Additive Manufacturing, A Key for Future Production

Vision 2020 – A customer-oriented setup

- Power and Gas
- Wind Power and Renewables
- Energy Management
- Building Technologies
- Mobility
- Digital Factory
- Process Industries and Drives
- Healthcare (eigenständig geführt)
- Financial Services

- Power Generation Services
- Dresser-Rand Unit

- Stromerzeugung
- Stromübertragung und -verteilung
- Effiziente Nutzung von Energie
- Medizin. Bildgebung und In-Vitro-Diagnostik

- Corporate Core
- Corporate Services
- 30 Lead Countries
Our organization
Corporate Technology at a glance

<table>
<thead>
<tr>
<th>Corporate Technology (CT)</th>
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<tbody>
<tr>
<td>Corporate Excellence, Quality Management, <em>top</em></td>
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<tr>
<td>Government, Quality management, Internal process and production consulting</td>
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<table>
<thead>
<tr>
<th>Corporate Intellectual Property</th>
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<tr>
<td>Protection, use and defense of intellectual property</td>
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<td>Patent and brand protection law</td>
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<th>Development and Digital Platforms</th>
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<tr>
<td>Competence center for horizontal and vertical product-and-system integration as well as software, firmware, and hardware engineering</td>
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<th>Innovative Ventures</th>
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<td>Access to external innovations</td>
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<td>Start-up foundation</td>
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<td>Commercialization of innovations</td>
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<th>New Technology Fields</th>
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<td>Research into potentially disruptive innovations with high market potential</td>
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<th>Research and Technology Center</th>
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<td>Development of technologies with a broad impact</td>
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<td>Incubator for innovations of our portfolio</td>
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<th>Technology and Innovation Management</th>
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<td>Siemens' technology and innovation agenda</td>
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<td>Standardization, positioning regarding research policy</td>
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<th>University Relations</th>
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<td>Global access to the academic world</td>
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<td>Top positioning in terms of university cooperations</td>
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Our global presence
Partner to customers all over the world

![Map of Siemens facilities around the world](image-url)
Additive Manufacturing at Siemens

R&D
- 1984 Stereolithographie
- 1989 CT Start
- ~ 2004 Ceramic SLA
- ~ 2007 Laser Melting

Prototyping
- 2002 X-ray grids
  Healthcare

Manufacturing
- 2010 Burner repair
  Power Generation
- 2014 Spare parts
  Different Divisions

Products

“3D printing” versus Additive Manufacturing

Different requirements

Consumer

Industry

Source: makerbot.com

Source: EOS

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Additive Manufacturing – Process Chain

Potential for unique features are based on the mastery of knowledge intensive process chain and the interaction between manufacturing process, material condition and component properties.

Power and Gas Division

- Large Gas Turbines, Generators (PG GT)
  - Gas turbines from 100 to 400 MW
  - Electrical generators from 25 up to 2,235 MVA
  - Fuel gasifiers
  - System Integration

- Distributed Generation (PG DG)
  - Industrial gas Turbines from 5 to 50 MW
  - Aero derivative gas turbines from 4 to 64 MW

- Steam Turbines (PG SU)
  - Steam turbines from 45 kW to 1,900 MW
  - Steam turbines for industrial applications & power generation

- Compressors (PG CP)
  - Turbo compressors for - Oil & Gas
  - Industrial applications
  - Compressor packages incl. drives
  - Compressor automation

- Energy Solutions (PG ES)
  - 50 HZ and 60 HZ Gas turbine power plant solutions
  - CHP*
  - IGCC**
  - Repowering
  - Integrated solar combined cycle
  - HRSG

- Instrumentation and Electrical (PG IE)
  - Control solutions
  - Electrical solutions
  - Energy management solutions
  - Solutions for distributed and hybrid power generation

* Combined heat and power  ** Integrated gasification combined cycle
High Tech-Components with complex design and high potential to increase the benefits of the customer (e.g. efficiency; life time)

Main benefits:

- Faster repair
- Technology updates included
Additive Manufacturing is a key technology to fulfill market requirements

**Market requirements**
- Increased energy and resource efficiency
- Highly complex structures and designs
- Individualized mass production
- Shorter innovation cycles

**Levers**
- Designed-in functionality
- High end resilient materials
- Rapid prototyping
- Spare parts on demand

Additive Manufacturing

1) ISO/TC 261 – Additive manufacturing

The Siemens portfolio along the entire value chain enables the industrialization of Additive Manufacturing

**PLM Software**

**Automation**

**Product**
Summary and Outlook

Summary

Additive Manufacturing ...  
... facilitates optimization potentials.
... is on the path of industrialization.
... requires a holistic digitalized approach.
Many thanks!

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