

**Siemens Gas and Power**  
**Overview of additive manufacturing, benefits and challenges**  
**industrial approach for AM**

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EPIC Online Technology meeting on Advanced and Additive Metal Manufacturing

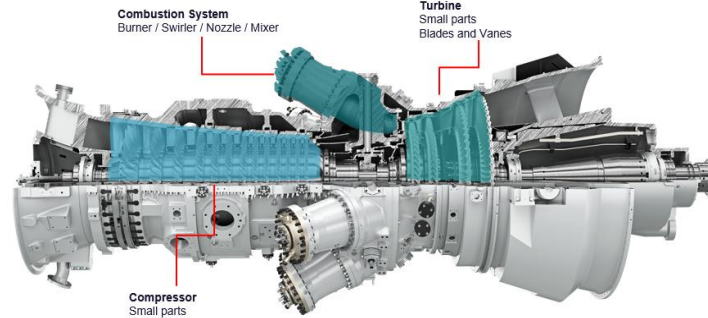
2020-10-19



# Additive Manufacturing at Siemens Energy AB-Sweden (Finspong)



Gas turbines with its **complex parts** in **expensive material** and **relatively small volumes** **makes AM very attractive!**



Turbine manufacturing in Finspong since 1913

Part of Siemens since 2003 ;2020 Siemens Energy AB

approx. 2,600 in Finspong & 100 in Trollhattan

40+3D printing machines operational worldwide

> 10 years experience of SLM

20+ components already commercially implemented

> 1 500 000 operating hours on Siemens turbines

150 + specialized engineers

200 components identified for AM until 2025

**Rapid Manufacturing**

65% Less resources in production process

**Rapid Repair**

60% Faster Repairs

**Spare parts on demand**

90% Reduction of lead time

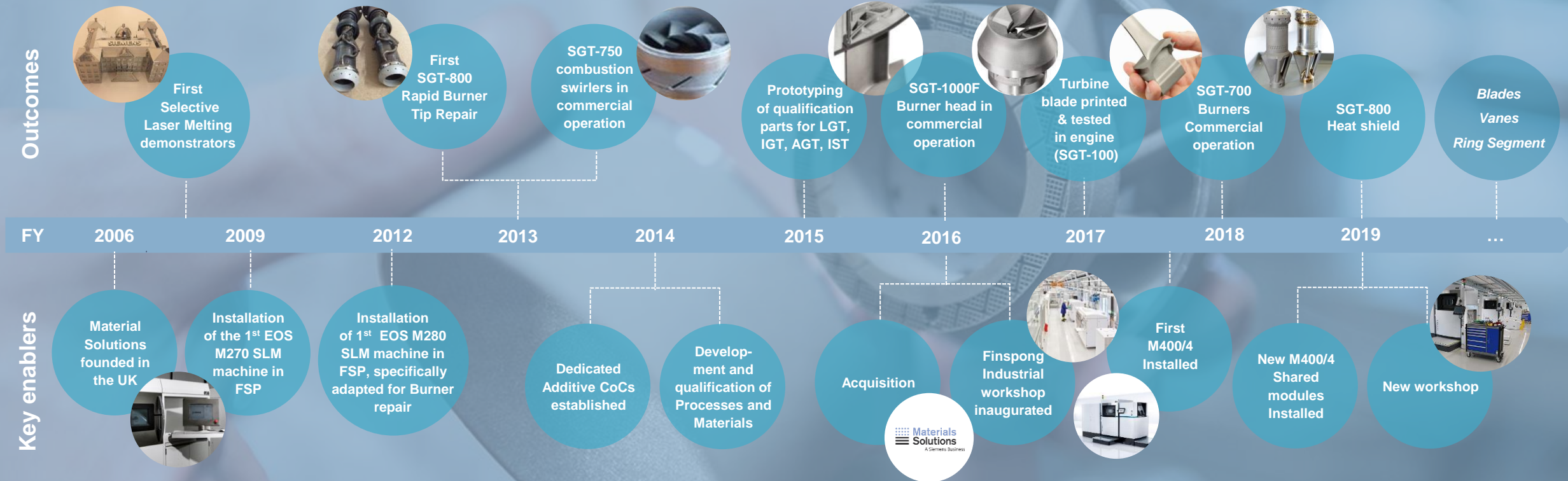
**Rapid Prototyping**

75% Reduction of Development time

# Siemens was an early adopter of SLM AM technology and have successfully scaled its production



## From R&D to serial parts production with SLM technology in 10 years



SLM: Selective Laser Melting

# AM challenges, opportunities and collaboration

## Challenges

- Material knowledge
- Design culture
- Stand-alone software
- Training
- Machine performance
- Quality issues
- Health and Safety concerns

**Disappointment:**  
*"It is not just 3D-Printing!  
 It is much more complex..."*



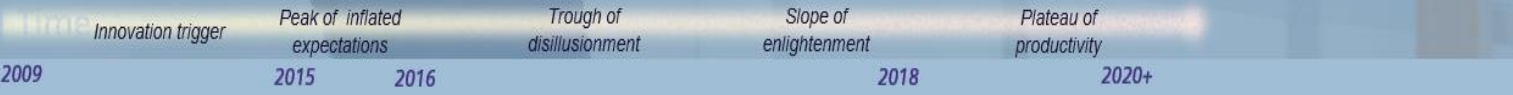
**Autonomous AM 2025 +**  
 IoT for AM

**Intelligent AM**  
 "Intelligent" through Robots, VR/AR, AI

**Learning AM**  
 "Learning" through Big Data Analytics, AM Monitor, Virtual Storage and Machine Learning

**Connected AM**  
 Connected" through MES, AM Network, Digital Twin and Use Build Job Simulation

**Traditional AM**



# Additive Manufacturing at Siemens Energy AB



**Conventional**

- 13 parts / 18 welds
- 26w lead time

**SLM burner**

- 1 integrated part
- 3w lead time

Innovative Designs

**SIEMENS**

Siemens d.o.o.  
Aleš Prešern  
Letališka 29c  
1000 Ljubljana  
Slovenia

Nuklearna Elektrarna Krško  
Vrbina 12  
8270 Krško  
Slovenia

**REFERENCE CONFIRMATION**  
Project PERUN  
3D printed spare parts

**Nuclear Power Plant Krško**  
hereby certifies that  
**Siemens**  
has successfully engineered and delivered a functional spare part – water pump impeller – which was created using the technology of additive manufacturing (3D printing) in stainless steel.

We confirm that the delivered parts fulfilled all of the given quality requirements, specified by NPP Krško. The impeller has been successfully tested and installed in January 2017, where it has been since performing normally and as per design specifications.

This represents the first time that Nuclear Power Plant Krško has installed and operated a part created by additive manufacturing.

Krško, February 2017

Stanislav Rozman  
President of the Management Board

NUKLEARNA ELEKTRARNA  
KRŠKO, d.o.o.

Obsolete parts (NUC area)



Cleaning Robot in AM

# Thanks you for the attention!



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