SLM SOLUTIONS

INVESTOR PRESENTATION

April 2022

SLM SOLUTIONS

Technology pioneer, Innovation Leader

⇒ **Inventor** of the Selective Laser Melting technology with a strong product portfolio, well positioned to benefit from the **growing TAM** for metal AM**, expected to increase by over 3x** by 2026*

⇒ Track record of **delivering path breaking technologies** that have resulted in improved quality of output and enhanced productivity

⇒ Large **installed base of over 750 systems** globally** with **industry agnostic, broad-based** customer base and **an industry gamechanger** in the NXG XII 600.

⇒ **Received orders for 10# NXG XII 600 systems** from automotive, energy, space, aviation and service bureau industries

⇒ **Outperformed guidance for the second consecutive year,** delivering **double-digit top-line growth** along with market-leading gross margins.

⇒ Begun 2022 with largest## backlog of **EUR 43m** and **over 500 people,** working singularly on **delivering the future** with LB-PBF based solutions.

---

* AM Power Report 2022
** As of Feb 2022
\# Including three conditional orders
\#\# Prior period figures adjusted for Chinese Frame Agreements.

REDEFINING THE BOUNDARIES OF MANUFACTURING

1. Why is Additive Manufacturing the future of metal manufacturing?
2. Why are we now at an inflection point for AM?
3. Why is Laser Powder Bed Fusion superior to other additive manufacturing technologies?
4. Why SLM will continue to lead
5. Financial Overview

SECTION 1

Why is Additive Manufacturing the future of metal manufacturing?

Benefits of Additive Manufacturing

Benefits of AM

Product Character - istics

Complex geometries at lower weights + enhanced performance **without design limitations.**

Lead Time

Substantially **shortened time to market**

Process Efficiency

Optimized working capital and cash conversion cycle

Supply Chain

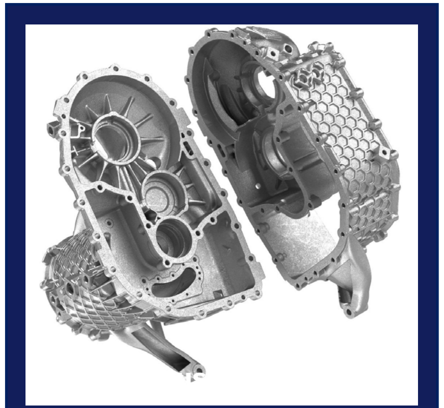
Decentralized manufacturing **reducing supply chain disruptions**

Environment

Near zero waste → Green Manufacturing

Advantages of AM

Enhanced Performance



A highly integrated final E-drive unit and gearbox in one main housing along with Internal coolant channel

Measurements: 590x560x367mm
Material: AlSi10Mg (Aluminium)
Machine: SLM® NXG XII 600

Traditional Manufacturing

1. Inability to optimize topology resulting in increased weight of component
2. Requirement of multiple parts for various functionalities, limiting enhancement in component performance.
3. Increased work steps causing higher labor costs.

Additive Manufacturing

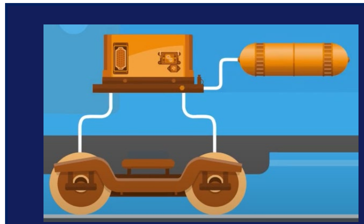
1. Optimized topology & functional integration enabled **weight reduction of ~10%**.
2. The use of lattice structures in the design resulted in **rigidity increasing by 100%**.
3. Installation work **reduced by around 40 work steps**.

Source: Prototype for small-series production: electric drive housing from a 3D printer – Porsche Press Release

SLM SOLUTIONS

Advantages of AM

Decentralized Manufacturing



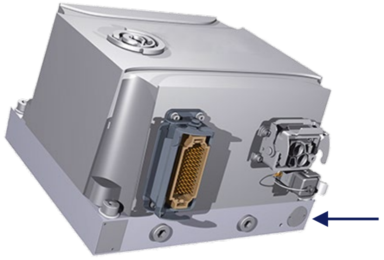
Metroflexx Brake panel

An integrated brake control system that features a service brake, emergency brake, and wheel slide protection. The pneumatic base plate acts as a manifold with many internal channels to direct air to other systems in the transit vehicle.

Measurements:
275x320x39 mm
Material: AlSi10Mg (Aluminium)
Machine: SLM®800

Traditional Manufacturing

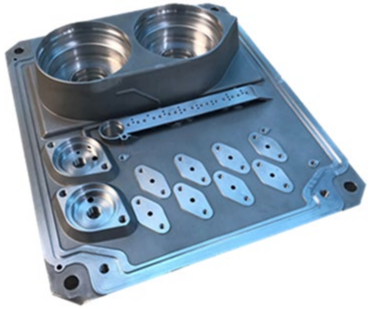
1. Pneumatic channels are machined into solid aluminum plates which are then sandwiched together.
2. Assembly requires multiple fasteners and gaskets which add to assembly time and can be potential sources for air leaks.
3. Component manufactured in France and shipped for use in the USA resulting in long lead times.



Metroflexx Pneumatic Base Plate

Additive Manufacturing

1. Design optimization contribution to significant weight reduction. **Weight reduction of 5 kg (from 7kg to 2kg)**
2. Additive Manufacturing enables for **32 parts to be combined in 1**
3. Decentralized manufacturing leading to **reduction in lead times by 70%**.



Source: SLM
Note: Based on case study with Wabtec Corporation, for more info click here.

Advantages of AM

Faster production times

Main Fitting

Main fitting component of a nose landing gear for a Bizjet

Measurements:
455x295x805 mm
Material: Titanium
Machine: SLM®800

Traditional Manufacturing

1. Length of production was a few months due to several manufacturing steps required in the process.
2. Significant carbon footprint due to the weight of the component
3. Component manufactured by assembling several parts.

Additive Manufacturing

1. Time taken to produce the main fitting **reduced from a few months to a few days** using the SLM® 800.
2. Additive manufacturing process as a whole, including optimized design resulting in **decreased carbon footprint**.
3. Component manufactured **as a single part.**

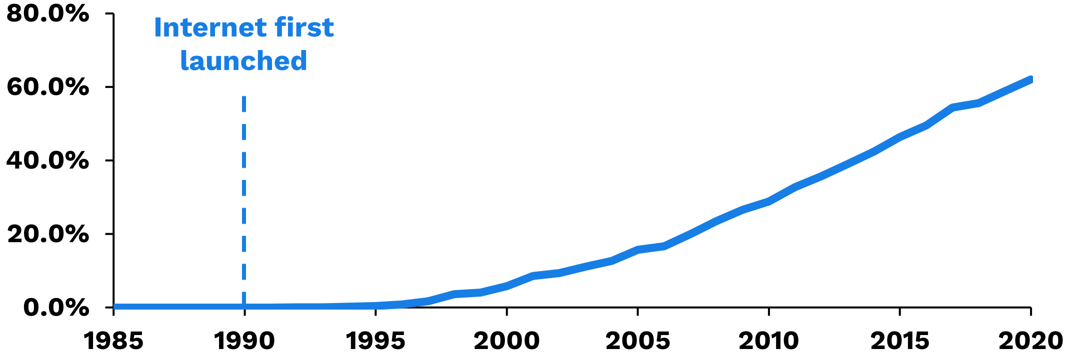
* Image is only illustrative and not the additively manufactured part.

SECTION 2

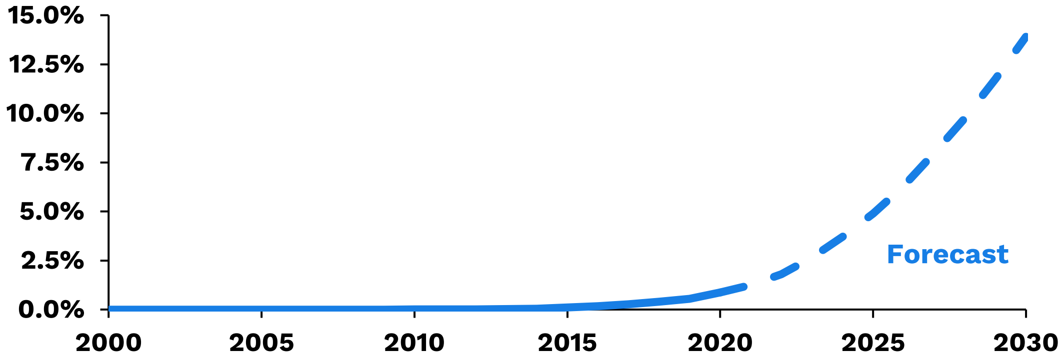
Why are we now at an inflection point for AM?

Disruptive technologies typically have a long lead up before reaching a demand inflection point

% of world population using the internet



% of electric vehicle share in global passenger car stock



Source: Worldbank, Our World in Data, International Energy Agency

AM is a disruptive technology that will completely turn industrial manufacturing as we know it on its head

As with most disruptive technology cycles, the time between invention and mass adoption is difficult to predict

Adoption of the AM technology is at the start of the inflection point where the launch of the NextGen machines will drive mass adoption

As this new tipping point for the technology emerges, this will be a revolution in the manufacturing industry and not an evolution

Key hurdles to industrialization are being cleared

Reliability of Machines

- × Machine reliability not yet on required level for large scale production

Number of Skilled Operators

- × Customers often lacking sufficient skilled AM machine operators
- × Specialized diplomas having only become available in the last few years

Certification of AM Parts

- × Certification for new AM-produced parts taking longer than expected
- × Business cases with beneficial economics especially in aerospace delayed due to missing certification of parts

Cost Per Part

- × Productivity not yet competitive with conventional casting manufacturing for large scale production
- × AM already with cost advantages on smaller scale production

✓ Moving from niche market to serial production driving machine reliability improvements

✓ Recent graduates already well versed in AM and OEMs offer trainings and webinars on large scale

✓ Industries working on standards and certification processes, localization policies to accelerate adoption

✓ NextGen machines with significant productivity increase making AM extremely cost competitive

Productivity increases enabling mass production

SLM is at the forefront of the push to industrialization

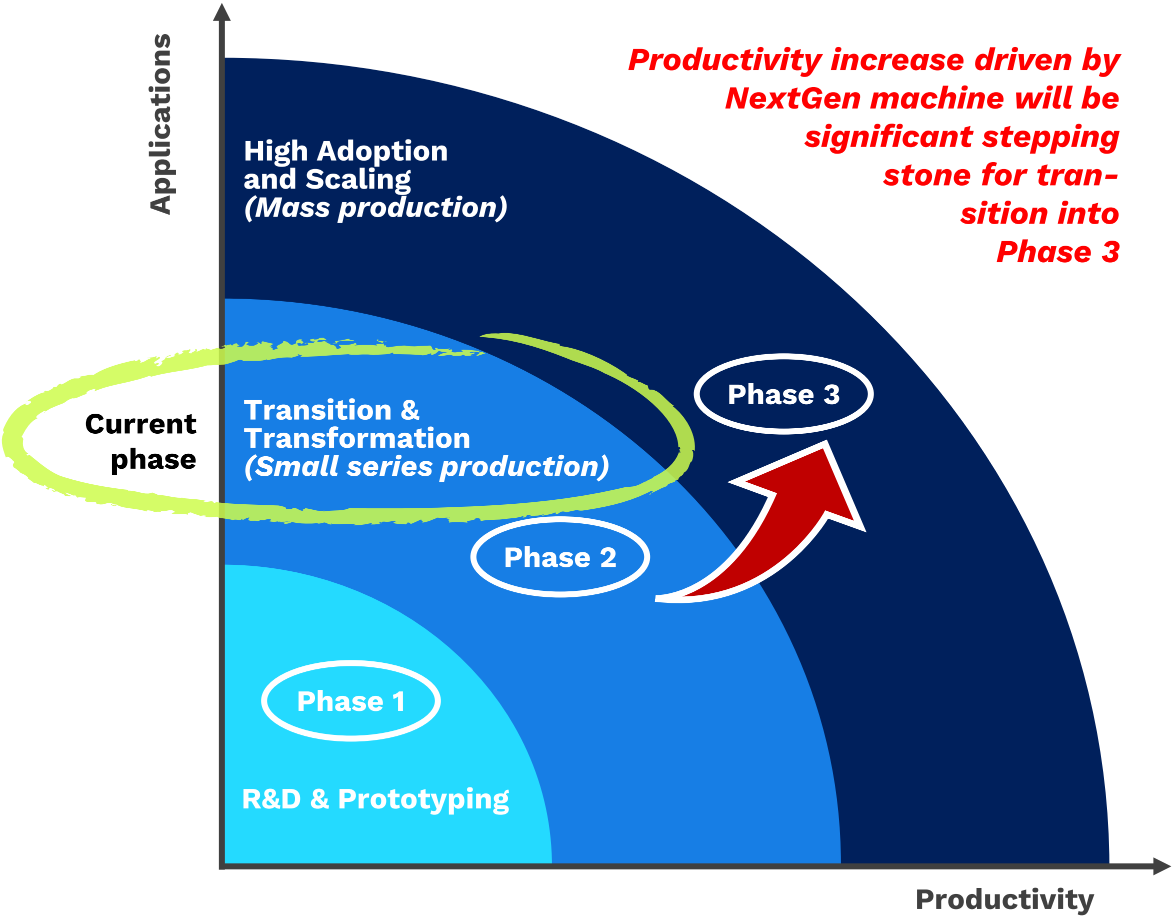
Phase 1 and 2

- Proof of concept of technological capabilities
- Continued development of machines, qualification and selection of parts
- Initial use cases for R&D and small-scale production
- Limiting factors: productivity and reliability of machines; economics per part

Transition to Phase 3 has been delayed

Phase 3

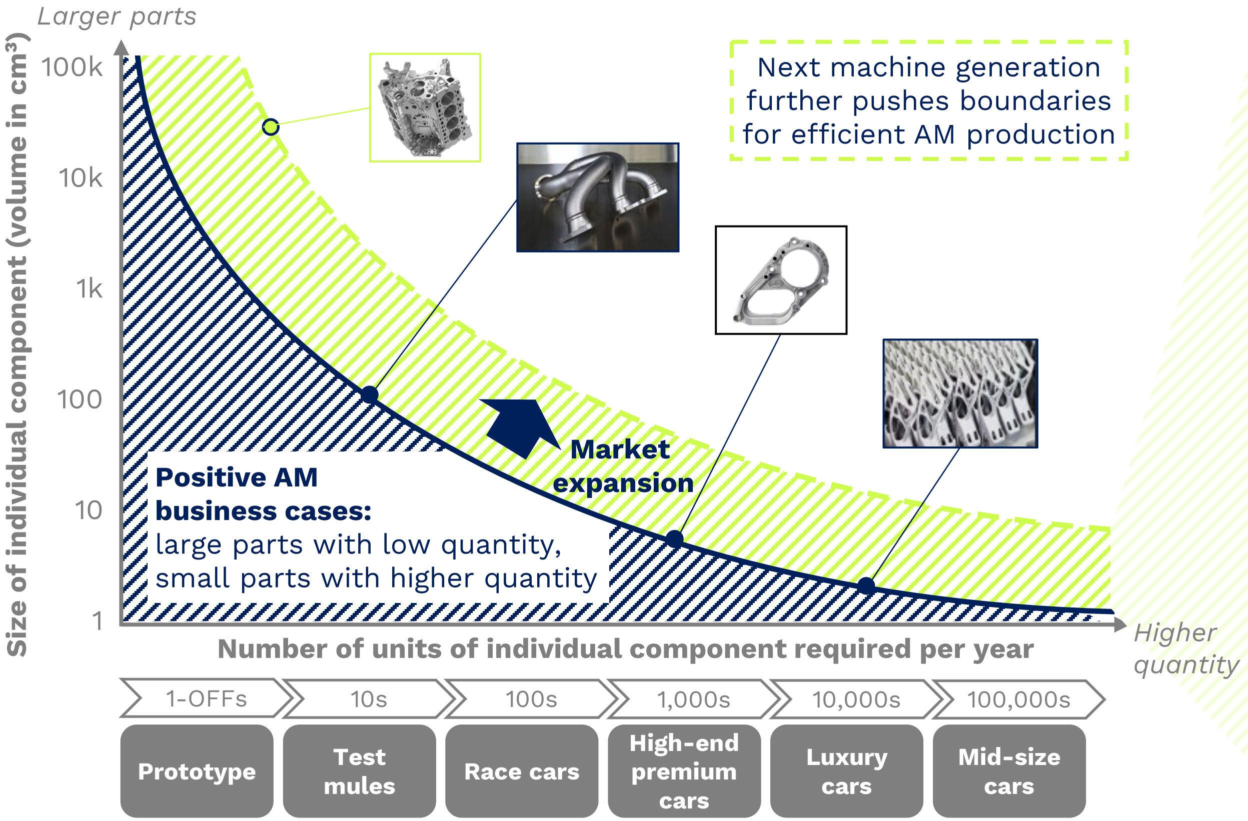
- Full integration of AM in manufacturing chain
- Industrialized machines
- Competitive economics facilitating large scale production while retaining advantages of AM



Productivity increase driven by NextGen machine will be significant stepping stone for transition into Phase 3

Market expansion with next generation of components specifically designed for AM

Illustrative: Break-even in Laser Powder Bed Fusion compared to conventional manufacturing (automotive example)



Next machine generation further pushes boundaries for efficient AM production

Positive AM business cases:
large parts with low quantity,
small parts with higher quantity

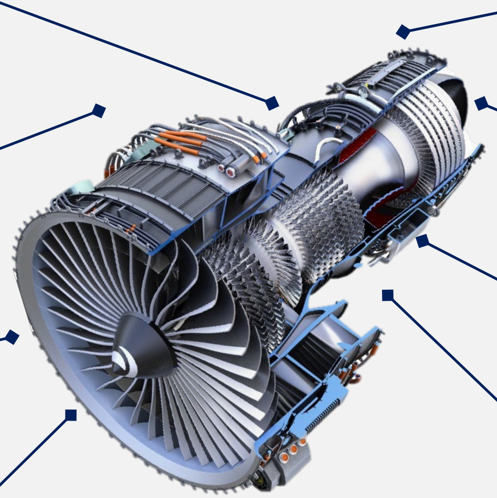
Market expansion and growth driven by several favorable developments

- Productivity increase of next generation of AM machines
- New parts being specifically designed to make use of advantages of AM production
- AM increasingly being integrated in industrialized production processes
- Completion of ongoing certification processes of AM produced parts

Source: SLM

AM industry growth driven by applications transitioning from prototyping to large scale production

Example: Metal additive manufacturing applications in the Aero Engine sector



Fuel Nozzles
In full-rate production
Units to double in 5 years

Casing Features
Prototyping
2-3 years to production

Compressor Components
Prototyping
2-3 years to production

MRO
Qualification
2-4 years to production

Vanes
Prototyping
+3 years to production

Rakes
Some in production
1-2 years to more production

Liners
Awaiting larger platforms
+4 years to production

Bearing Housings
Qualification
+2 years to production

Adoption of metal additive manufacturing is expanding and is being integrated into the design process of new engine programs, creating a growing number of applications for selective laser melting

Source: SLM

AM key in transformation of global supply chains

COVID-19 has accelerated this transition

Further accelerated by COVID-19

Megatrends

- **Decentralization** & **flexibilization** of manufacturing
- Shifting manufacturing **in-house**
- **Repatriation** of manufacturing

- Focus on **green manufacturing**

How AM will be part of the solution

- **Flexible production** of various parts on same machine type relinquishes expensive retooling of traditional manufacturing equipment, allowing businesses to use AM to bridge supply gaps
- **Production costs largely independent of location** as labor costs of operating the machine are of minor importance; AM is becoming more and more **cost competitive** as machine productivity increases
- Next generation products already **include AM in their design processes** facilitating the transition

New AM manufacturing plants will bring a **whole new eco system** of surrounding suppliers and customers with them, which will result in **new regional job opportunities**

AM enables greener manufacturing

Components produced with AM with substantially better environmental footprint

Waste reduction

Near zero waste produced

Metal powder up to 95% recyclable

Lower energy consumption

Requires less energy than traditional manufacturing methods

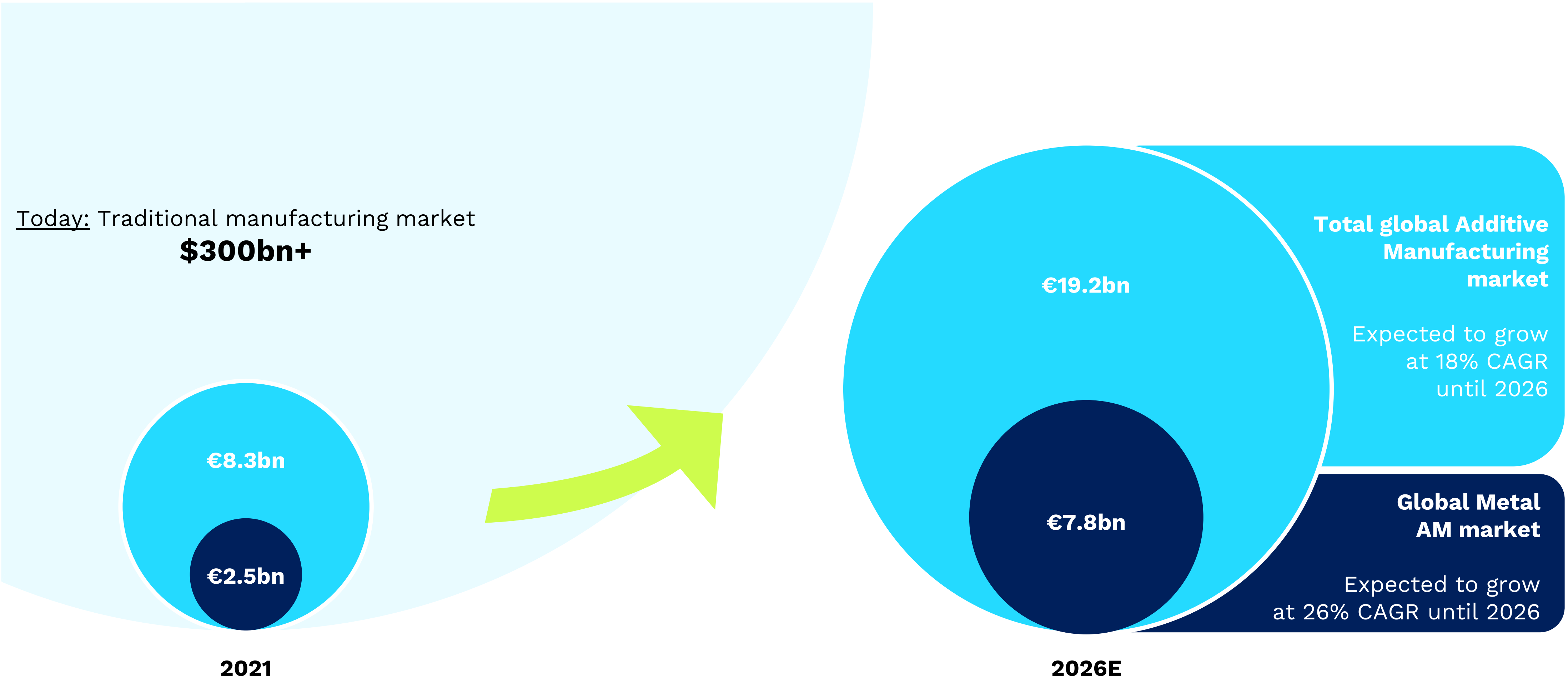
Greener components

Design flexibility results in significant reduction of weight and assembly steps of components

Leaner supply chains

Enables local-for-local production and reduces dependency on global supply chains

Advantages of AM to continue to drive strong market growth



Today: Traditional manufacturing market
$300bn+

€8.3bn

€2.5bn

2021

€19.2bn

€7.8bn

2026E

Total global Additive Manufacturing market

Expected to grow at 18% CAGR until 2026

Global Metal AM market

Expected to grow at 26% CAGR until 2026

Source: AM Power Report 2022, Equity Research, GS Research

SECTION 3

Why is Laser Powder Bed Fusion superior to other additive manufacturing technologies?

Laser Powder Bed Fusion (LPBF)

Sole AM technology with widespread industrial use

Superior mechanical properties…

Size / Geometric Freedom

- Size of parts **only limited by machine chamber size**
- Outperforming in terms of **absolute size and variability of part thickness**
- **Geometry complexity is for free**, allowing for **topology optimization** that is **without limits**

Mechanical Properties

- Constantly **high mechanical properties**
- **Low porosity**
- **High density**

Wide Material Choice

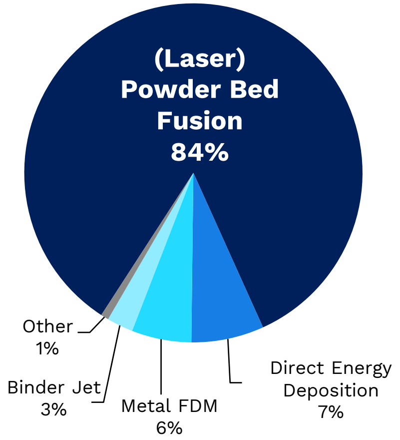
- Compared to all other additive technologies **LPBF offering greatest number of input materials.**
- **Any material that can be welded can be processed**

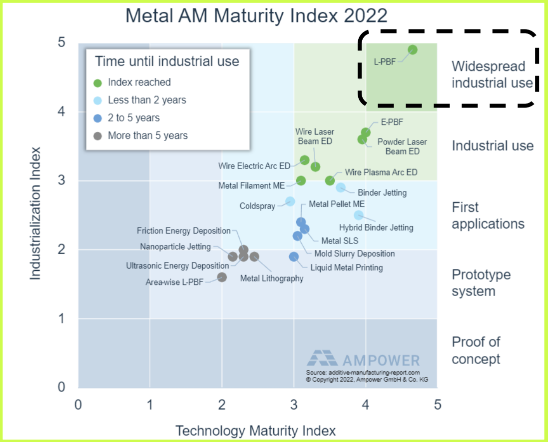
One Step-Processing

- Little to no post-production increases **"first time right potential"**
- **Enabling thin wall sections**
- **Consistently accurate geometrical output** due to **controlled and predictable part shrinkage and distortion**

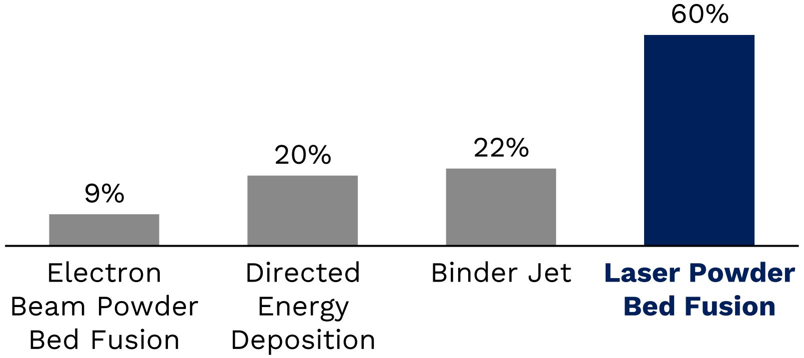
…make LPBF the leading AM technology in the market today and tomorrow

Installed base (units) by technology 2021[1]





Investment related to AM in next years[2]



Source: 1) AM Power Report 2022 2) Survey by Barnes Global Advisors: "What capital equipment related to metal AM does your company plan to purchase in the next 2-5 years?"

LPBF shows superior properties vs. MBJ

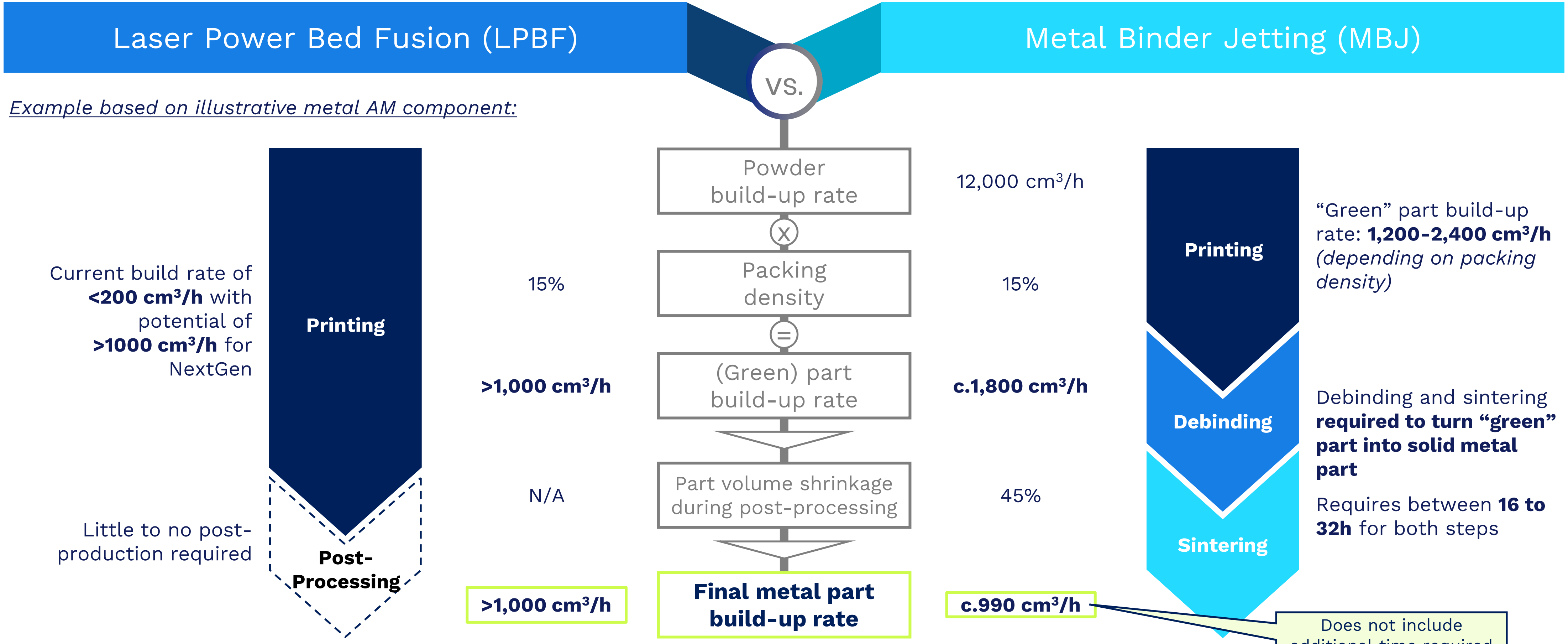
Better quality, material range and geometric freedom

Laser Power Bed Fusion (LPBF)	vs.	Metal Binder Jetting (MBJ)
▪ **High** mechanical properties and **extreme accuracy** ▪ **High** density and **low** porosity	Quality	▪ **Lower** mechanical properties, **lower** density and **higher** porosity vs. LPBF ▪ Complex sintering process with **many unknown effects** and **low first-time-right availability**
▪ **Wide** range of materials	Material range	▪ Currently, material choice **limited**
▪ Size **only constrained by machine chamber size**, suited for a wide range of thickness ▪ **Controlled** part shrinkage and part distortion possible	Geometric freedom	▪ **Limited** size and minimum thickness of parts ▪ **Shape limitations** due to debinding and sintering ▪ **Uncontrolled** creep deformation possible
▪ Solid metal parts are produced directly, in a **single process** **Printing** → **Post-Processing**	Productivity	▪ **Multi-step process** – solid metal parts are only created during last step of sintering ▪ **Build-up rate significantly lowered** by shrinkage – debinding and sintering required to turn "green part" into metal part **Printing** → **Debinding** → **Sintering**

Source: AM Power, SLM

NextGen LPBF at least as productive as MBJ…

…while keeping its advantage in material properties



Example based on illustrative metal AM component:

Laser Power Bed Fusion (LPBF)	vs.	Metal Binder Jetting (MBJ)
	Powder build-up rate	12,000 cm^3/h
	x	
15%	Packing density	15%
	=	
>1,000 cm^3/h	(Green) part build-up rate	**c.1,800 cm^3/h**
N/A	Part volume shrinkage during post-processing	45%
>1,000 cm^3/h	**Final metal part build-up rate**	**c.990 cm^3/h**

Current build rate of **<200 cm^3/h** with potential of **>1000 cm^3/h** for NextGen

Little to no post-production required

"Green" part build-up rate: **1,200-2,400 cm^3/h** *(depending on packing density)*

Debinding and sintering **required to turn "green" part into solid metal part**

Requires between **16 to 32h** for both steps

Does not include additional time required for debinding/sintering

Source: AM Power; Company disclosure; SLM; Wielage, B. et al. (2010). *Utilisation potential of water-atomised metal powders for thermal spraying.*
Note: Compares NextGen LPBF technology with latest single pass MBJ machines. Packing density based on illustrative metal AM component.

SECTION 4

Why SLM will continue to lead

Our Strategy

Enabling long-term sustainable growth

SLM SOLUTIONS	Technology leadership	Operational excellence	Best-in-class AM solutions provider
SLM Solutions is a **leader in the metal additive industry**, and aims to continue being a driving force in the industry	We will always **push the limits of additive manufacturing**, thus maintaining our technology leadership	We deliver **best-in-class operational excellence** and are relentless in consistently improving	**Our customers' success is our success**, and we will work towards maximizing customer satisfaction
Technology Pioneers with decades of experience in the metal additive industry	**Value-accretive product portfolio** with a focus on delivering quality	**Optimized sourcing → decrease in material costs** on a like-for-like basis of approx. 3% in 2021	Laser focus on **maximizing customer satisfaction**
Large IB of +750 systems globally across a wide variety of customers	**Software enablers** to aid the ongoing industrialization of AM	Lean manufacturing processes **enhancing efficiency across the value chain**	**Upgraded CRM** system to aid **quality service delivery**
Maintain long-standing focus on **investing into technologies of the future**	Revamped PLM System to **enhance efficiencies in product life cycle**	**EBITDA margin improvement** in FY 2021 of **50% YoY**	**Global roll-out of Net Promoter Score** (NPS) system in 2022

SLM Solutions – a technological pioneer active in the AM space for more than 50 years[1]

Corporate Milestones

1960s: Introduction of prototype tooling technologies by MCP Group, the precursor to SLM Solutions

2006: Founding of the operating company SLM Solutions GmbH

2014: IPO of SLM Solutions Group AG

2016: Failed takeover attempt by GE

2018: Move into new HQ in Lübeck

2019: Appointment of new management team and board

1960s–70s … 1996 | 2000 | 2005 | 2010 | 2015 | 2020

Technology Advances

1996: Co-inventor of Selective Laser Melting base patent

2003: Launch of the first selective laser melting system in the market, the SLM®250

2011: Launch of the SLM®280 Twin Production Series

2013: Launch of the SLM®500 Production Series

First to the market with twin (SLM®280) and quad (SLM®500) laser technology

2017: Launch of the SLM®800 Production Series

2020: Commercial launch of NXG XII 600 Multi laser machine

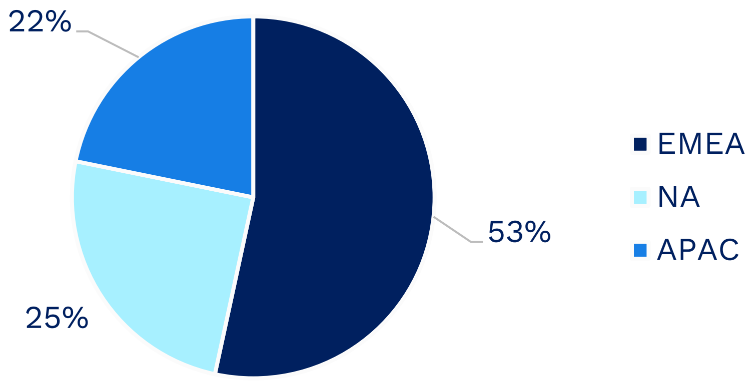
---

1. Timeframe includes activities within the MCP Group out of which SLM Solutions was split off

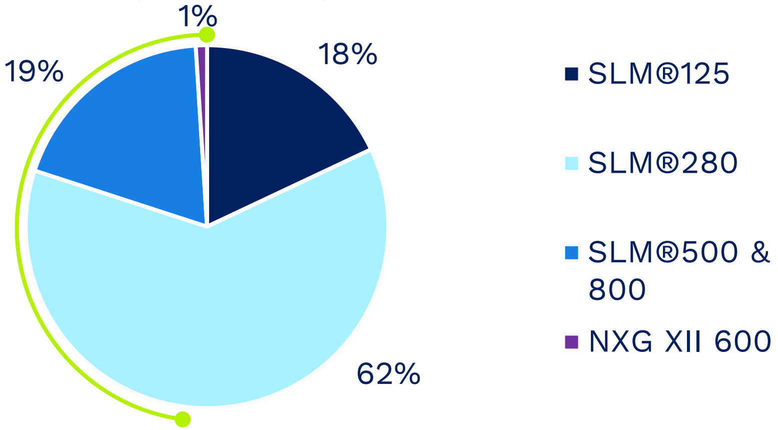
>750 machines installed globally

Serving a broad range of blue chip customers

Installed base by region



Installed base by machine type



>50% of IB multi laser

~95% of Backlog multi laser

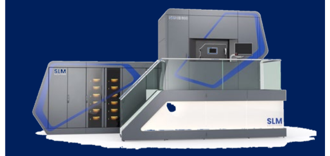
Source: SLM
Note: Installed machine base as of Feb 2022

Serving more than 150 blue chip customers

including **Fortune 500** companies, **Dax30** companies, some of the **largest OEMs** as well as leaders in **space exploration**, **aviation**, **electro mobility**, **motor racing**, **science**, and many more…

Rolls-Royce
EMERSON
BLUE ORIGIN
Honeywell
AIRBUS
BOEING
Baker Hughes
SAFRAN
BMW
PORSCHE
NASA
MAN Energy Solutions
MAHLE®
Collins Aerospace

Technology pioneer with history of product innovation

	2009	2011	2013	2017	2020
	SLM®280	**SLM®280**	**SLM®500**	**SLM®800**	**NXG XII 600**
					
Addressable Market	Prototyping, small series production				High volume, serial production
Chamber Size	280x280x365	280x280x365	500x280x365	500x280x850	600x600x600
Laser	Single	Twin	Twin & Quad	Quad	12
Build Rate cm³/h	**Up to 88**	**Up to 88**	**Up to 171**	**Up to 171**	**>1,000**

Larger building platform + higher build rate imply >500% productivity increase

The superior efficiency level of the NXG XII 600 machine enables SLM to target a new market Development cycle for NextGen machine is >5 years.

Source: SLM

NXG XII 600 – designed for serial production

20x faster
than a standard single laser system

5x faster
than the SLM quad-laser machine

Designed for
serial production

Optimized for large parts and
high-volume production

12 Lasers
1000 Watts each

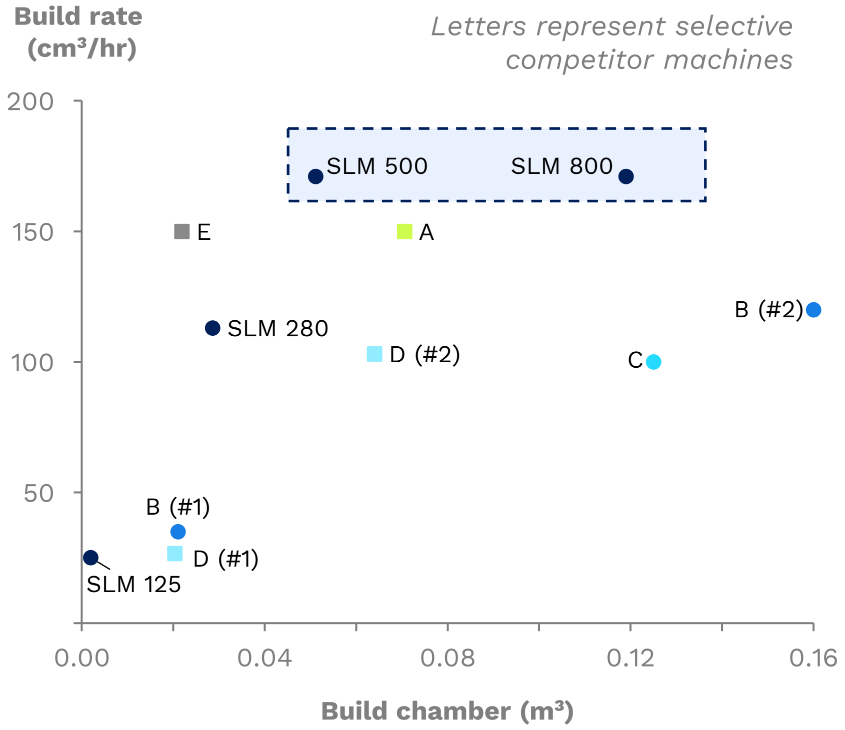
Zoom function
build up rate up to 1000 cm³/h

Capable of
large layer thickness

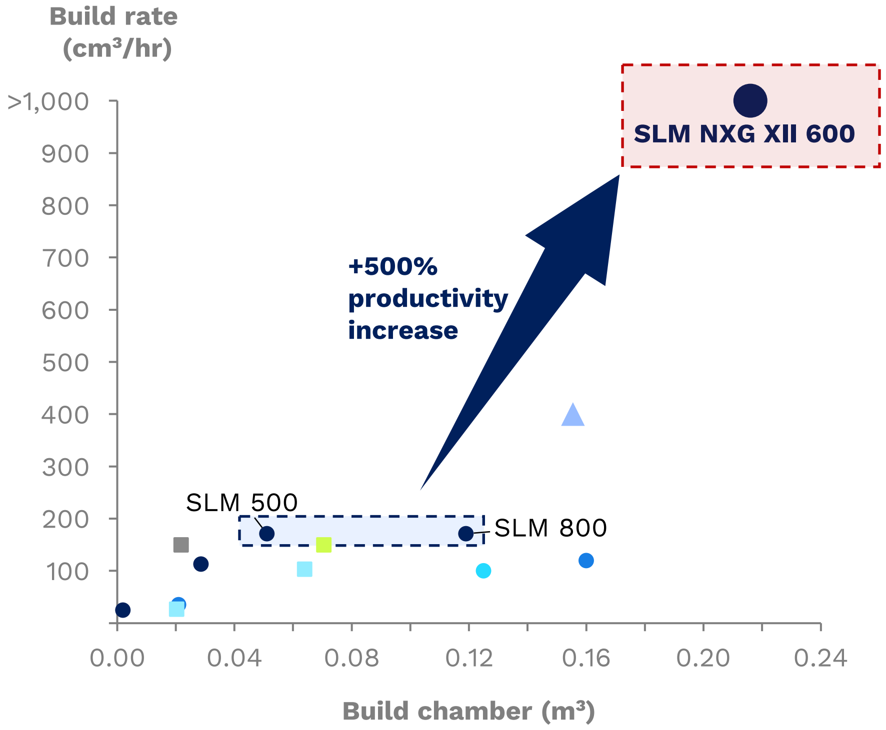
Fine features and
delicate patterns possible

NXG XII 600 is moving metal AM economics to a completely new level

SLM's current generation of machines is already at the top level of productivity for Metal AM machines…



… but SLM's NextGen machine will be a gamechanger



NXG XII 600 - Order Intake as of 4Q21

Successful roll-out with broad-based interest

DIVERGENT	⇒ **Three NXG XII 600**s will support the increasing production demand by major global auto manufacturers implementing the Divergent Adaptive Production System® ⇒ The three additional NXG XII 600 systems will bring their install base for this system to six.
SINTAVIA	⇒ **Two NXG XII 600**s[1] that will enable Sintavia to cost-effectively supply the unprecedented demand for printed metal componentry, aided by a manufacturing rate and quality that remains unequaled in the industry ⇒ System capabilities tested on a benchmark part → large Inconel shrouded impeller with an exposure area of more than 50% and a weight of 174 kg was built successfully in under a week.
Collins Aerospace	⇒ **An NXG XII 600** will enable Collins Aerospace, a world leader in the design and production of Engine nozzles, to produce additively manufactured aerospace parts faster.
MAN **MAN Energy Solutions**	⇒ MAN ES ordered **an NXG XII 600** to meet the growing demand for large-scale AM parts with a greater envelope size. ⇒ MAN ES will utilize the machine for the serial production of components for technology solutions within the marine, energy, and industrial sectors.
LEADING SPACE COMPANY	⇒ **Two NXG XII 600**s[2] will allow a leading California-based rocket company to make its space missions more affordable and efficient by creating lighter, faster, and more robust space components.

1. Both orders are not included in the Company´s backlog as of 4Q21 as the contracts include a clause which allow the customer to cancel the order in a specific timeframe free of charge. The conditionality on one of the machines was removed in March 2022 and therefore this machine will be added to the company´s backlog and order-intake in 1Q22.
2. One order is not included in the Company´s backlog as the contract includes a clause which allow the customer to cancel the order in a specific timeframe free of charge.

Open Architecture

Unlocking innovation. Driving industrialization.

WHY DOES IT MATTER?

⇒ Provides customers with a fundamental **competitive advantage**.

⇒ Fosters **innovation** at SLM Solutions and in the wider AM industry.

⇒ Drives the **industrialization** of AM at a faster rate.

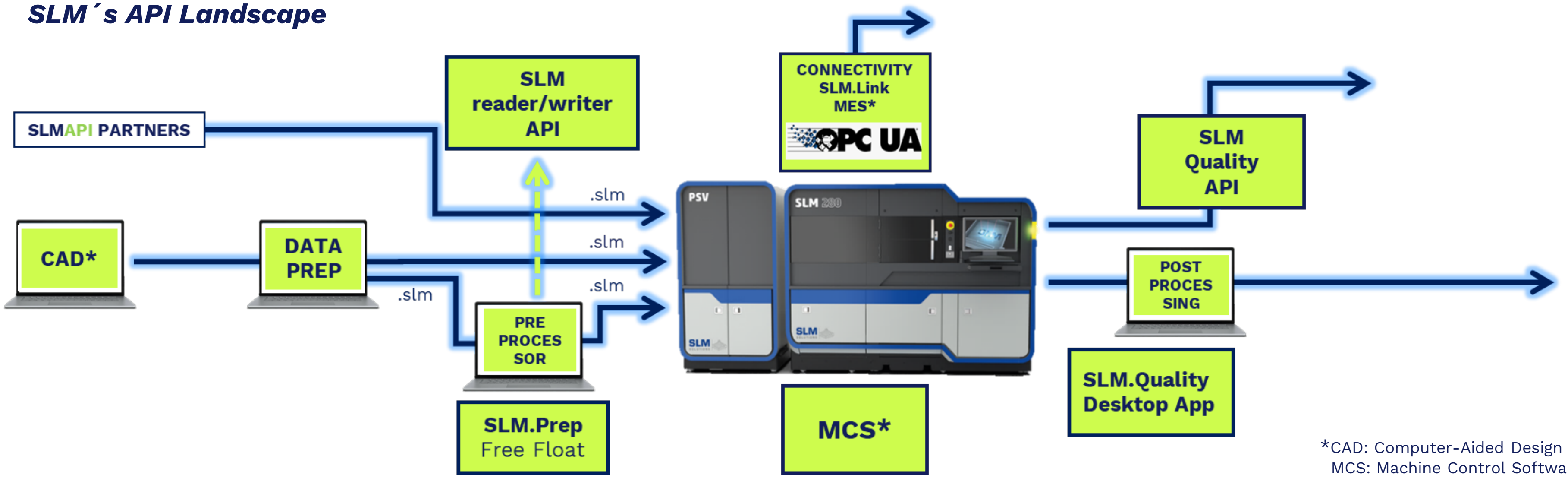
WHAT DOES IT MEAN?

⇒ **Software:** Application Programming Interfaces (APIs) to several external software vendors. Customizability for software offerings.

⇒ **Materials & Process:** Enable the free selection of materials & process parameters.

⇒ **Services:** Customized service agreements to meet the precise need of the customer, with measurable success criteria.

SLM´s API Landscape



*CAD: Computer-Aided Design
MCS: Machine Control Software
MES: Manufacturing Execution System

Free Float is unique

Customizability sets us apart

DIFFERENTIATOR	SLM SOLUTIONS	VELO3D	eos
Designated application for support reduction with minimalistic workflow targeting standardized processes	YES	Not known	NO[*]
Open material parameter selection	YES	NO	YES
Ability to customize Free Float process	YES	NO	YES
Retrofittable on existing system portfolio	YES	N/A	YES
Availability of Free Float technology or similar solution	YES	YES	YES

By harnessing the power of **Free Float**, customers can **reduce post-processing costs by up to 94[#]%**

SLM Solutions' **Free Float** places power in the hands of our customers, enabling them to customize the solution in the manner that best suits their requirements and part profile

Source: SLM Solutions Research

[*] No automated algorithm/application. Additional time and effort (therefore costs) required to work in the system on an engineering level to tweak settings manually, without direct knowledge of outcome.

[#] Detailed case study here.

Experienced Management Team

Leadership with extensive industry track record

Sam O'Leary
CEO
Since Dec-2019
(CEO since Jan-2021)

- GE Additive Director of Product Management
- Prior: GE Power Supply Chain Strategy Leader

Dirk Ackermann
CFO
Since Jun-2020

- Senior Finance Manager at GE
- Prior: Finance Manager in various segments and locations of GE

VP Engineering & Technology
former GE

Product Management
former Trumpf

Service & Application
former Rockwell Collins

Quality Management
former Draegerwerke

Global Supply Chain
former Airbus

General Counsel & Chief People Officer
former Siemens

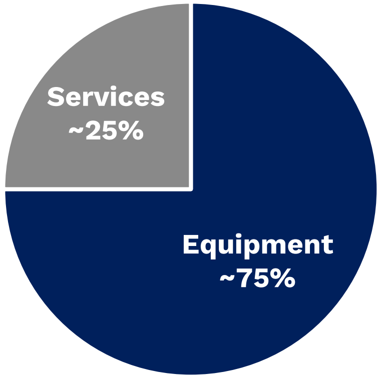
Chief Sales Officer
former ExOne, 3D Systems

Experienced management team driving best-in-class processes across the organization

Increased focus on services

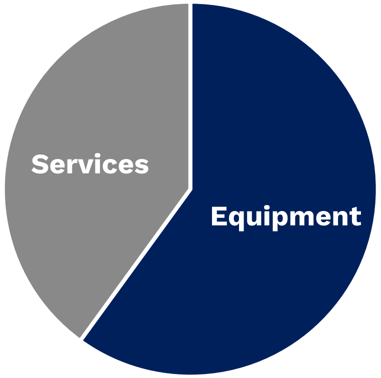
Acceleration of service revenues while boosting profitability

Historically, limited focus on services



- **Limited focus** across company, main goal to sell machines
- **Customer success not a KPI**, limited collaborations with customers
- Current **machine generation with low powder consumption** given application in prototyping and small series production

Share expected to significantly increase going-forward



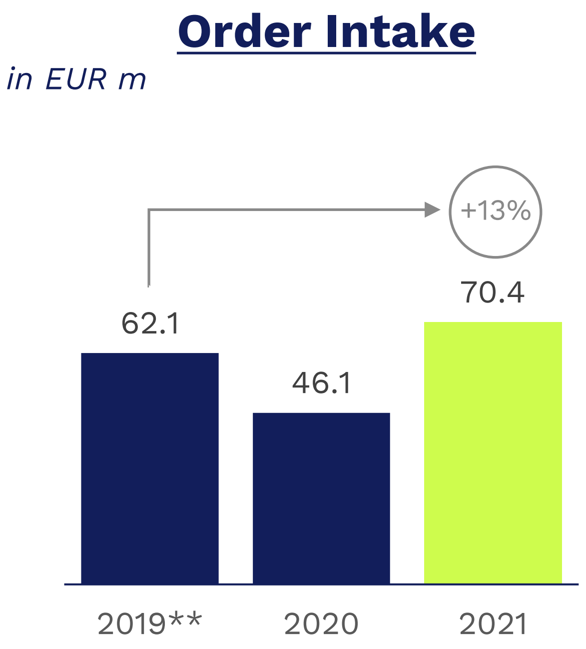
Gradual increase of service revenue as the business matures

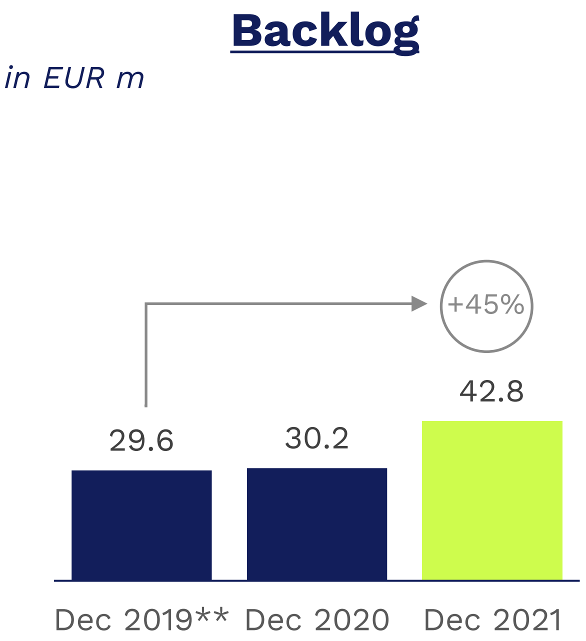
- **Our customers' success is our success**
- **Increased alignment of revenues** to criteria important to our customers
- **NXG machines requiring significant powder supply** given large series production
- **Mandatory service contracts** on NXG machines to ensure customer success

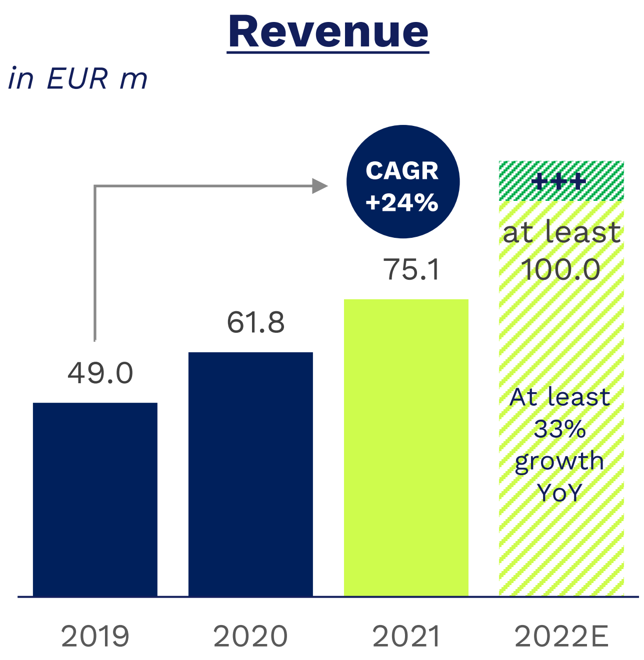
SECTION 5

Financial overview

Growing Topline







- ☐ Order intake for FY 2021 at EUR 70.4m, **higher by 53%** as compared to FY 2020.
- ☐ Strongest* order backlog as at year-end 2021 of EUR 43m, **up by 42% YoY**, provides SLM Solutions with a solid base going into 2022.
- ☐ Revenue **up 22% at EUR 75.1m**, as compared to FY 2020, **outperforming guidance for the second consecutive year**.

* Prior period figures adjusted for Chinese Frame Agreements.
** Includes EUR 5.6m of backlog adjustments performed in Q2 ‘20

Selected Financials

Sustained upward trajectory in revenue & profitability

in EUR m	**2021**	Change	**2020**
Machines Revenue	57.6	+28%	45.1
After Sales Revenue	17.5	+5%	16.6
Gross Profit	46.3	+36%	33.9
Gross Profit Margin	**56%**	**+3p.p**	**53%**
Payroll	**(39.0)**	**+9%**	**(35.6)**
Other Exps. & Income	**(15.8)**	**+22%**	**(13.0)**
EBITDA	(8.6)	+42%	(14.8)
Operating Cash Flow	**(18.3)**	**U**	**(3.4)**
Working Capital	**33.2**	**+36%**	**24.4**
Cash and cash equivalents	25.0	+33%	18.9

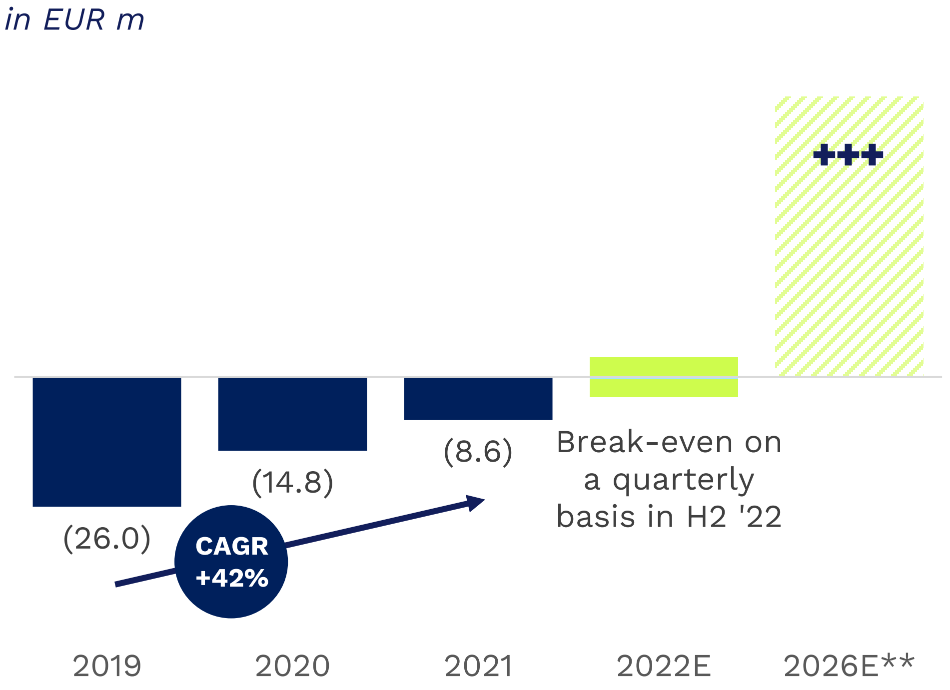
- Machines revenues increase mainly driven by SLM500 → doubled output vs 2020
- Focused on fixing after sales business by concentrating on quality & customer satisfaction, initial steps taking to accelerate revenue growth
- Gross Profit Margin improvement driven by product cost out & lower inventory write-offs, Q4 negatively impacted by ~EUR 1m increase of obsolescence reserve
- Other operating income includes forgiven PPA loan within US entity (EUR 0.8m)
- Other operating expenses negatively impacted by freight rates
- Increase in payroll aligned to mid-term growth targets
- Operating Cash-Flow negatively impacted by higher safety stock levels due to supply chain constraints and increase in receivables driven by late shipments and unfavorable terms

U = Unfavorable (change <(100)%)

Operational Profitability

Focus on enhancing operational efficiencies

EBITDA



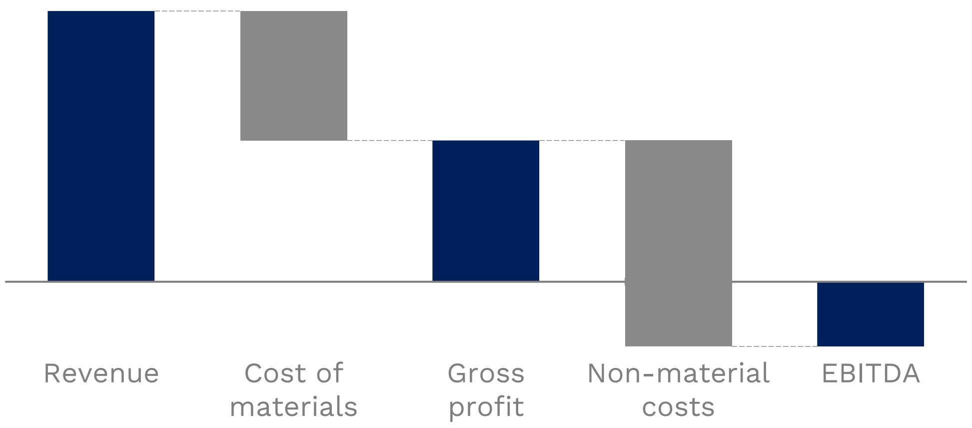
- Ongoing focus on operational excellence across all departments
- Implemented new manufacturing lines in 2021 to improve product throughput and variable labor costs, further improvement to be driven by lean principles
- Ongoing progress in driving material costs down, 3% material deflation in 2021 despite global supply chain crisis
- Implemented new CRM tool at the beginning of 2021 driving automation and better visibility in sales & services
- Initiated roll-out of new Product Life-Cycle Management (PLM) system with efficiency gains expected from product development to product roll-out stage.
- On track to achieve breakeven profitability on a quarterly basis in H2 2022, with continuous improvement in the following years.

** 2026E bar is only illustrative.

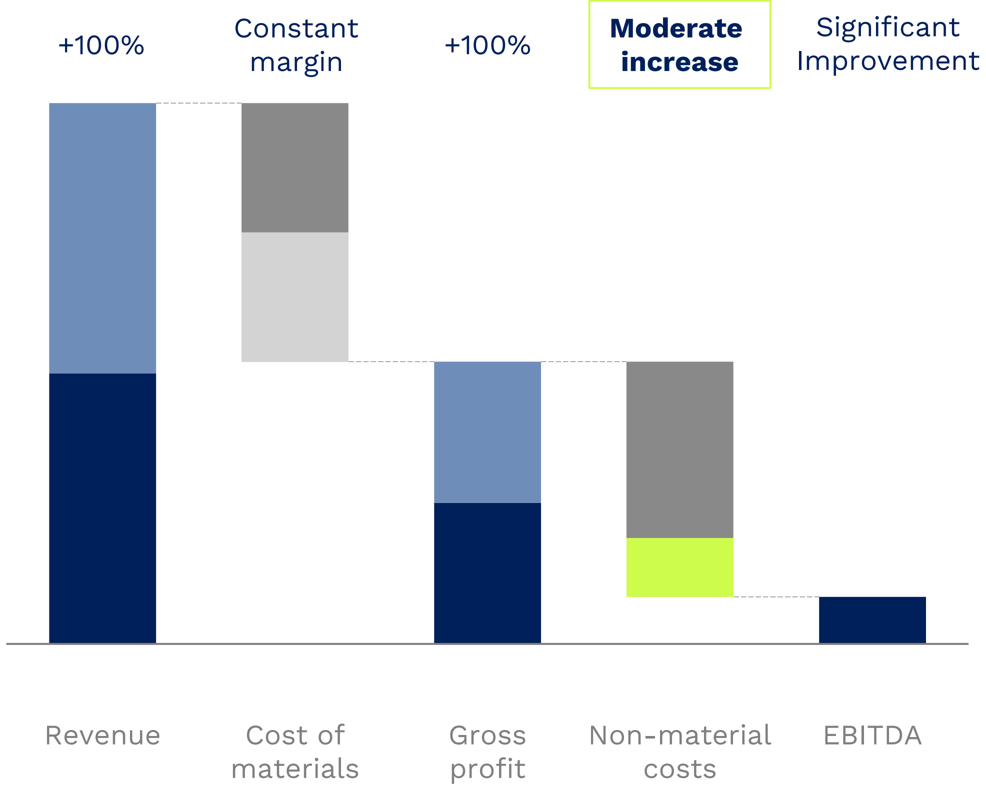
Path to growth and profitability

High operating leverage & NXG introduction

__Currently:__ **Negative EBITDA largely driven by high non-material costs (R&D, admin) relatively to revenue**



__Illustrative:__ **Revenue increase resulting in significant operating leverage due to decoupling of non-material costs**



Guidance & long-term view

Targeting 5x revenue growth in 5 years

Guidance

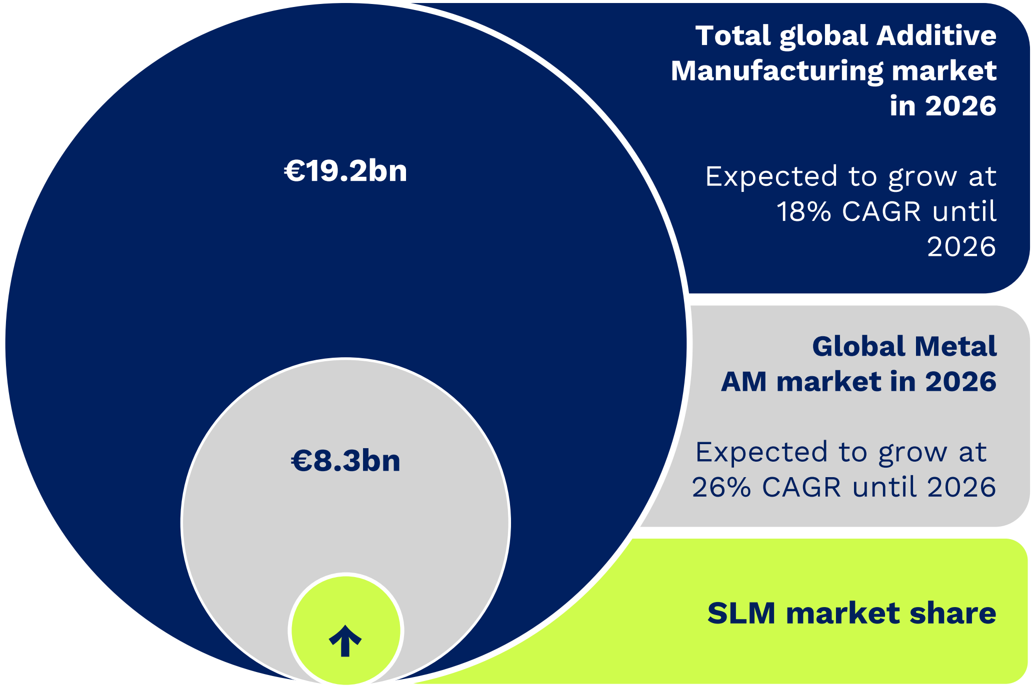
	2022E	2026E
Sales	At least EUR 100 m	~5x revenue growth vs 2021
EBITDA	Break-even on quarterly basis in second half	+++

Key Assumptions

2022E: *Easing of supply chain constraints in second half, no significant COVID-19 restrictions in key markets, successful NXG XII 600 ramp up, no severe economic slowdown due to Ukraine-Russia crisis*

2026E: *Ramp-up in serial production of key industries as expected in market forecasts, no significant economic events*

Expected market size*



Total global Additive Manufacturing market in 2026

Expected to grow at 18% CAGR until 2026

Global Metal AM market in 2026

Expected to grow at 26% CAGR until 2026

SLM market share

* Source: AM Power Report 2022

SECTION 6

Additional Case Studies

Advantages of AM

Improving functionality

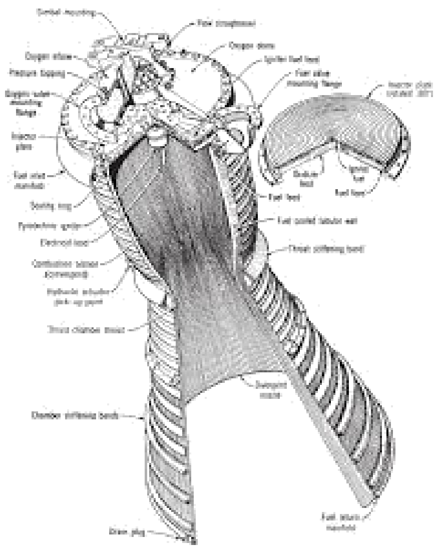
Monolithic Thrust Chamber

Core element of a liquid-propellant rocket engine.

Measurements: 228X194X310mm
Material: IN718 (Nickel Superalloy)
Machine: SLM® 280

Traditional Manufacturing

1. Time consuming and cost intensive process to produce
2. Increased risk of human error due to requirement of multiple parts for single component.
3. Essential cooling structure manufactured separately



Additive Manufacturing

1. Production time decreased from **~6 months to <5 days**
2. Entire component printed, without needing multiple parts – **significantly improving reliability.**
3. Innovative lattice structure enabling an **integrated cooling function** which also resulted in **increased stability.**

Source: SLM; NASA; G. P. Sutton, History of Liquid Propellant Rocket Engines, AIAA, Reston, VA, 2006.

Advantages of AM

High precision hybrid manufacturing

Grooving component used in metal cutting

This component performs an essential service in the production of parts for the aerospace, energy and electronics industry, to name a few

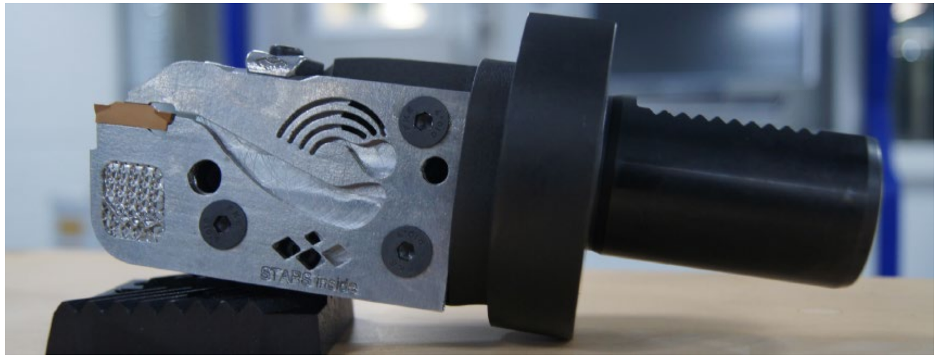
Material: 16MnCr5 (case hardening steel)
Machine: SLM® 280 Twin.

Traditional Manufacturing

1. Ineffective geometric shape of cooling channel with complex shapes unable to be produced.
2. Ineffective cooling leads to shorter life of product for end-users.
3. Increased weight of component → environmentally unfavorable.

Additive Manufacturing

1. **Complex star-shaped cooling channel** produced over a traditionally manufactured component.
2. Enhanced cooling functionality **increases life of product**, thereby **reducing total costs for customers**.
3. Weight of component **reduced by 45%**.



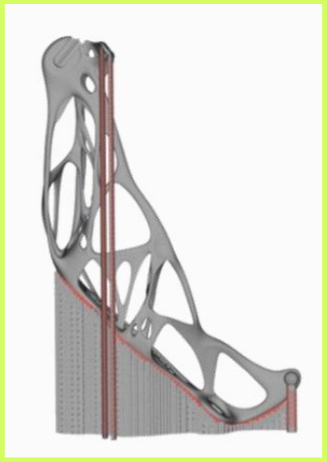
SLM Solutions' **Open Architecture** enables Burgmaier to realize the benefits of AM using its innovative case-hardening steel 16MnCr5 material

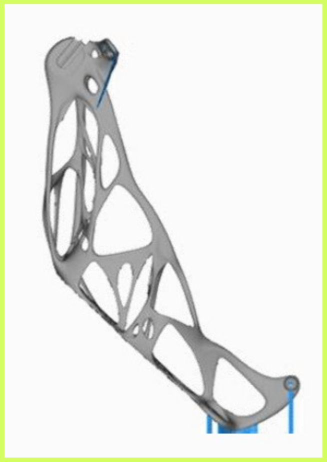
Source: SLM

Advantages of AM

Minimized post-processing costs

By harnessing the power of **Free Float**, customers can reduce post-processing costs by **up to 94%**





SLM produced the part^2 using Inconel 718, a nickel-based superalloy extensively used in the energy & space industries.

Inconel is a robust material but also results in high post-processing costs.

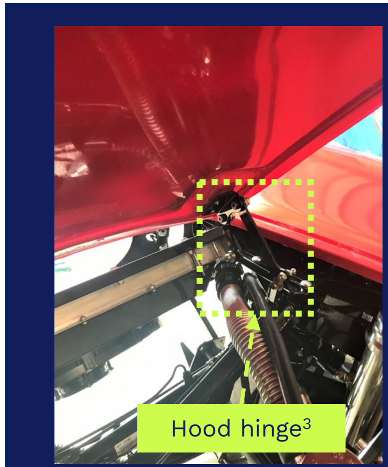
With SLM® **FREE FLOAT –**
Robustness of material? ***YES***
High post processing costs? ***NO***

	Without Free Float	**With Free Float**
Material [1]	Inconel 718	Inconel 718
Supports	Block Supports up to 45°	Flat sections + connections
Support Volume	59,588 mm^3	767 mm^3 **-99%**
Post Processing Time (hh:mm)	01:30	00:05 **-94%**

1. Original part manufactured using Aluminium. Additively manufactured part produced using IN718 (Nickel-based superalloy). SLM Solutions computed material and labor requirements if original part was manufactured with IN718. Comparative figures based on this study.
2. Part by Lighthinge (EDAG, voestalpine, simufact)

Advantages of AM

Increased precision, decreased post-processing



Lightweight hood hinge[2]

Additively manufactured Lightweight hood hinge with integrated pedestrian protection

Material: IN718 (Nickel Superalloy)[1]
Machine: SLM® 280 Twin

Traditional Manufacturing

1. Component weight resulting in larger carbon footprint.
2. Several individual parts required for the component – resulting in high assembly and tooling costs.
3. Inability to add new functionalities without compromising on quality or cost.

Additive Manufacturing

1. Weight of component **lowered by approx. 50%**.
2. Number of parts **decreased from approx. 40 to 2**.
3. Post processing costs **can be reduced significantly.**
4. **Complexity for free**

1. Original part manufactured using Aluminium. Additively manufactured part produced using IN718 (Nickel-based superalloy). SLM Solutions computed material and labor requirements if original part was manufactured with IN718. Comparative figures based on this study.
2. Part by Lighthinge (EDAG, voestalpine, simufact)
3. Image is only illustrative and not the additively manufactured part.

Advantages of AM

Significant weight reduction

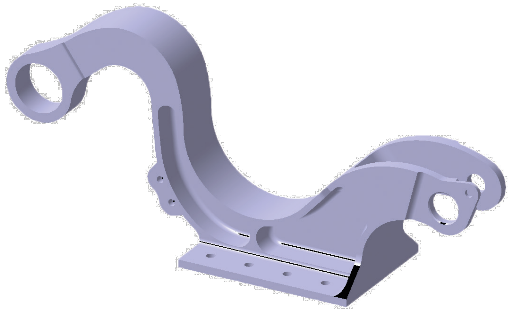
Gooseneck bracket

Structural component from Krueger flap actuating mechanism for airplanes.

Measurements: 93X220X136mm
Material: Ti6Al4V Titanium
Machine: SLM® 280 Twin

Traditional Manufacturing

1. Increased weight of component leading to high fuel consumption.
2. High buy-to-fly[1] ratio resulting in wastage.
3. Long Multiple parts required for single component leading to higher labor costs.
4. production time.



Additive Manufacturing

1. Weight of component **down by 31%**.
2. Buy-to-fly ratio **decreased from 17x to 1.5x,** significantly reducing wastage.
3. Production time **decreased by over 40%**.

Source: SLM
Note: 1. Ratio between weight of raw material purchased and weight of final part.

SECTION 7

Comparison with US industry peers

SLM in Perspective

SLM with superior technological capabilities

	SLM SOLUTIONS	Velo3D	Desktop Metal[1]
Technology	Powder Bed Fusion	Powder Bed Fusion	Binder Jetting
Support Free	Yes	Yes	*Not applicable*
Applications	Production of high value / high complexity metal parts	Production of high value / high complexity metal parts	Mass production of low-cost / low complexity parts
Industry Diversification	Aerospace, auto, energy, medical, research	Aerospace, energy	Auto, general industry
IP Portfolio	~450 publications >150 granted patents	<50 granted patents	650+ publications[2]
Technology Heritage	20+ years	7+ Years	6+ Years
Machine Portfolio	5 (1 to 12 lasers)	2 (2 to 8 lasers)	7[2]
Maximum Build Size	600 mm X 600 mm X 600 mm 40% Larger than Velo	Ø 600 mm x 550 mm	490 x 380 x 260 mm
Proven Productivity	>1,000 cc/h	<100 cc/h	~1,000 cc/h

Source: SLM, Velo3D disclosure, Desktop Metal disclosure

Note: 1. Focus on Desktop Metal's binder jet printing segment.
2. Post acquisitions of EnvisionTEC, ExOne, among others

SLM in Perspective (continued)

SLM with significantly more advanced fundamentals

	SLM SOLUTIONS	Velo3D	Desktop Metal[1]
Installed Base (# machines)	>750	<50	1[3]
Market Share (%)	>10%	<3%	*Not applicable, different market*
Employees (#)	>500	~200	~1,000[2]
In-house Manufacturing	Yes	No	No
Global Sites (#)	4	1	1
Direct Global Sales	Yes	No	No
Revenue 2021 (€m)	€75m	~€24m[4]	~€99.5m[2,4]
Gross Profit Margin FY 2021 (%)	56%	16%	27%

Source: SLM, Velo3D disclosure, Desktop Metal disclosure
Note: 1. Focus on Desktop Metal's Binder Jet segment.
2. Post acquisitions of EnvisionTEC, ExOne, among others
3. First P50 system shipped in Feb 2022.
4. 1 EUR = 1.13 USD