



# ENERGY EFFICIENCY

## AT THE HEART OF OUR PROCESSES

CAPITAL MARKETS DAY – NOVEMBER 29, 2018

CHRISTOPHE BOMMIER, CTO



# CUSTOMERS THAT BENEFIT FROM OUR EXPERTISE FOR GREATER PERFORMANCE AND EFFICIENCY

## ELECTRICAL POWER

**NO. 2 WORLDWIDE**  
Industrial fuses



**ELECTRICAL PROTECTION  
& CONTROL**

**NO. 2 WORLDWIDE**  
Components  
for power electronics



**SOLUTIONS FOR  
POWER MANAGEMENT**

## ADVANCED MATERIALS

**NO. 1-2  
WORLDWIDE**  
Graphite  
anticorrosion  
equipment



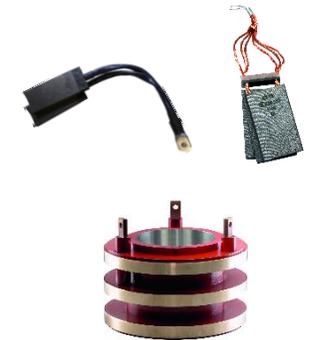
**ANTICORROSION  
EQUIPMENT**

**NO. 1-2  
WORLDWIDE**  
High-temperature  
applications



**GRAPHITE  
SPECIALTIES**

**NO. 1-2  
WORLDWIDE**  
Brushes for industrial  
motors



**POWER TRANSFER  
TECHNOLOGIES**

# INSIDE MERSEN: A REDUCED ENVIRONMENTAL FOOTPRINT

## ...FROM PRODUCT DESIGN TO RECYCLING



### CLEAN PROCESSES

Graphite manufacturing:  
a “best available technology” process

Fuse manufacturing: component  
assembly



### ECO-FRIENDLY PRODUCTS

No Mersen product is harmful to the  
environment



### PROACTIVE WASTE MANAGEMENT

Percentage of waste recycled:  
**42%** in 2017  
**+5 points\*** vs. 2016



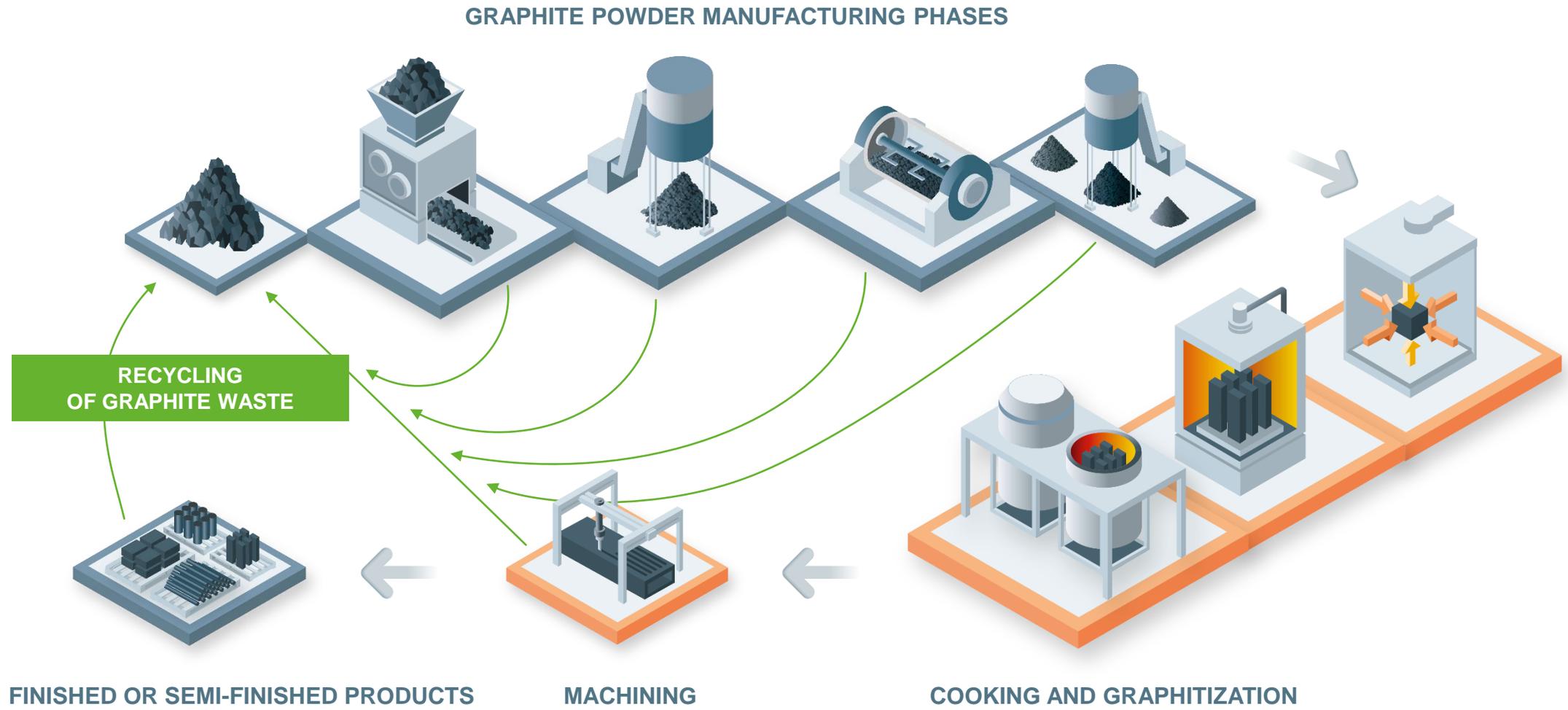
### ONGOING RECYCLING

**100%** of graphite powder recycled  
during the process

Fuse and electrical component  
recycling (external service provider)

\* At constant scope of consolidation

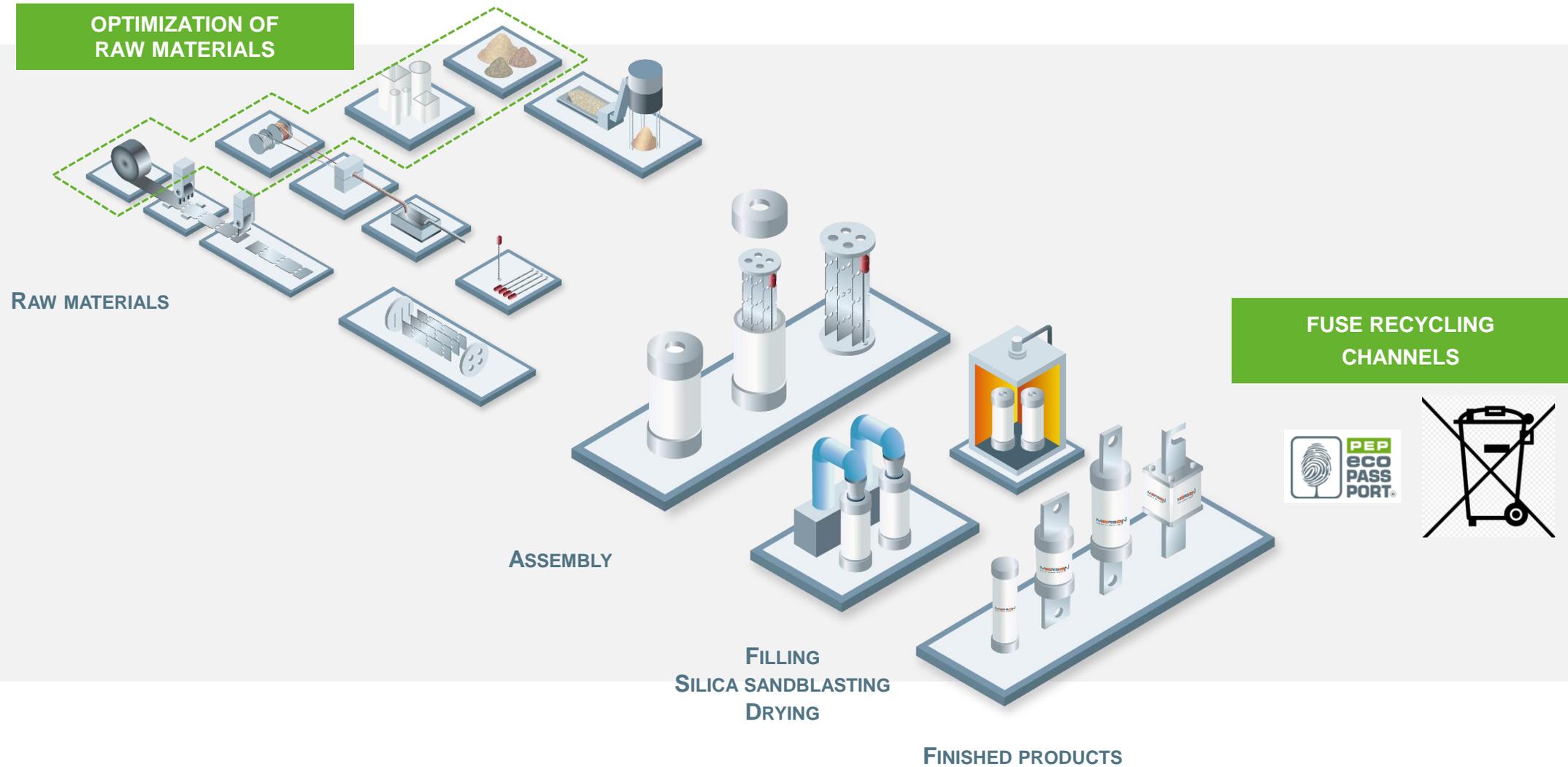
# GRAPHITE MANUFACTURING: A PROCESS THAT CLOSELY MATCHES TODAY'S "BEST AVAILABLE TECHNOLOGIES"



# HOW TO OPTIMIZE ENERGY CONSUMPTION IN OUR PROCESSES: THE EXAMPLE OF HOLYTOWN



# MANUFACTURING OF FUSES: THE IMPORTANCE OF RAW MATERIALS



# HOW TO OPTIMIZE THE USE OF RAW MATERIALS: THE EXAMPLE OF MODULOSTAR

## CONTEXT

Stand out from the competition on the fuse holder market

Propose a solution that consumes less raw materials and is easier to use

## CHALLENGES

Make it easier to access and change fuses

Reduce the use of raw materials by modifying the design

Maintain the same functionalities and obtain certifications for the new product

## STAKES

Reduction in the quantity of plastic materials

Reduction in copper

20% reduction in total production costs



BEFORE/AFTER DESIGN



QUESTIONS ?



# ENERGY EFFICIENCY

## AT THE HEART OF OUR STRATEGY

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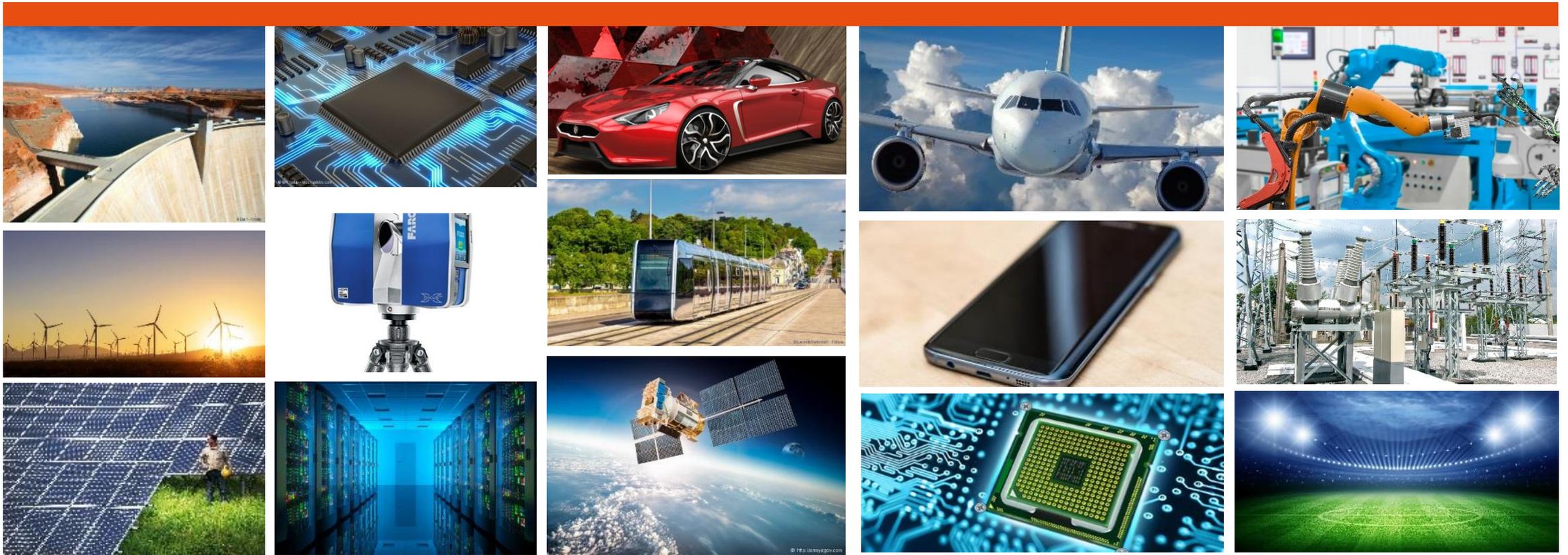


# MERSEN: OUR MISSION, TECHNOLOGICAL PROGRESS

WE ARE DEVELOPING  
THE **BEST TECHNOLOGIES**  
FOR THE INDUSTRIES OF THE FUTURE



WE PROVIDE INDUSTRIAL COMPANIES  
WORLDWIDE WITH **INNOVATIVE SOLUTIONS**  
ENHANCING THE PERFORMANCE OF THEIR  
**PRODUCTS AND SERVICES**



# CUSTOMERS THAT BENEFIT FROM OUR EXPERTISE FOR GREATER PERFORMANCE AND EFFICIENCY



Example:

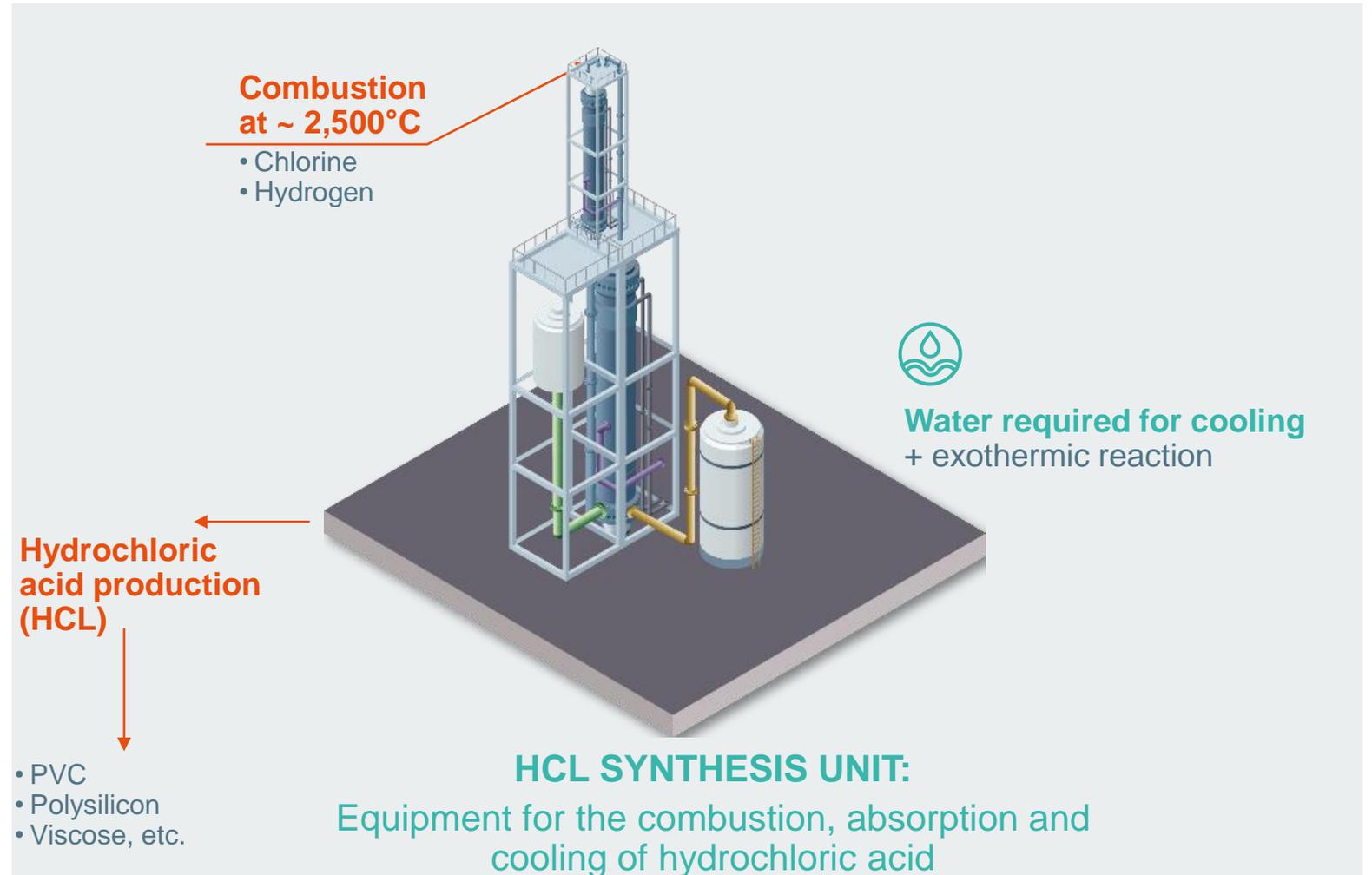
## THE CHEMICALS MARKET

# THE CORROSIVE CHEMICALS MARKET

HCL SYNTHESIS UNITS ARE NEEDED IN DEVELOPMENT ACROSS A VAST NUMBER OF MARKETS

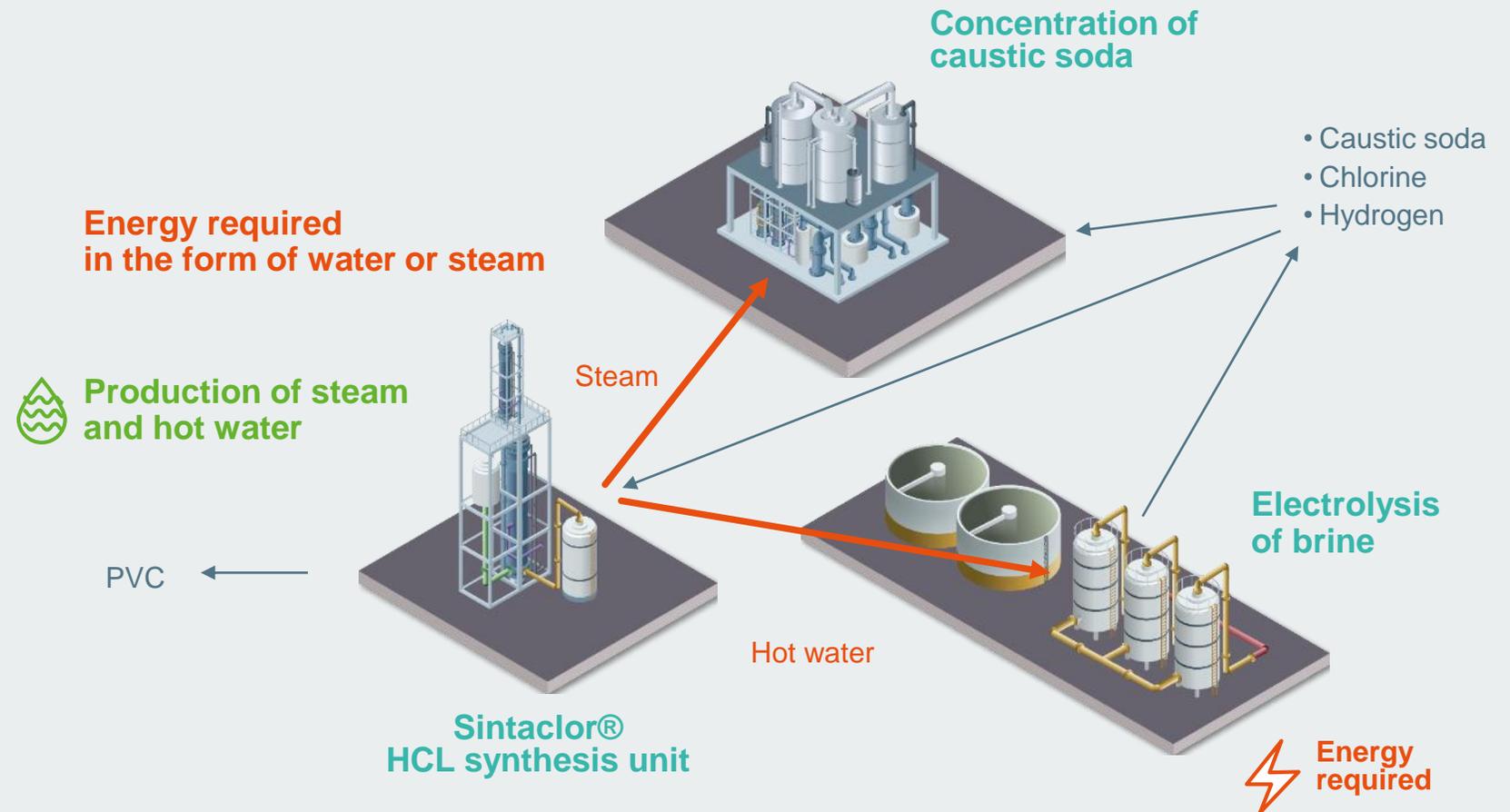


# MERSEN SUPPLIES HCL SYNTHESIS UNITS



# BENEFITS FOR OUR CUSTOMERS

Cooling water from synthesis units IS REUSED FOR HEAT RECOVERY



# SOLUTION TO THE WATER CHALLENGE IN INDIA

## CUSTOMERS



ADITYA BIRLA GROUP



## CONTEXT

Viscose and aluminum markets are seeing strong growth

Difficult climate conditions

Need for a solution with low water consumption

## SOLUTION

Adaptation and optimization of an existing product

Limited water consumption (-65%)

Production in India

## STAKES

Long-term customer relationships

Sales of several million euros

# MERSEN STRENGTHS



## PRODUCT EXPERTISE

**Special grade of graphite  
for high temperatures  
( $>2,000^{\circ}\text{C}$ )**



## SYSTEM EXPERTISE

**System that recovers energy**  
produced in the form of steam for  
customer needs

**System for recycling water**

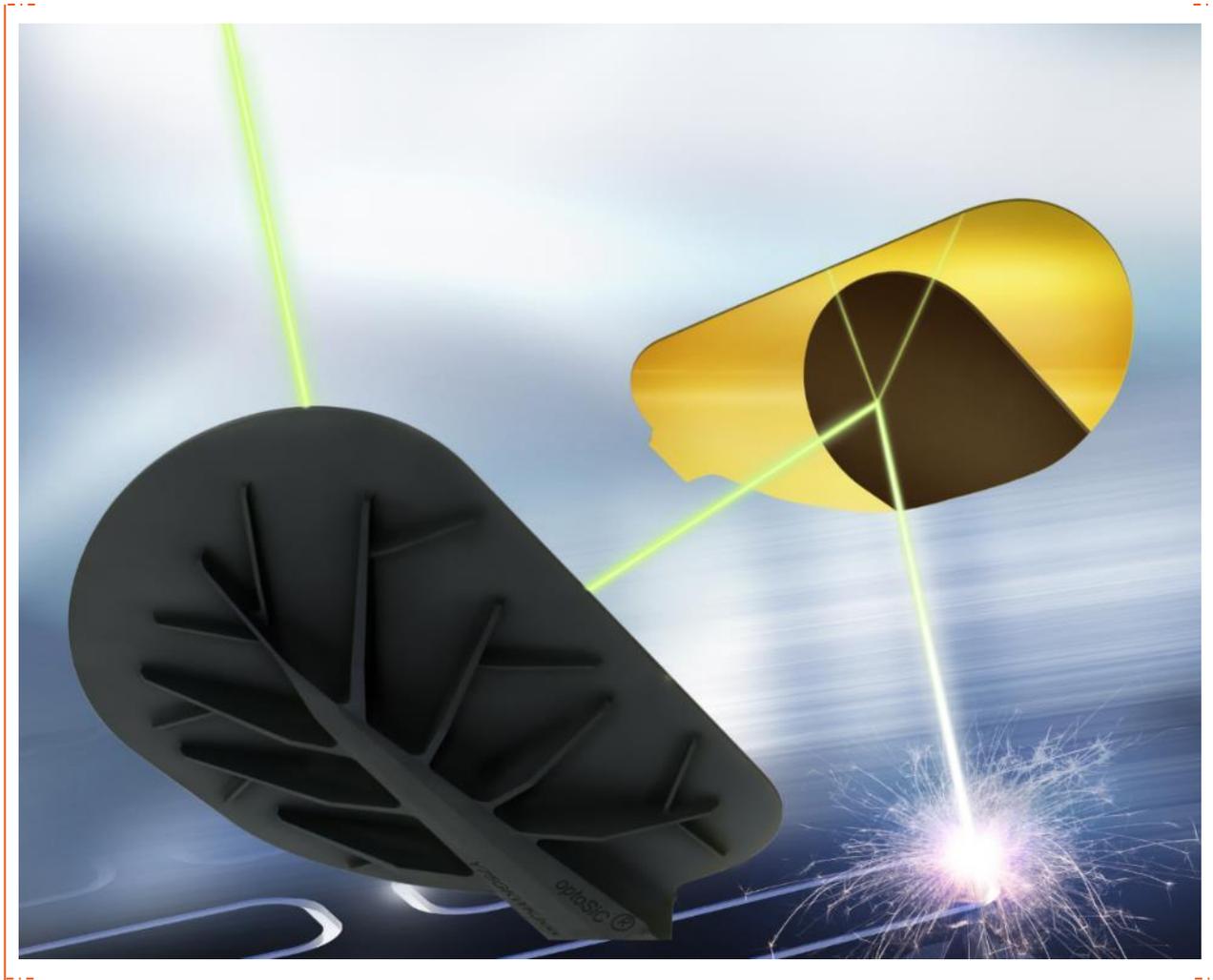


## GLOBAL NETWORK

**Local manufacturing**

Synthesis units for  
production facilities are  
**manufactured locally**  
(*lower transport costs*)

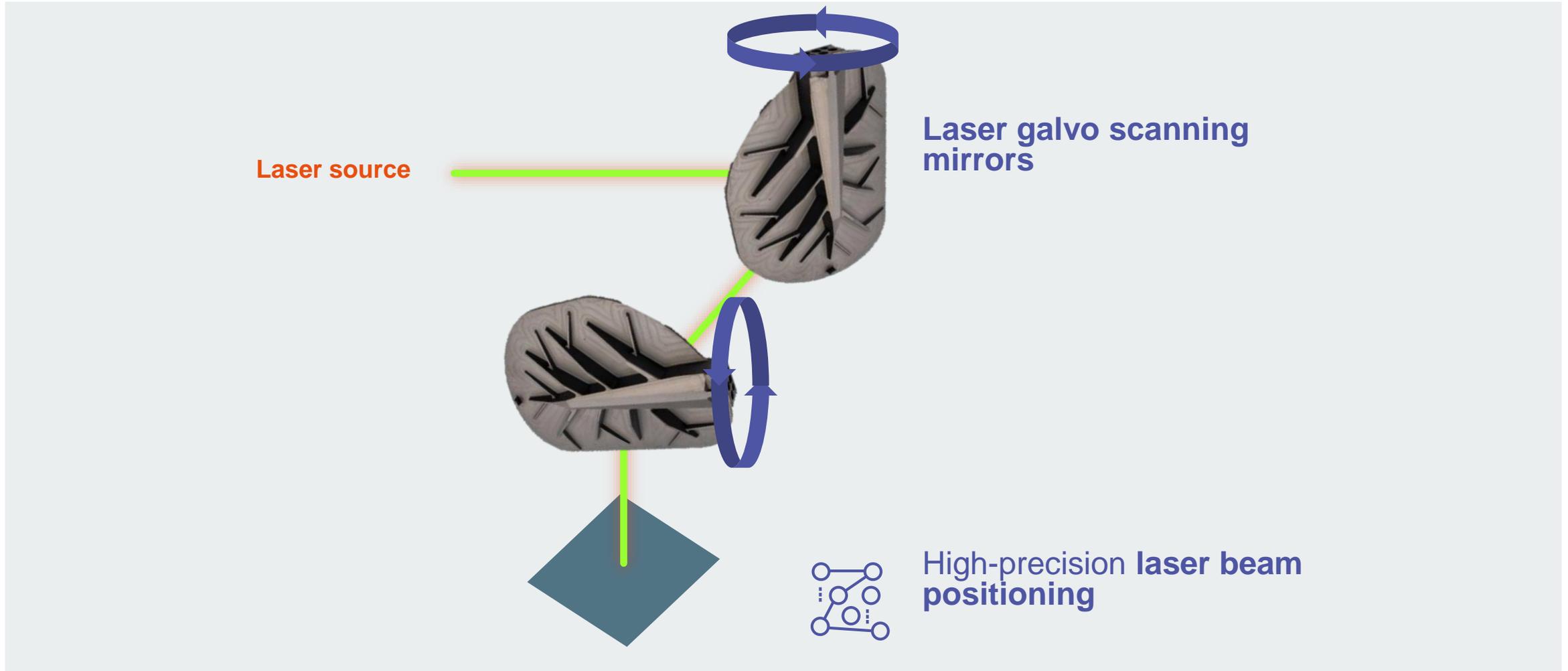
# CUSTOMERS THAT BENEFIT FROM OUR EXPERTISE FOR GREATER PERFORMANCE AND EFFICIENCY



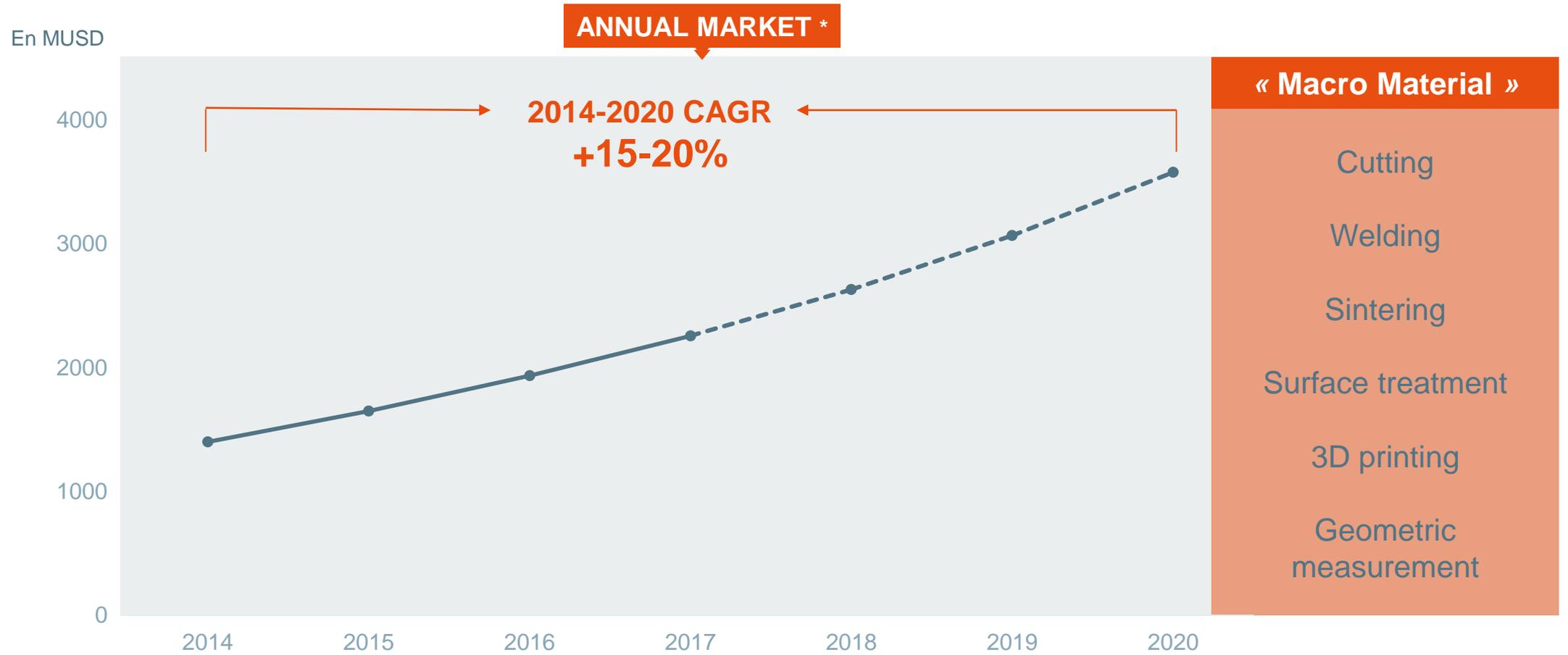
Example:

## INDUSTRIAL APPLICATIONS FOR LASERS

# UNDERSTANDING LASER SCANNERS



# A GROWING MARKET



\* Source: "Industrial Laser Solutions" - Macro Material - March 2016 – and Mersen estimates for price erosion

# SIGNIFICANT MARKET OPPORTUNITIES MEAN LIMITED EXPOSURE TO CYCLICAL CHANGE

**END-CUSTOMERS**

TOYOTA Volkswagen TESLA

adidas intel

BOEING AIRBUS

MICHELIN

LONGI SAMSUNG

**LASER MACHINE MANUFACTURERS**

FARO stratasys

XYZ PRINTING Mazak OPTONICS CORP.

GE Additive manz

HAN'S LASER COHERENT

TRUMPF NGK

NOVARTIS

**GALVANOMETER MANUFACTURERS**

RAYLASE SCANLAB

RIEGL AEROTECH

Marc Newson

FARO

CAMBRIDGE TECHNOLOGY

**MERSEN CUSTOMERS**

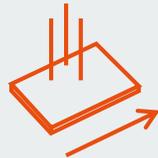
Non-exhaustive list

# GROWTH DRIVERS



## Technical advancements in laser sources

Wavelengths, pulse lengths, lower energy requirements, etc.



## Increase in the size of mirrors

Broader spectral range, large surface processing



## Higher quality mirrors

High angle acceleration

Thermal stability

**GREATER**

PRODUCTIVITY AND ENERGY  
EFFICIENCY

**LOWER**

ELECTRICITY CONSUMPTION

# SiC IS THE IDEAL MATERIAL

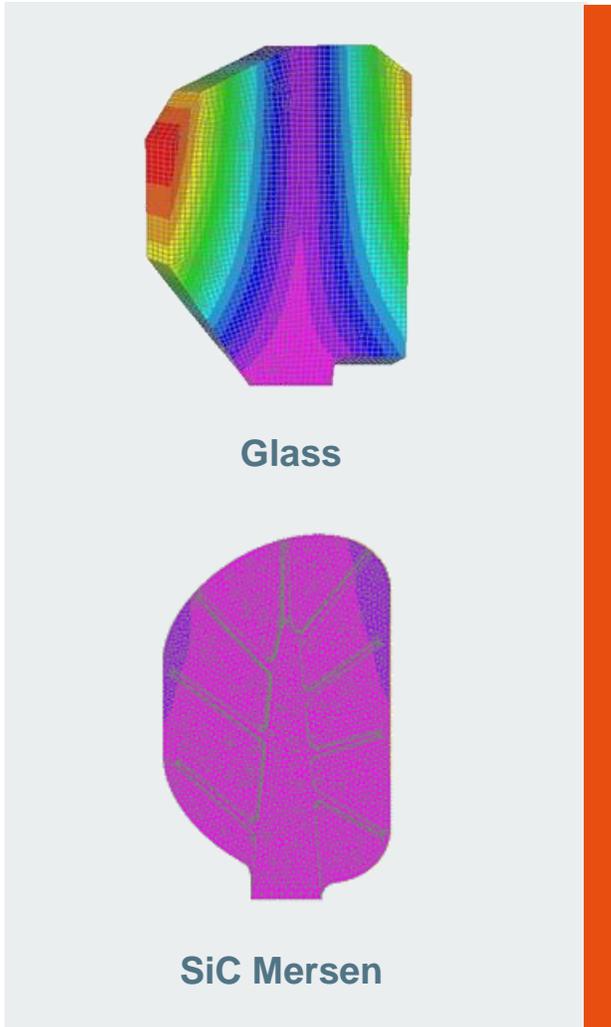
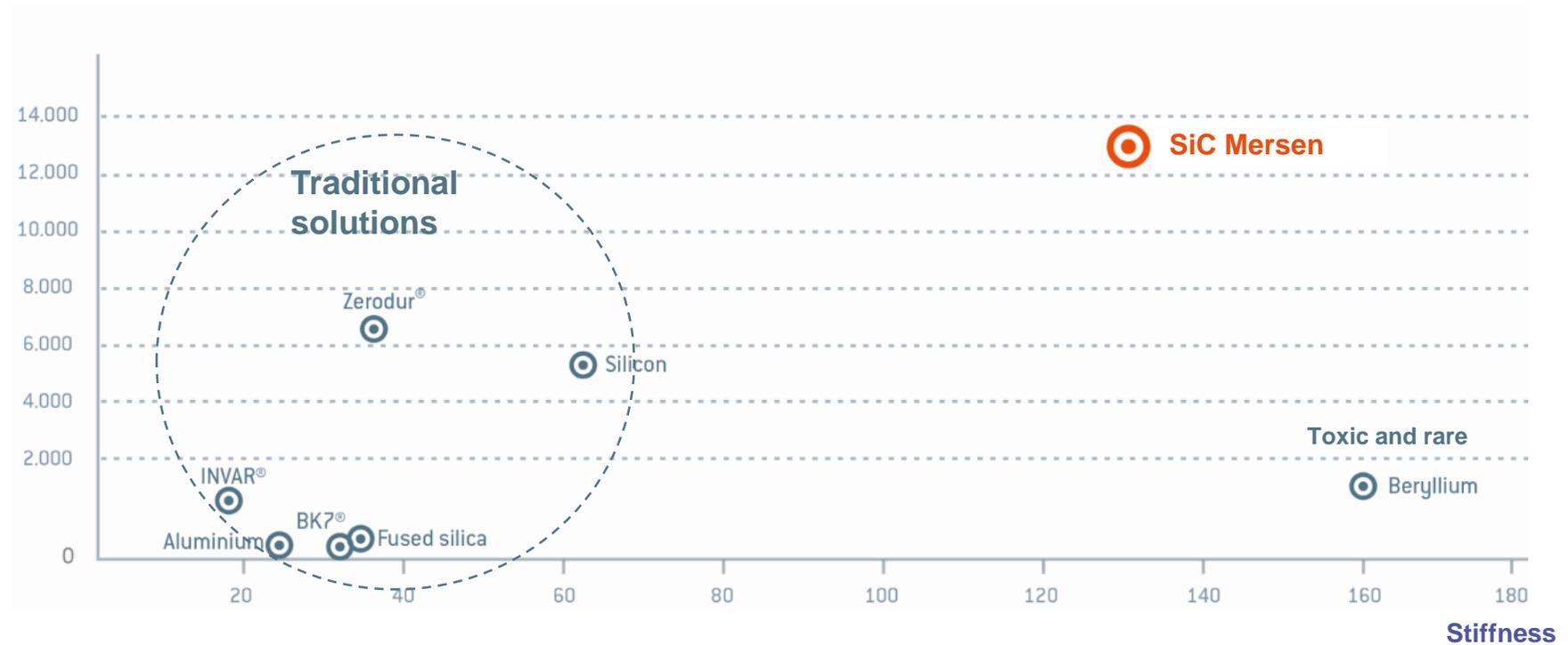
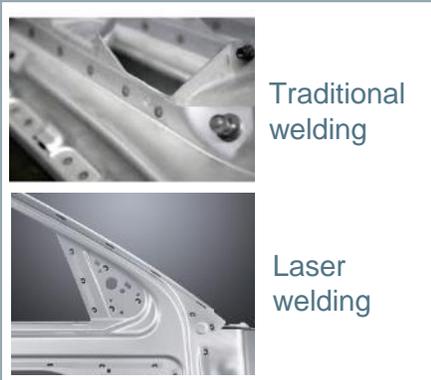


Figure of merit:  
quality of materials for mirror applications



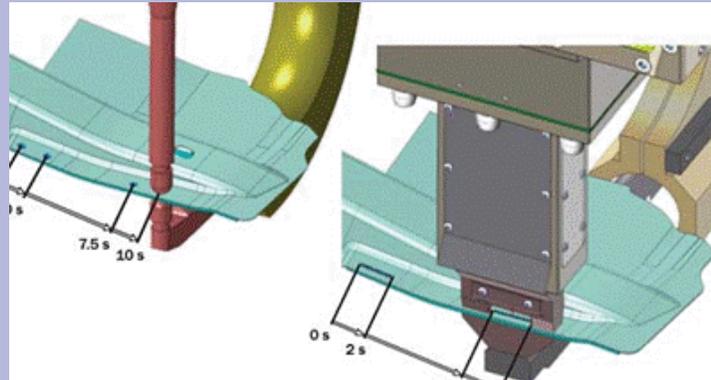
# AUTOMOTIVE INDUSTRY EXAMPLE

## WEIGHT SAVINGS



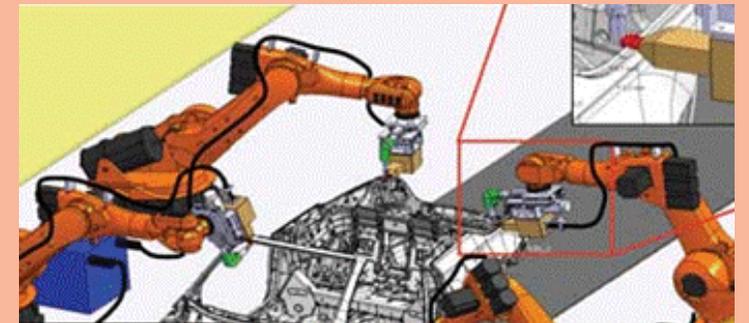
**40 kg less metal**  
per car

## TIME SAVINGS



**Time savings**  
of **50%**

## SPACE SAVINGS - LOWER CAPEX



**Half**  
the manufacturing space

**Half**  
the number of robots

# AUTOMOTIVE MARKET EXAMPLE



# MERSEN STRENGTHS IN SiC MIRRORS FOR LASER PROCESSES



## UNIQUE EXPERTISE

Recognized expertise in **silicon carbide**, a material with the ideal properties for this application

Clear technical understanding of end applications (**optical systems expertise**)



## TAILORED MANUFACTURING

Integrated **mirror polishing** process



## GLOBAL NETWORK

Strong partnerships with OEMs

# GROWTH SALES POTENTIAL FOR MERSEN IN LASERS



# SiC MIRRORS FOR LASERS STRATEGY



**Develop SiC optical polishing expertise**  
(10mm to 30mm)



**Increase production capacities in line with current demand**

(capex: €3m to €5m in 2 years)



**Next steps:** laser com satellite constellation projects that could impact the size of the market over time (*1 constellation = 1,000 to 2,000 satellites with 2 to 3 mirrors per satellite*)



# CUSTOMERS THAT BENEFIT FROM OUR EXPERTISE FOR GREATER PERFORMANCE AND EFFICIENCY



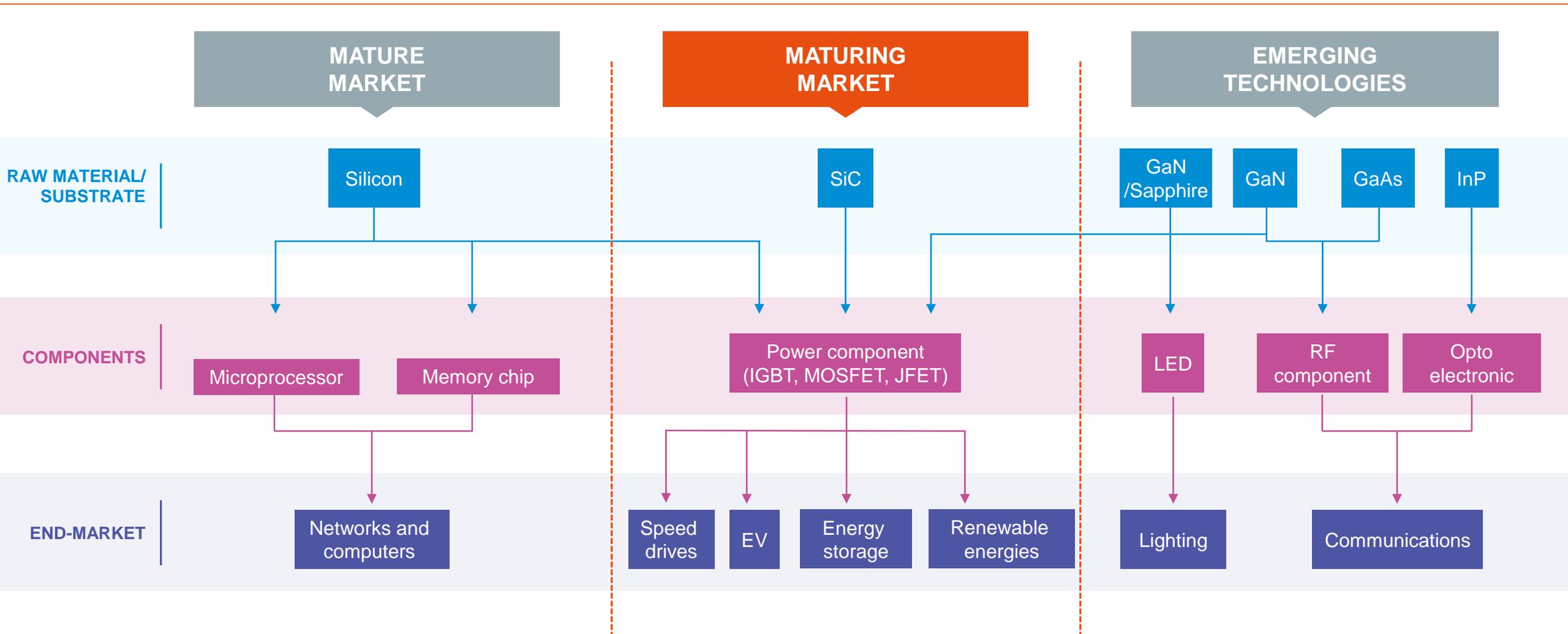
Example:

**SiC**  
**SEMICONDUCTORS**

# WHAT MAKES SiC SEMICONDUCTORS SO SUCCESSFUL?

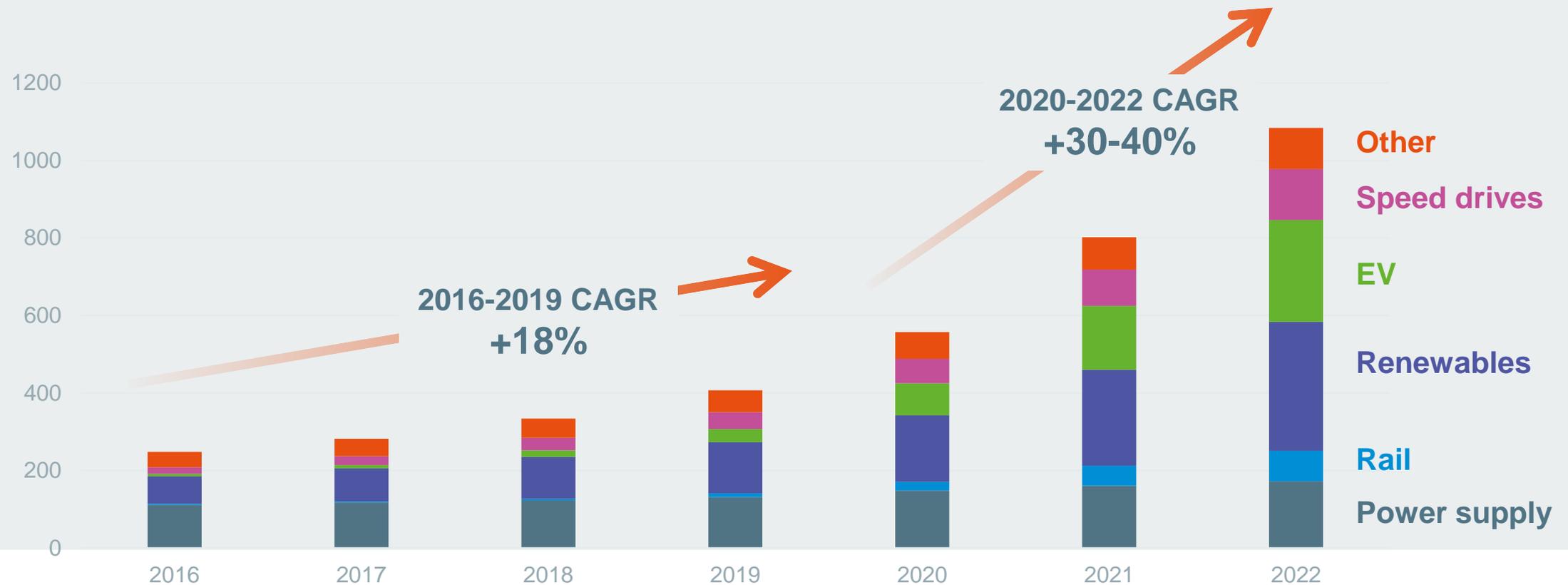
The silicon carbide  
semiconductor  
revolution

# DEVELOPMENTS IN THE SEMICONDUCTORS MARKET



# THE GROWTH OF THE SiC SEMICONDUCTORS MARKET IS SET TO ACCELERATE AFTER 2020-2022 IN LINE WITH THE GROWTH OF THE EV MARKET

SiC COMPONENTS MARKET IN USD MILLIONS



Source: Yole Development, Power SiC 2017 – Materials, Devices and Applications

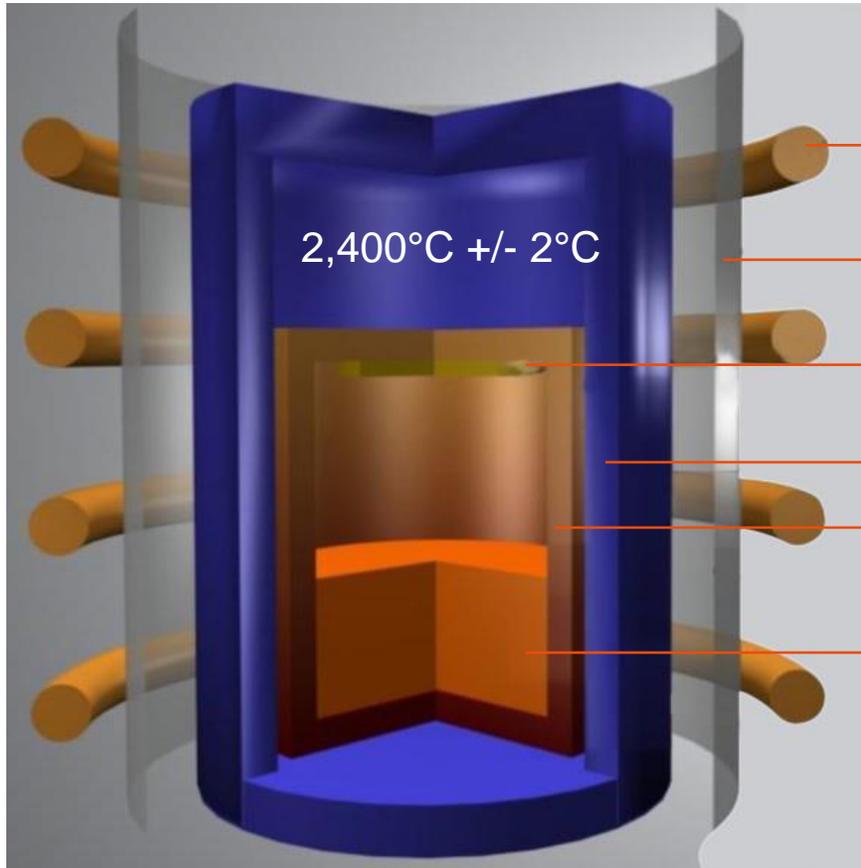
# A GLOBAL MARKET FOR WAFERS AND COMPONENTS



 Designers/manufacturers of SiC components

 Designers/manufacturers of wafers

# MERSEN SOLUTIONS



- Induction coil
- Quartz tubing
- SiC
- **INSULATION**
- **GRAPHITE CRUCIBLE**
- Reservoir of SiC powder

**GRAPHITE**  
COMPONENTS  
Crucible

—  
**RIGID FELT**  
**INSULATION**  
(Patent pending)



SiC ingot

# MERSEN STRENGTHS ON THE SiC SEMICONDUCTORS MARKET



## UNIQUE EXPERTISE

**Ability to meet technical challenges**

**Graphite: very high grade**

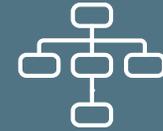
Felt: guaranteed thermal homogeneity of 2,400°C



## CUSTOMER RELATIONS

**Long-standing relationships with designers**  
*(wafers + components)*  
that place us at the forefront of design (“Designed in”)

**Ability to accompany new players**  
*(particularly in China)*

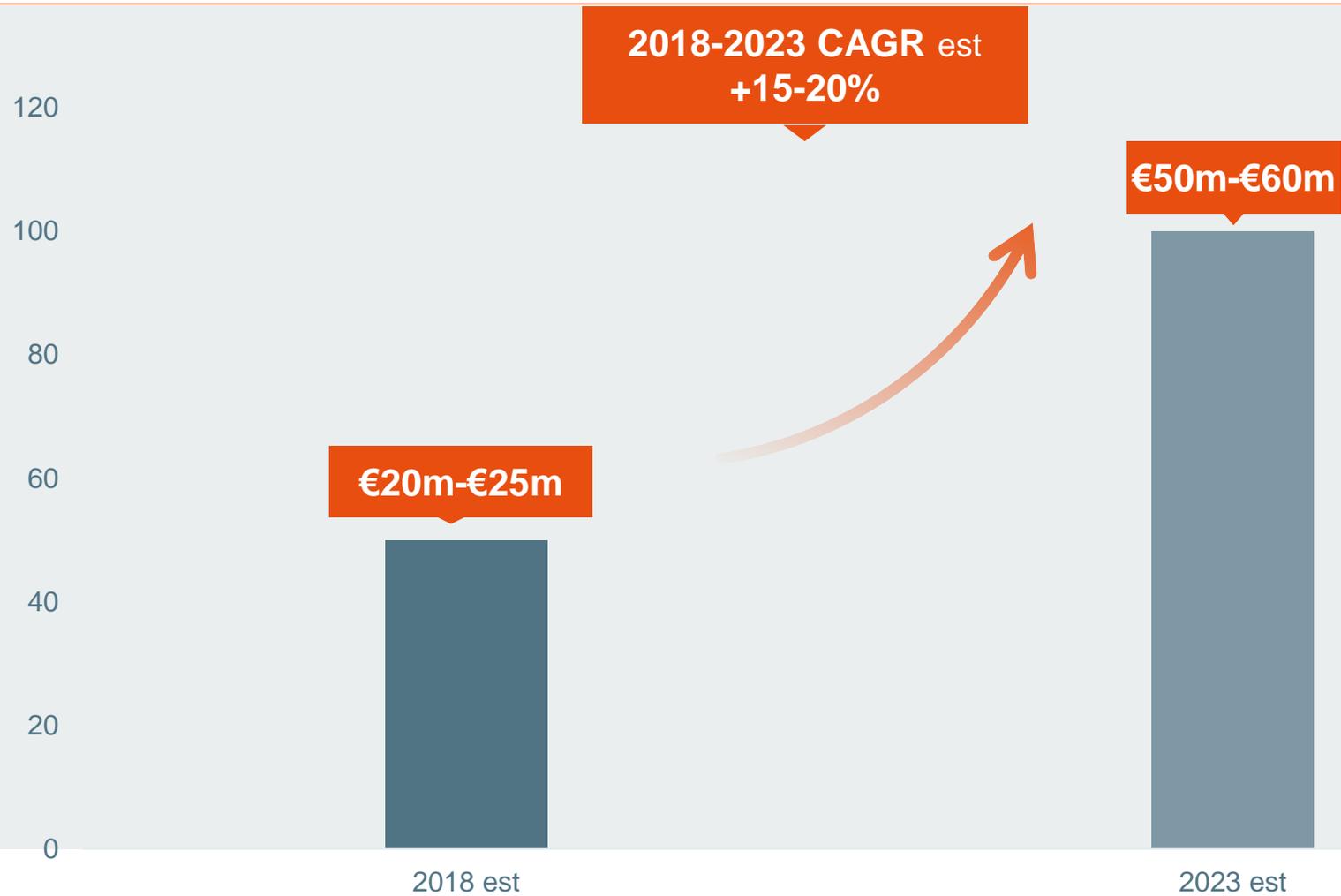


## STRONG ORGANIZATION

**Global organization**

*Asia, Europe and the United States*

# GROWTH POTENTIAL FOR MERSEN IN SiC SEMICONDUCTORS



# MERSEN STRATEGY FOR THE SiC SEMICONDUCTORS MARKET



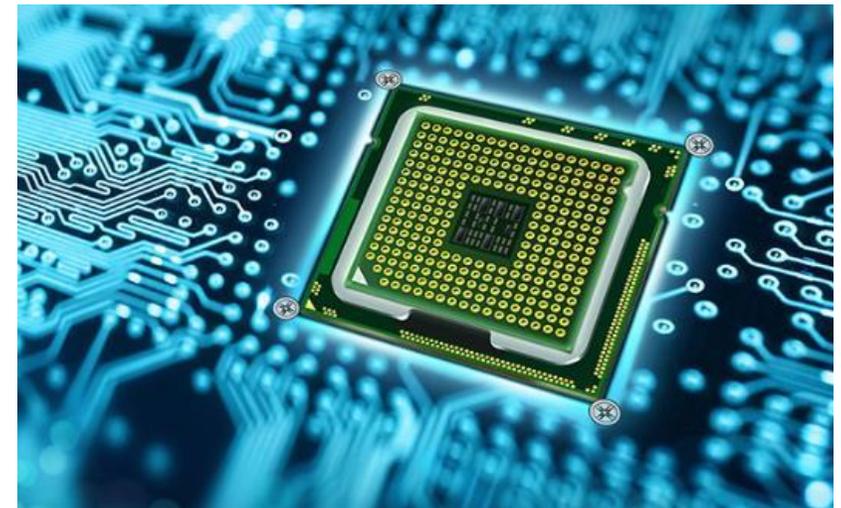
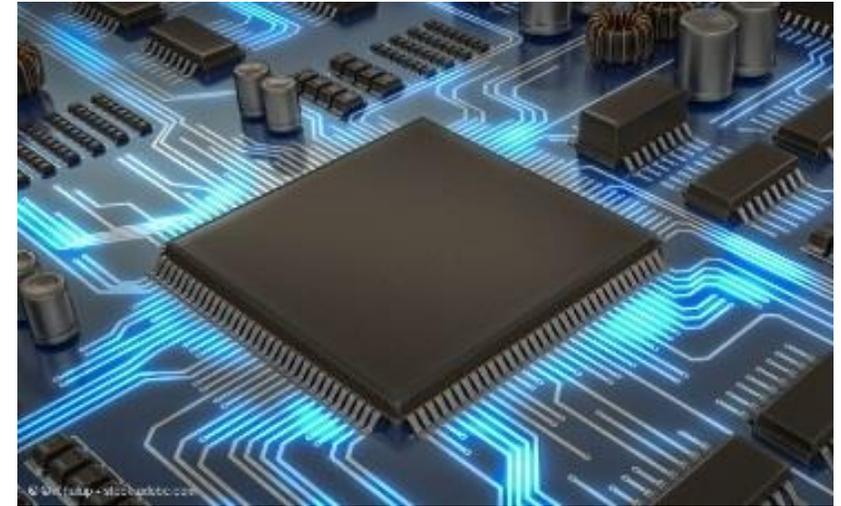
**Accelerate our positioning on the SiC semiconductors market which is less cyclical than other semiconductor markets**



**Keep pace with the accelerated growth of the market** by increasing investment in rigid felt (€25m-€30m for the next 3 years) in preparation for the market after 2020



**Capitalize on SiC properties to create high-performance protection solutions** through our partnership with Caly Technologies



# CONCLUSION



**A BROAD VARIETY OF  
HIGH-POTENTIAL OPPORTUNITIES**

**FOR MERSEN**

**MATERIALS EXPERTISE**

*INSULATION*

*GRAPHITE*

**ELECTRICAL EXPERTISE**

**SiC SEMICONDUCTORS NEED TO BE  
PROTECTED**

*COMPONENTS FOR POWER  
CONVERSION*



**QUESTIONS ?**