



Notes: Welcome to this e-learning module on Siemens
Approach to Additive Manufacturing



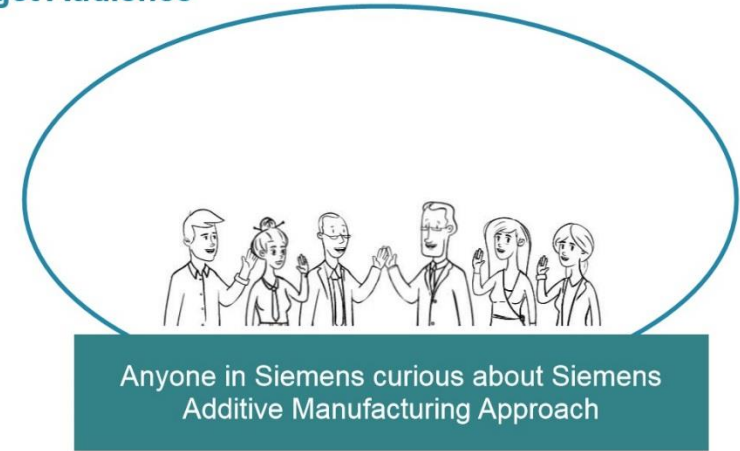
Notes: In order to download the resource materials for this course,
click the attachments tab in the top left hand corner of
your screen.

If you would like to read along with this course, please
click the closed caption option in the bottom left hand
corner of your screen.



Notes: Please note that all video content is proprietary and confidential to Siemens PLM Software.

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Anyone in Siemens curious about Siemens Additive Manufacturing Approach

Notes: This course is for anyone in Siemens that is curious about Siemens Additive Manufacturing Approach

Learning Objectives

By the end of this course you will be able to:

- Summarize what Additive Manufacturing is and why it matters
- Describe the Siemens AG messaging around Additive Manufacturing
- Explain how Siemens PLM messaging relates to the Siemens AG messaging

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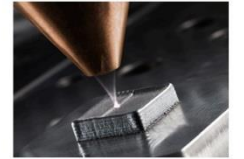
Summarize what Additive Manufacturing is and why it matters;

Describe the Siemens AG messaging around Additive Manufacturing;

Explain how Siemens PLM messaging relates to the Siemens AG messaging.

What is Additive Manufacturing?

Additive Manufacturing (AM), also known as 3D printing, refers to a process used to create a three-dimensional part where layers of material are formed with a variety of techniques and methods to create an object. Objects can be of almost any shape or geometry as defined in a 3D model.



Notes: What is Additive Manufacturing?

Additive Manufacturing, also known as 3D printing, refers to a process used to create parts.

In this process thin layers of material are added on top of each other and fused or melted together (by laser or agents).

Additive Manufacturing allows us to design and create previously impossible and complex shapes, get high performance products due to innovative materials, and produce small volumes at competitive prices.

Processing of different materials such as metals, plastics and ceramics is possible.

Why Additive Manufacturing?

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Additive Manufacturing has the potential to disrupt business in all industries.... but also offers a enormous potential to create and expand new business

Notes:

Additive Manufacturing has the potential to disrupt businesses in all industries, but also offers enormous potential to create and expand new business.

Goldman Sachs estimates that Additive Manufacturing has an \$550 Billion annual economic impact by 2025.

If 3D printing only would penetrate 1% of the manufacturing market, this is still equal to \$140bn.

And with the new opportunities to print local close to the customer this could even affect global trade by 40% according to ING

3D Printing Market (Industrial AM)

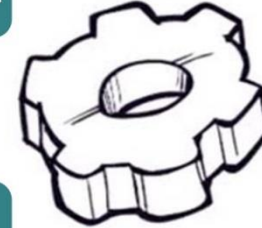
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Total industrial AM market of \$6bn with CAGR of 17.4% in 2016

Installed basis of > 100.000 industrial AM printers worldwide

13,000 industrial systems sold in 2016

Average price per machine approx. \$100k



Notes:

In 2016 the Industrial Additive Manufacturing market had been worth \$6bn comprising of \$2.7billion in Products and \$3.4billion in Services. The market grew by 17.4%. The most renowned and also most concise report for Additive Manufacturing is the Wohlers Report.

This report counts every machine above 5 thousand as industrial printers and over 100 thousand printers of this kind have been sold.

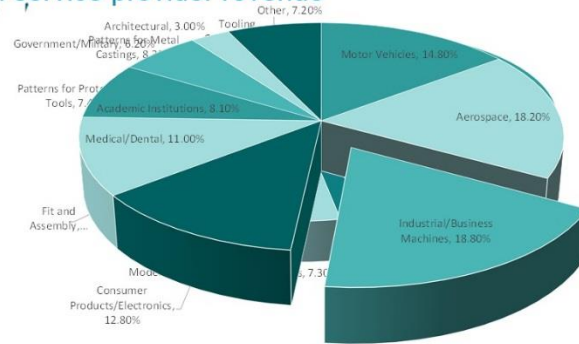
When we look at the relevant market share for Siemens PL we talk about still a very large installed base of approx. 3 to 4 thousand printers.

You can see that key markets are the U.S., Germany, China and Japan when we look at the installed base.

3D Printing Market Overview

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Distribution by Industry in 2016
(based on service provider revenue
(2016 split))



Notes: 3D Printing Market Overview

When it comes to the applications you can see that functional parts make up for 1/3rd.

Our customers also use it for replacing assemblies, tooling components, fixtures and jigs, molds and mold inserts.

Around 40% of Additive Manufacturing products are for end products.

All of our core industries apply additive manufacturing today. Including Aerospace, Auto and Medical.

Academic institutions and governments are also interesting customers to Siemens for the future.

Siemens AG Approach

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Siemens businesses
use additive manufacturing for real
production

CLICK THE IMAGES



Notes: Siemens has been using Additive Manufacturing in many of its businesses for some time.

We have designed and printed real production parts for Power and Gas, Mobility, and Medical applications. This is very important to show to our customers as it gives credibility to our software solution.

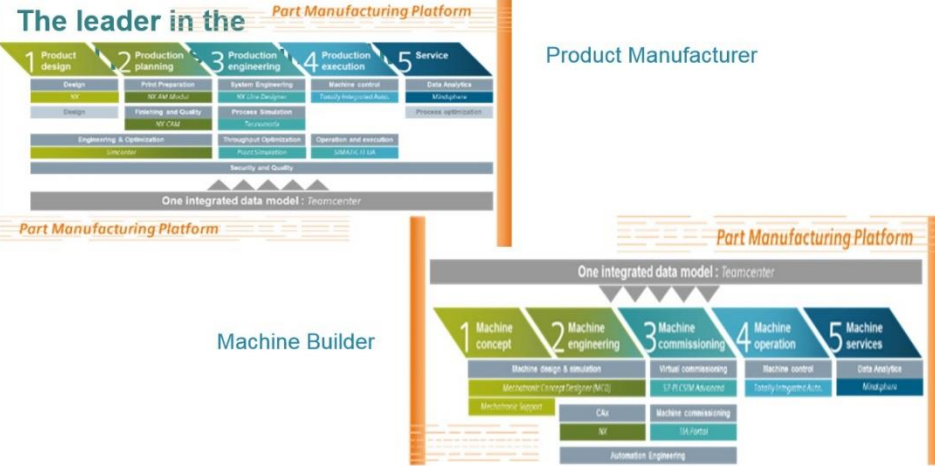
You can see here, for example, the gas turbine blade of our Power and Gas division which, thanks to Additive Manufacturing, has now improved internal cooling.

Besides functional parts, Siemens uses Additive Manufacturing as well for e.g. repair applications and spare parts on demand.

Our Corporate Technology Department certifies materials for production and provides internal consulting on designing parts.

Siemens Approach to Additive Manufacturing

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Notes: Siemens is the leader in the digital process chain for Additive Manufacturing.

We are the only company to cover the complete end-to-end process from design, engineering to manufacturing and controls for 3D printers.

This provides a complete software solution for Product Manufacturers as well as Machine builders.

And we have installed and tested our portfolio in our own production site in Finspång, Sweden.

Accelerate industrialization and generate customer value



Notes: We also help our customers to industrialize AM through our Additive Manufacturing Experience Center in Erlangen. This is a perfect place for you to send customers in order to give them the opportunity to explore there the end-to-end AM solution and see real printers in action.

Accelerate industrialization and generate customer value



Notes: Siemens is also offering Additive Manufacturing Consulting services as well as high-end 3D printing services via Materials Solutions.

Siemens bought Materials Solutions to produce parts for our own Power and Gas division and now offers this service also to customers.

Be the global gateway to collaboration and AM printing services



Notes: Last but not least we will become the global gateway for collaboration and Additive Manufacturing Printing services with our “Additive Manufacturing Network.”

This global platform will offer tools to help designers evaluate and optimize designs for 3D printing – and to connect qualified 3D printing production services to designers.

Siemens PLM Approach

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Notes: **What's limiting your customers' business potential?**

Today, our customers are limited by challenges such as performance, design complexity and weight when it comes to designing parts.

Siemens PLM Approach

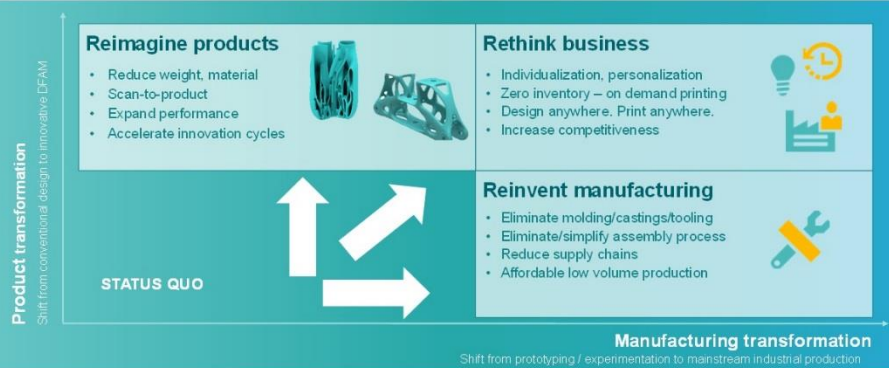
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Notes: **In Manufacturing lead times and lifecycle cost need to be reduced as well as the quality of parts increased.**

Additive Manufacturing is driving Innovation and help overcome current barriers by...

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Notes:

Additive manufacturing is an answer to many of these barriers.

With Additive Manufacturing our customers can reimagine their products, reinvent their manufacturing and rethink their business.

We see a lot of potential for example in aerospace to reimagine their products by reducing the weight of parts and increase its strength. This will also save a lot of cost.

In Industrial Machinery there is the potential to reinvent manufacturing by eliminating some of the moulding and casting processes. This will reduce lead times.

In the medical industry there is the potential to rethink the business by producing individual and personalised cutting guides for implants that are tailored towards individual patients.

Example for the Benefits of Additive Manufacturing

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13 → 1 part
system simplification

26 → 3 weeks
lead time reduction

22%
weight reduction

Conventional thinking



Additive Manufacturing thinking



Combustion System
Burner
Swirler/Nozzle/Filter/Mixer



Notes:

To show you what is possible with AM take this example from Siemens Power and Gas:

The results are impressive.

This Burner part was made of 13 individual components before, and now with AM they can print it as one part.

Lead time has been reduced from 26 to 3 weeks.

And a weight reduction of 22% has been achieved.

Status Quo in the current market

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Notes:

But there are limitations when trying to take advantage of additive.

We all know that new technology comes with hurdles and road blocks to overcome. In the case of Additive

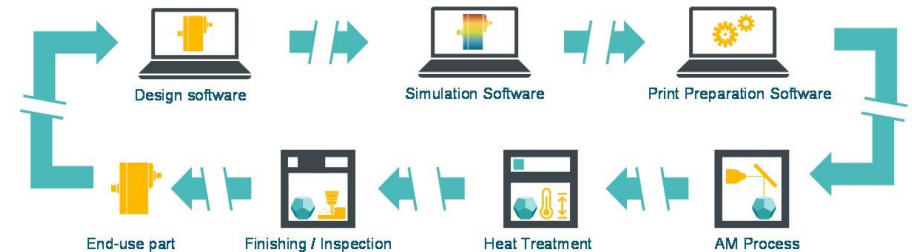
In a typical Additive Manufacturing process today, Customers use many different softwares for each of these steps and require conversion of files from one software application to another.

The consequences of this are that not only is the process time consuming, but also a lot of information is lost between each process.

Frequent design changes would be too complicated on an industrialised basis.

Status Quo in the current market

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Notes:

During a typical Additive Manufacturing process today our customers use many different softwares for each of these steps. This requires the conversion of a file from one software application to another.

The consequences of this are not only that it is time consuming, but also that a lot of information gets lost between each of the process steps.

Frequent design changes would be too complicated using this model on an industrial basis making it impossible.

Summary



Additive Manufacturing is a **fast growing market** with **attractive sales opportunities** in our core industries

Siemens is the leader in **industrializing Additive Manufacturing as well as in** providing a **end-to-end digital process chain** for Additive Manufacturing

Siemens PLM is offering the most comprehensive **integrated software system for product development and production** for Additive Manufacturing

We're building an extraordinary **ecosystem of world leading partners and drive the widest range of production 3D printing technologies** all in one system

Notes: To summarize what we have learned:

Additive is growing fast and shifting from prototyping to

We offer the most comprehensive end-to-end integrated software system for product development and production

We drive the widest range of production 3D printing technologies all in one system

We're building an extraordinary ecosystem of world leading partners

We help our customers to engage with AM by sharing with them our experience via our consulting, engineering and printing services

Learn More

Additive Manufacturing GSI

<https://sales.industrysoftware.automation.siemens.com/tools/sales/gtm/additive-manufacturing.html>

Chatter Group

<https://na68.salesforce.com/ui/core/chatter/groups/GroupProfilePage?g=0F913000000HMss>

Sign-up for the AM Email List

additive-3dprinting-discuss-subscribe.plm@siemens.com

Public Siemens Webpage on Additive Manufacturing

www.siemens.com/plm/additivemanufacturing

NX Manufacturing Forum

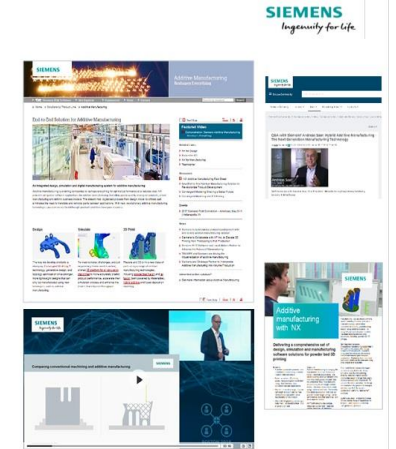
www.siemens.com/plm/community/nx/manufacturing

Additive Manufacturing Curriculum

https://siemensplmlearningcenter.sabacloud.com/Saba/Web_spf/PRODTNT130/common/learningeventdetail/curra000000000004480

Learning and Development Additive Manufacturing Page

https://siemensplmlearningcenter.sabacloud.com/Saba/Web_spf/PRODTNT130/pages/pagedetailview/spage000000000002600/-&-d-portal/additive-manufacturing



Notes: To learn more about our solution for additive manufacturing you can visit our web or the Chatter Group as well as sign up for the Additive Manufacturing Email List.

You can also join the discussion on our public manufacturing community, where you can learn from experts and stay informed about the latest news.

You can also learn more by accessing the Additive Manufacturing Curriculum

Thank you

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