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Power Semiconductors in Emerging Applications

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Power semiconductors at the heart of all energy conversion systems

More energy with less resources

More performance with less energy

More mobility with fewer emissions

More connectivity with less interruption

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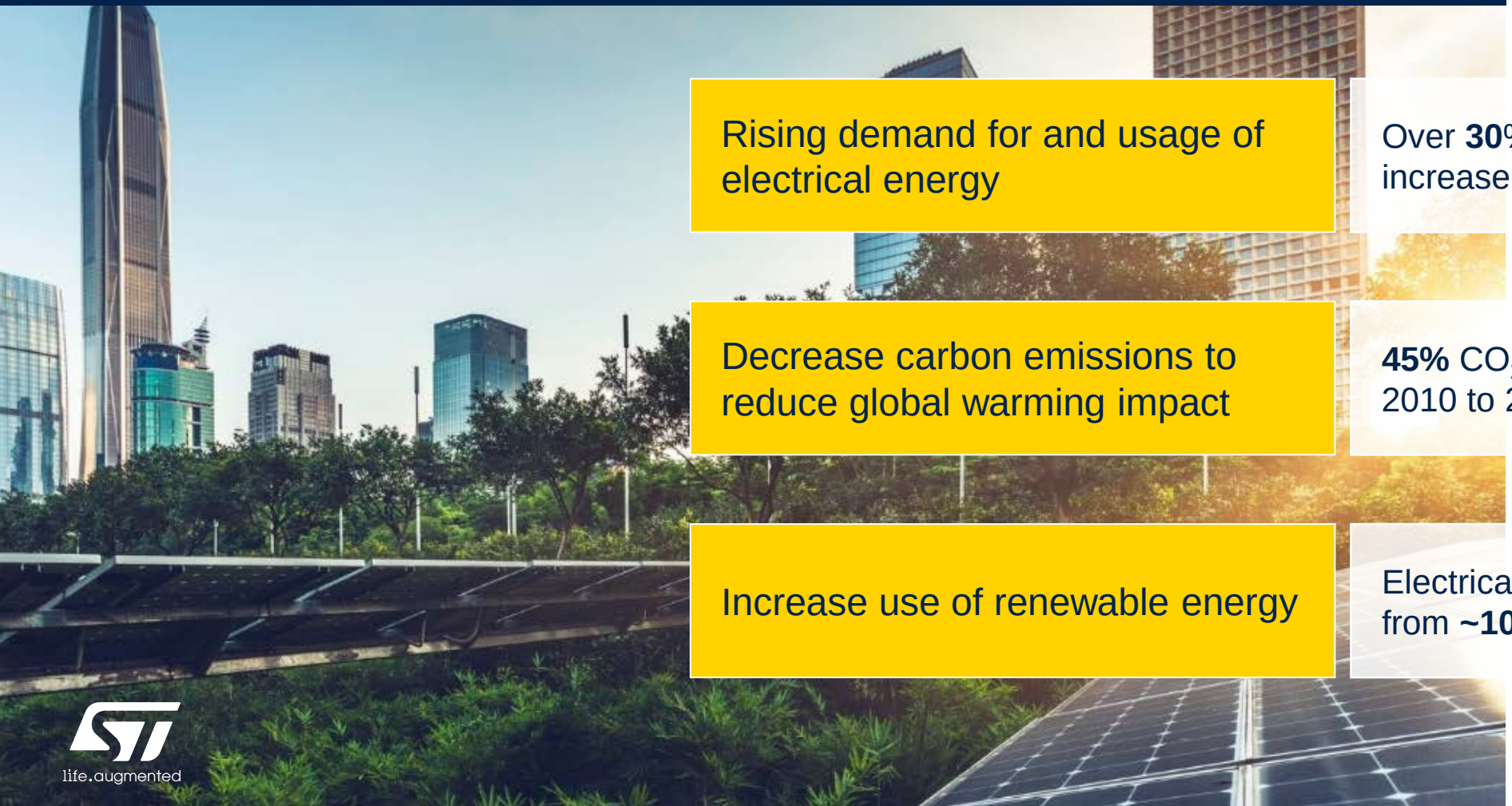
Power & energy

ST technology and solutions enable customers to increase energy efficiency everywhere & support the use of renewable energy sources



Rising demand for and usage of electrical energy	Over **30**% global electricity demand increase from 2020 to 2030
Decrease carbon emissions to reduce global warming impact	**45%** CO_2 emission reduction from 2010 to 2030 to limit warming to 1.5°C
Increase use of renewable energy	Electrical energy from renewal sources from **~10%** in 2020 to **~20%** in 2030

Sources: IEA, IPCC, BP

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Our products and solutions enable customer innovation

MEMS
for sensors & micro-actuators

Smart Power: BCD
(Bipolar - CMOS - Power DMOS)

FD-SOI CMOS
FinFET through Foundry

Discrete, Power MOSFET, IGBT
Silicon Carbide, Gallium Nitride

Analog & RF CMOS

Vertical Intelligent Power

eNVM CMOS

Optical sensing solutions

Packaging technologies
Leadframe – Laminate – Sensor module – wafer level

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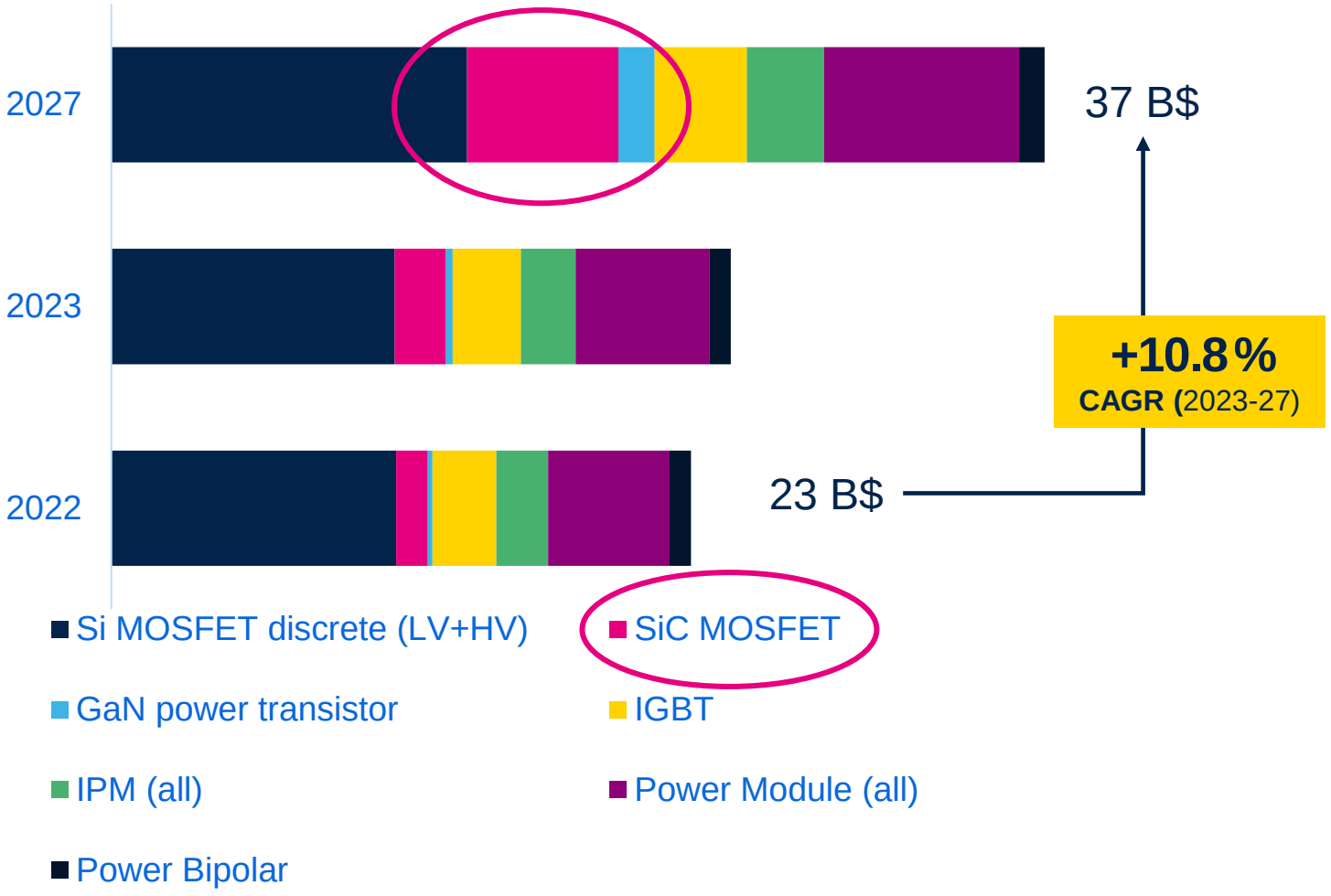
Power transistor markets and applications



Industrial

+8.3% CAGR (2023-27)
From 14B$ to 19.6B$

- Motor control and appliances
- SMPS and LED lighting
- 5G & datacenter power supplies
- Solar and energy storage
- Charging stations

Automotive

+14.1% CAGR (2023-27)
From 8.8B$ to 17.2B$

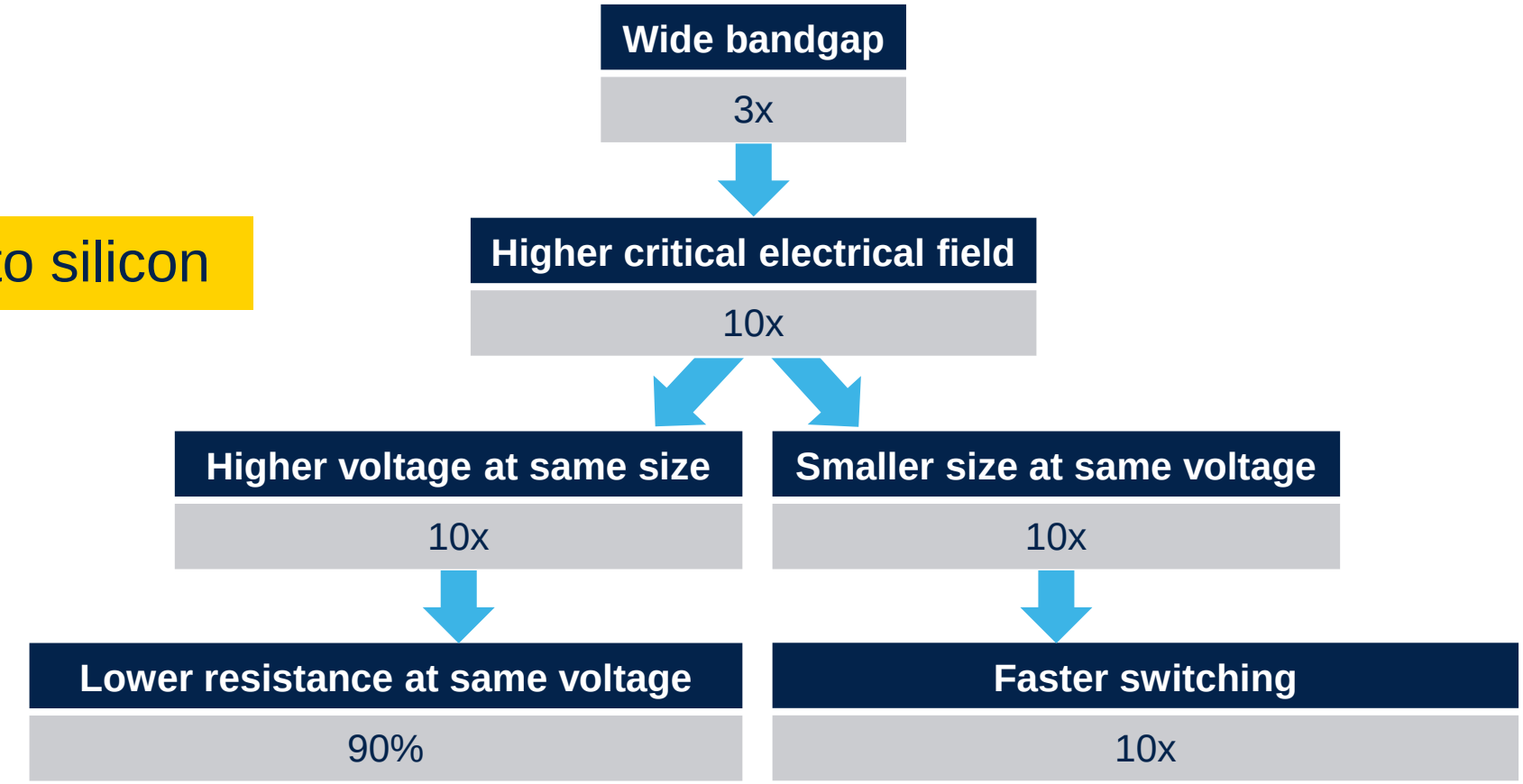
- Electric vehicles
  - Traction inverters
  - DC-DC converters
  - On-board chargers
- Traditional automotive

Industrial includes home appliance, motor control, power supply, renewable energy, others

Sources: Omdia - Power Discrete and Module Market 2022, Nov 2023
Yole Power GaN, Aug 2023. Yole Power SiC, Aug 2023

Silicon Carbide properties

Compared to silicon



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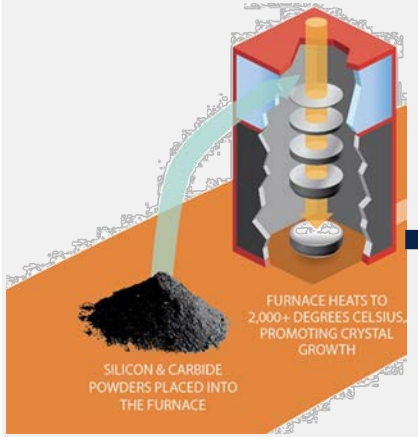
SiC MOSFET manufacturing flow from powder to final product

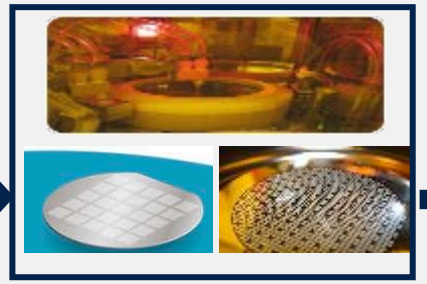
Substrate Technology	Front-End Technology	Testing	Backend Technology (Assembly)



SiC ingot

Wafer Slicing & polishing

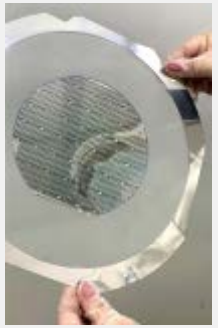
Epitaxy



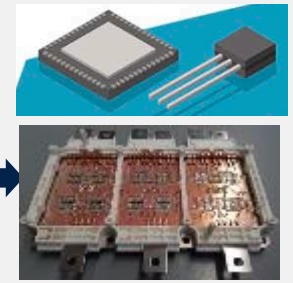
Device Fabrication

Litho, deposition, etching, Thermal treatment metallization, etc.

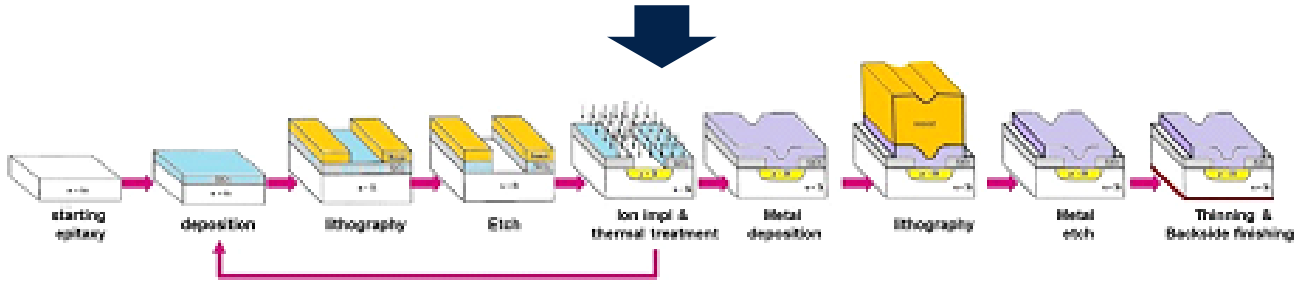
Wafer testing (Electrical Wafer Sorting)



Dicing (singulation)



packaging



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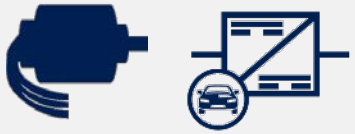
Silicon Carbide Benefits For Key Application

Addressing energy efficiency in Automotive and Industrial applications

Key Advantages of SiC for Automotive



Traction inverter & On Board Charger

Charging station

Longer driving range	> 600km with SiC
Faster charging	SiC charging station handles 2x the Energy
Car weight reduction	1% saving in the overall weight and space of an EV

Key Advantages of SiC for Industrial

Factory Automation

Power Supply for Server

Energy & Solar Inverter

Increased Power Efficiency	50% lower losses and with 5x frequency
Reduced Total Cost of Ownership	Reduction of 20%
Smaller, more compact machined	Size/weight by 70%/80% with an average 50% reduction

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System Solution Go-to-market Strategy

1. Establish **value add** proposition
2. **Organize** lab and marketing collaterals with a **consistent message**
3. Intimate **customer engagement**
4. **Prioritization** of resources and opportunities
5. **Customer collaboration** through to design production

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Find out more at www.st.com

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