>
<td>Result</td>
<td>-19</td>
<td>-25</td>
</tr>
</tbody>
</table>

Operating result Automotive in EUR million

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<td>Hardparts</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Operating</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Result</td>
<td>-4</td>
<td>-5</td>
</tr>
</tbody>
</table>

Restatement of 2016 reported figures in Mechatronics and Aftermarkets related to change in plant assignment

Reasons for result development

- **Mechatronics**
  - Strong demand for fuel optimization as main driver; emission reduction on solid level

- **Hardparts**
  - Higher demand for Large Bore Pistons and good development for European LV pistons

- **Aftermarket**
  - Recovery of sales in East European countries

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Hardparts streamlined its global footprint

Financial impact

- One time cost of around €22 m:
  - €17 m for severance payments (cash-effect in 2018)
  - €5 m asset impairment (non-cash effect)

- Annual savings of around €10 m expected mid-term
Global Mega Trends... 

...are still valid
Engine efficiency as a driver of growth

Around the globe, rules on CO₂ emissions are becoming more and more stringent.
Sales split Rheinmetall Automotive

Vision 2025+

Emissions & Efficiency

New Business

E-Mobility
Growth of electric vehicles/hybrids
Based on LV production worldwide (in m)

+2% per year

Source: IHS
Sales by segment 2017

Combustion Engines
- 75% LV
- 10% Truck
- 15%

Non-Combustion Business
- Continuous Casting
- MIR, LB
- Aftermarket
- Others

Image source Getty Images, Data based on fiscal 2016
Sales by segment 2040

Combustion Engines
- 40% LV
- 10% Truck
  (thereof just 30% ICE related)
- 30%

Non-LV Business
- Continuous Casting
- MIR, LB
- Aftermarket
- Others
- 20%

New Business
- Electric Drive
- Hybrid Drive
- 30%

Image source Getty Images, Data based on fiscal 2016
Scenario 2040 vehicle production
The internal combustion engine isn’t dying, but it now has competition

Rheinmetall Automotive worldwide: More than 40 locations with high focus on local needs

Germany
Tamn
Berlin
Dormagen
Hartba
Langenhagen
Neckarsulm (Headquarters)
Neuss
Neuenstadt
Papenburg
St. Leon-Rot
Walldürn

Czech Republic
Ústí n. L.
Chbarovice

Great Britain
Kirtlington

France
Lyon
Paris
Thionville

Spain
Abadiano

Italy
Lanciano
Livorno
Turin

USA
Auburn Hills
Greensburg
Greenville (Fountain Inn)
Marinette

Mexico
Celaya

Brazil
Nova Odessa

Japan
Hiroshima
Odawara
Tokyo

China
Shanghai (7)
Kunshan (2)
Yantai

India
Pune
New Delhi
Supa

Turkey
İstanbul

Russia
Moscow

Including JVs in Neckarsulm und Greensburg / Yantai / Shanghai / Tokyo as well as the stake in the New Delhi enterprise and the sales offices
E-mobility@Rheinmetall Automotive

Electric vehicle orders close to €500 million

- **E-Taxis in London**
  - Pump technology for pure electric taxis

- **Battery cell boxes**
  - Aluminum battery boxes for German premium OEM

- **Electric engine housing**
  - Electric engine housing for German premium OEM to serve the Chinese market
Sales split Rheinmetall Automotive
Vision 2025+

Emissions & Efficiency
New Business
E-Mobility
AMPRIO

E-bikes becoming increasingly popular

Development of e-bike sales (volume) in Germany and their share of sold bicycles

Sources: ZIV, Allianz (Germany) and Cycling News Industry (ww)
AMPRI

Market Potential of Bicycles and Pedelecs (units)

EU 28

- 2016: 1.7 Mio.
- 2023: ~ 20 Mio.

CAGR 23%

5.8 Mio.

n.a.

Update 10/2017, Sources: ZIV, Allianz (Germany) and Cycling News Industry (ww)
Summary

Markets and Customers:
Markets in better shape than anticipated, global LV production will grow by >2%
Our global production and technology footprint will follow local needs
Rheinmetall Automotive intends to outperform markets in future, too

Performance and Products:
Sales growth at Mechatronics will follow the high demand for fuel-optimization products
Hardparts will continue to optimize its global footprint, with the focus on generating cash
Aftermarket: back on track with a new strategy, now set to return to former profitability

New Mobility Concepts:
Trend to more efficiency and emission reduction promises higher content per car
Electrification brings additional business and sales growth
Product pipelines are still filled with innovations for every type of power trains

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Not too early ...

Not too late ...

Just right!
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Heinrich Dismon, CTO Automotive
### Stricter Emission and Fuel Consumption Standards

#### Emissions and Efficiency

<table>
<thead>
<tr>
<th>Euro 6 c,d</th>
<th>WLTP</th>
<th>RDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>- New regulation of PM emissions for gasoline engines</td>
<td>- Increased duration, speed and acceleration compared to NEDC</td>
<td>- Real driver behavior</td>
</tr>
<tr>
<td>- Introduction of WLTP and RDE</td>
<td>- Lab testing</td>
<td>- Real ambient conditions including low temperatures operation</td>
</tr>
</tbody>
</table>

Emission Compliance – A Basic Requirement of the Market!

More or Better Fuel Efficiency – Leads to Differentiation in the Market!
A Simulation Approach based on CO₂ Emission Legislation (EU)

The ICE – Challenges & Potentials to Close the CO₂ Gap

Assumptions:
- Cycle NEDC
- Steady state ICE operation @ bsfc, opt.
- Recuperation, 85%
- Vehicle mass:
  - Segment B 1250 kg,
  - Segment D/E 1470/1810 kg
- bsfc, opt, Diesel = 180 g/kWh
- bsfc, opt, Gasoline = 210 g/kWh

Vehicle Segment B
(Example)

Vehicle Segment D/E
(Example)

bsfc: Brake Specific Fuel Consumption
Efficiency

CO2 Reduction with Automotive Products – Gasoline Engine Vehicle

Reference model
1.4L 4-cylinder TC DI gasoline engine (115kW)
Approx. 138 g CO₂/km in NEDC

Rheinmetall Automotive Products
Efficiency

Variable Valve Train – UpValve

Function and Application

- Fully variable mechatronic valve system (CVVL)
- Applicable to engine intake and exhaust especially for future-oriented gasoline engines
- Robust to high engine speeds
- Fuel savings by de-throttling and combustion process optimization of approx. 4-5% (NEDC)
Efficiency

Variable Valve Train – UpValve

Booked business for series production

Asian customer – SOP 2020

4-cyl.-4V-turbo gasoline engine

UpValve System Integrated in Gasoline Cylinder Head
Efficiency

Lightweight Design Parts – Valuable for all Vehicle and Powertrain Concepts

Function and Application

- Structural parts and chassis assemblies for conventional and new vehicle concepts (passenger cars)
- Components for new energy vehicles (NEV)
- Aluminum processing with various casting techniques
- Ready-to-use, including machining and finish

Rear Axle Subframe
LP Process

Weight: 18kg
SOP: 01/2017
## Efficiency

### Lightweight Design Parts – Valuable for all Vehicle and Powertrain Concepts

<table>
<thead>
<tr>
<th>Function and Application</th>
<th>Battery Box</th>
<th>Housing for e-Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural parts and chassis assemblies for conventional and new vehicle concepts (passenger cars)</td>
<td>Weight: 8kg</td>
<td>Weight: 20kg</td>
</tr>
<tr>
<td>Components for new energy vehicles (NEV)</td>
<td>SOP: 2018</td>
<td>SOP: 2018</td>
</tr>
<tr>
<td>Aluminum processing with various casting techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ready-to-use, including machining and finish</td>
<td>20kg</td>
<td></td>
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Emissions and Efficiency

Additional New Products at a Glance

- Electrical Vacuum Pump EVP 40
  - Booked business for series production → SOP 2017!

- New Side-Channel Secondary Air Pump
  - Customer presentation

- Electrical Vapor Pump
  - Booked business for series production → SOP 2018!

- Wastegate Actuators Gasoline Engine
  - Customer presentation
Electrification
Opportunities for all Types of Electrification (Hybrid – BEV – FCEV)

Technology Fields

- Thermal Management
- Heating / Conditioning
- Comfort and Safety
- Energy Storage
- Propulsion System
- Lightweight Design
Example: Automotive Heat-Pump Installed in EVEX 910e

Energy Efficiency
Automotive Heat-Pump

Energy Efficiency

Automotive heat-pump unit results

Driving range comparison PTC-Heater – Automotive heat-pump

- Proven range on a commercially available BEV increased by +38%!
- First applications also in E-Bus/E-Truck segment
- Prototype orders by several customers
E-Mobility @ Rheinmetall Automotive

Established Product Portfolio

- Electrical A/C Compressor
- Heat-Pump Module
- Electrical Oil Pumps
- Electrical Vacuum Pumps
- Electrical Coolant Pumps
- Electrical Coolant Valves/Systems
- Castings for E-motor-housings
- Battery Boxes (Castings)
- Lightweight Components

Expanded Product Portfolio

- Battery Pack (Body, TM,...)
- BMS
- E-Traction Motors (HV)
- Power Electronics
E-Mobility @ Rheinmetall Automotive

Battery Pack

E-Traction Motor

Various electr. Auxiliaries
- Electr. Coolant Pumps & Valves
- Electr. Oil Pumps
- Electr. A/C Compressor
- Electr. Vacuum Pumps
- Electr. Air Blower for Batt.-TM
- ...

Thermal Management Components & Systems
E-Traction Motor

- High degree of efficiency
- Wide speed range
- Reduced power losses by optimized tooth geometry
- Single-tooth winding
- Minimized structural length by small winding head
- Scalable performance and torque characteristics
Battery Pack

**Lightweight Design 1:**
Battery cover made of fiber composite material

**Protection System 1:**
Integrated flame retardants

**Lightweight Design 2:**
Weight optimized aluminum cast tray with integrated floor cooling

**Protection System 2:**
Load optimized lightweight design as underfloor protection
Battery Pack

Safety:
3P12S cell configuration
Module voltage < 60 V

Power:
High specific energy – optimized ratio between package, weight and capacity

Thermal Conditioning:
Optimization of the total pack

Flexibility:
Modular design for optimal customizing
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Heinrich Dismon, CTO Automotive
**AMPRIO SYSTEM OVERVIEW**

+ **Open Modular System**

- Complete system (e-motor, battery, display)  
  *or*  
- Single drive unit

Remote Control Unit + Smartphone App  
Optional Display

Battery Pack (incl. Recharger)  
On Tube Battery or In Tube Battery

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PRODUCT FEATURES* DRIVE UNIT

+ Very high power density (W/kg)
  - 250W/650W at 2.8kg

+ Specific characteristic curve
  - Bike-Segment characteristic
  - Parameterizable
  - Gliding operation mode

+ Optimal integration
  - Smallest package
  - Optimal connecting points
  - Q-factor bottom bracket
    (128 mm = Norm)

+ Lightest drive
  - 10% benefit (total 2.8kg)

+ Trendsetting 48V operating voltage
  - Performance scaling
  - Cost efficient electronics

+ Efficient drive
  - Efficiency-optimized high-speed concept

+ Ideal torque
  - 80 Nm at chain ring
  - OEM-Optimum achieved

* Status Market / Eurobike 2017

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