Growth opportunities for Power GaN beyond the Consumer market

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YOLE Intelligence

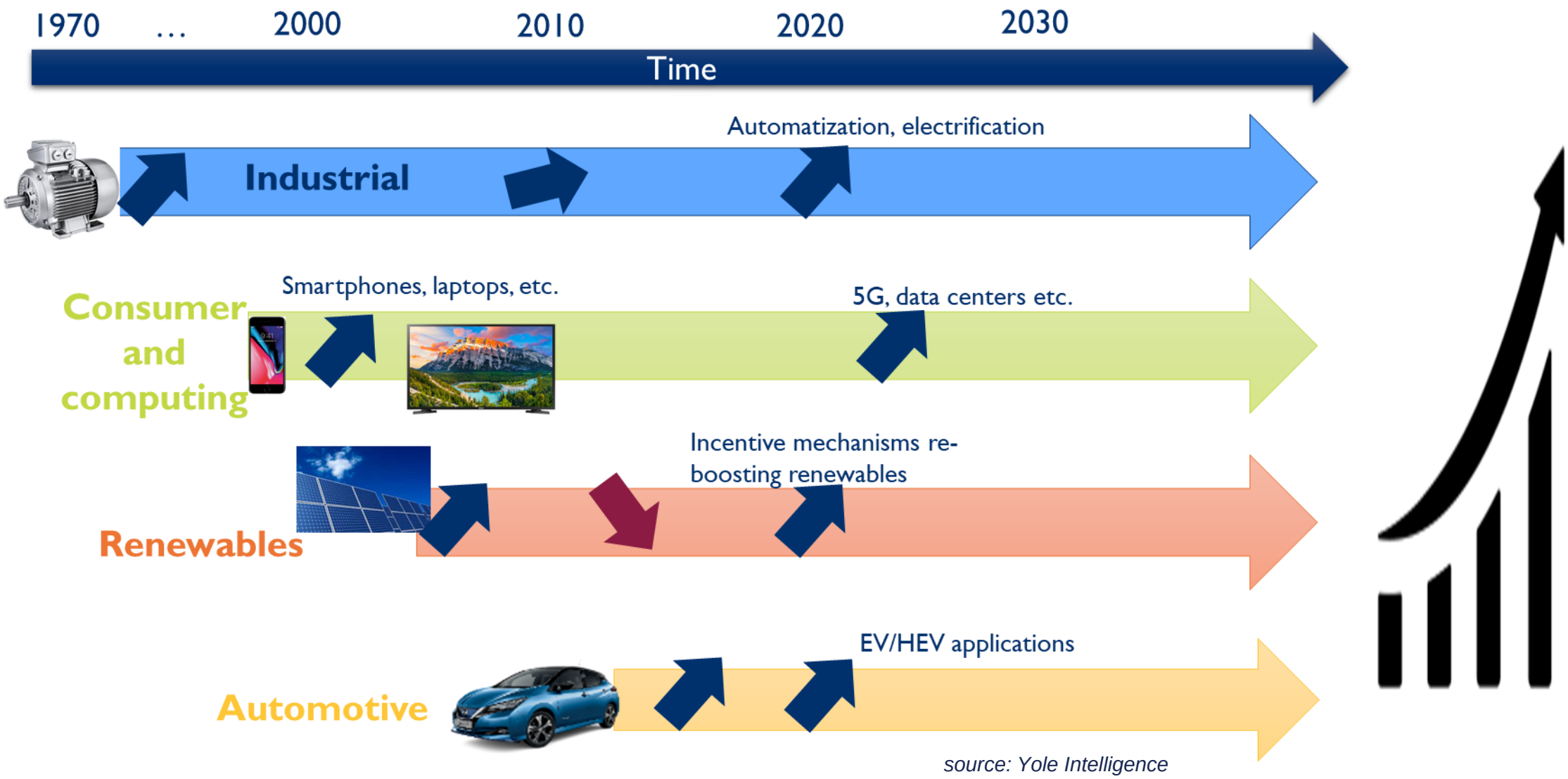
PE INTERNATIONAL CONFERENCE ANGELTECH

OUTLINE

- Power Electronics overview: the big picture
- Established consumer power supply market
- Future growth engines
- 2022-2028 Device Market Forecasts
- Conclusion

Power Electronics overview: the big picture

MAIN DRIVERS FOR POWER ELECTRONICS – HISTORICAL PERSPECTIVE

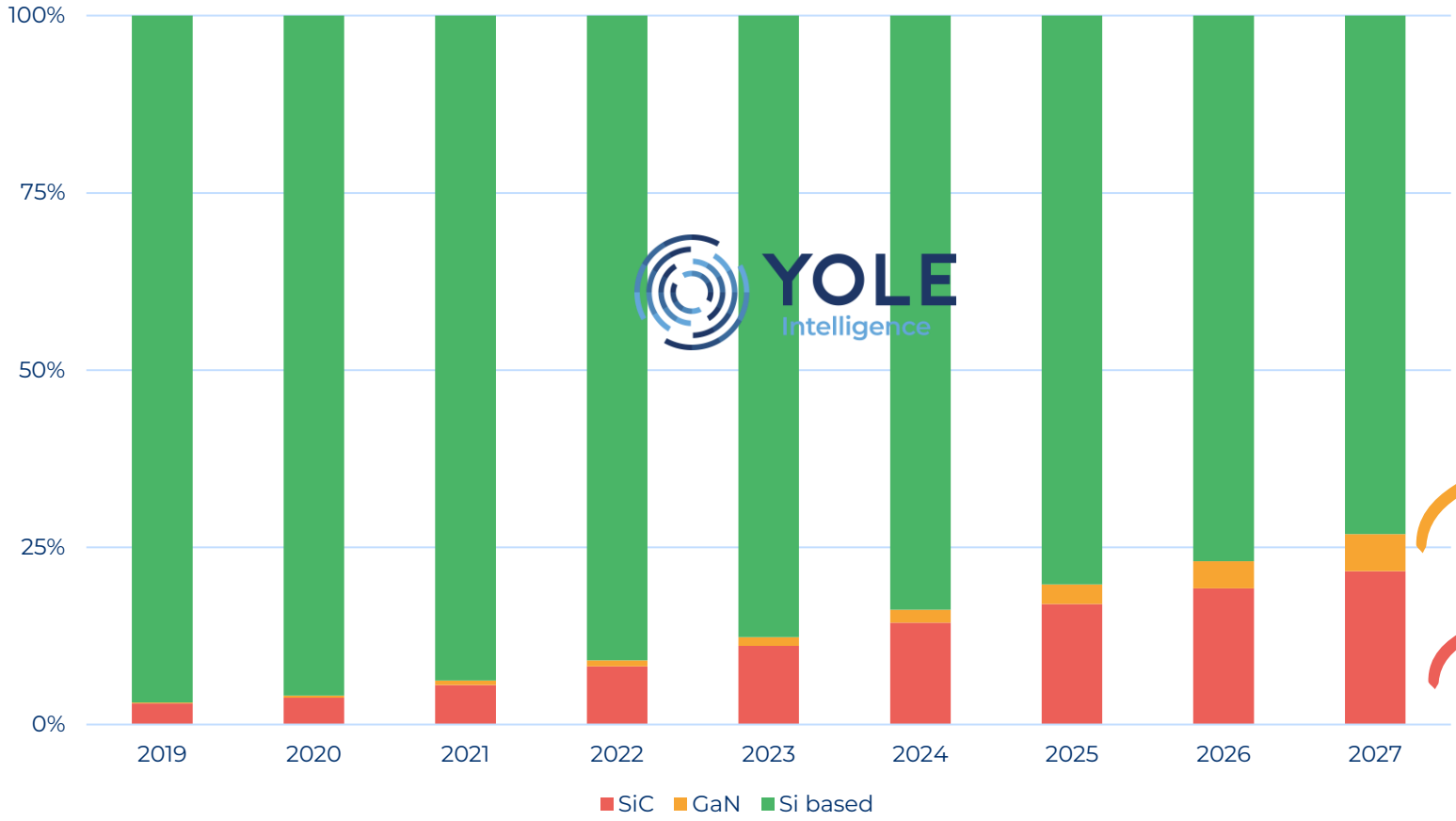


source: Yole Intelligence

MEGA-TRENDS IN POWER

WBG to grow from ~ 9% in 2022 to ~36% in 2027

SiC is mainly driven by automotive applications, while GaN is strongly driven by consumer, e.g. smart phone fast chargers.

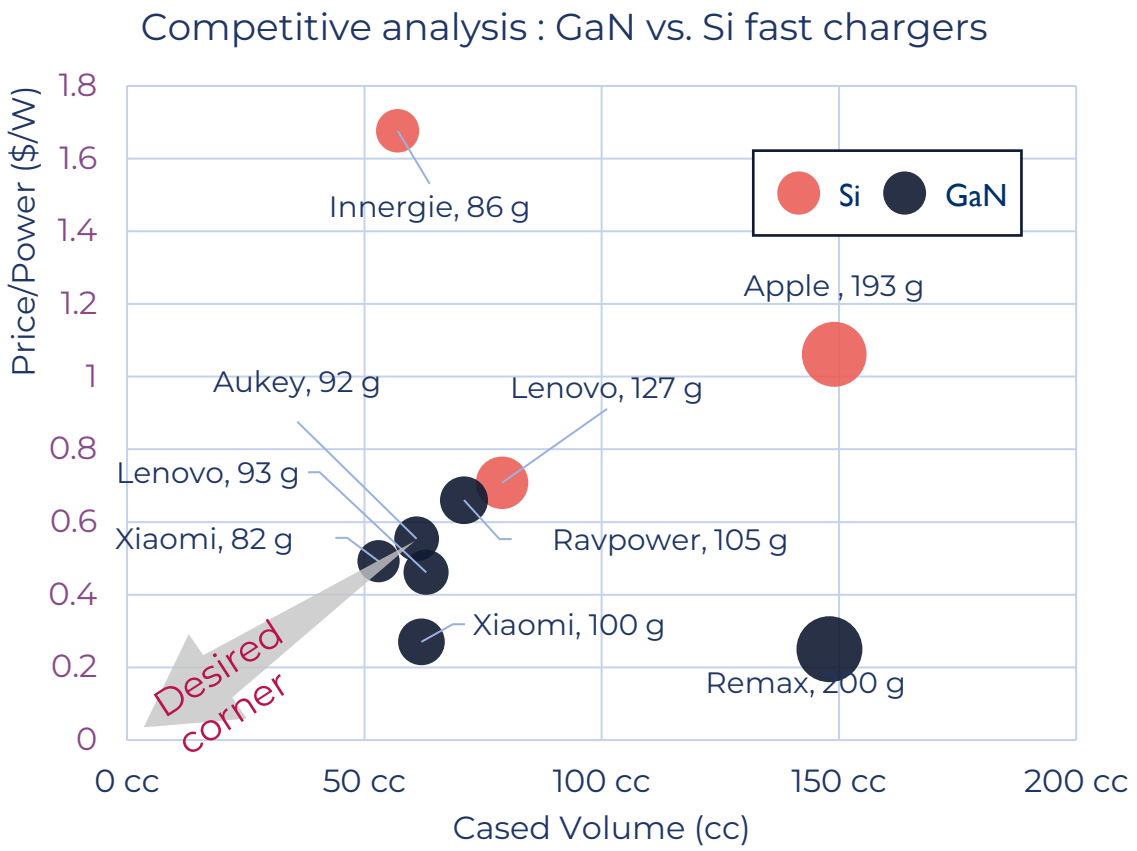


Main market drivers:

Source: Power SiC/GaN Compound Semiconductor Market Monitor, Q1-2023, Yole Intelligence

Established consumer power supply market

GAN POWER SUPPLIES : SMALLER, FASTER AND MORE ECOLOGICAL



Samsung's 45W fast charger based on silicon
52x53x30 mm
Power density: **0.55 W/cm³**

EP-TA845

Samsung's 45W fast charger based on GaN **48x44x28 mm**
Power density: **0.76W/cm³**

EP-T4510

SAMSUNG

GaN chargers offer higher power densities

Xiaomi's 120W fast charger based on silicon
64x61x28 mm
Power density: **1.1 W/cm³**

MDY-12-ED

Xiaomi's 120W fast charger based on GaN **56x56x28 mm**
Power density: **1.37 W/cm³**

MDY-13-ET

xiaomi

FAST CHARGERS: GaN DESIGN WINS

Non-exhaustive list

In-box chargers

H2-21

- 16-inch MacBook Pro 140W
- Dell™ Alienware X15 R1 240W
- ProArt StudioBook One 300W

H1-22

- realme GT Neo 3 150W
- MOTOROLA Edge X30 68W
- iQOO 9 Pro 120W
- Red Magic 7 Pro 165W

H2-22

- OnePlus 10R/ACE 5G 160W
- Redmi laptop family 100W
- iQOO 10 Pro 200W
- MOTOROLA X30 Pro 125W
- Note 12 Explorer 200W
- Note Pro+ 120W
- Realme GT 3 240W

Accessory chargers

H2-21

- 66W, 90W
- 65W
- 65W
- 130W
- 33W
- 65W
- 100W
- 65W
- 100W
- 120 W

H1-22

- 120W
- 65W
- 150W
- 230W
- 65W
- 45W
- 135W
- 120W
- 100W
- 100W

H2-22

- 120W
- 140W
- 65W
- 30W
- 65 W
- 100 W
- 35 W
- 130 W
- 65 W
- 65 W

We witness the entry of new GaN players profiting from the domestic Chinese fast chargers' market

- power integrations
- Navitas
- Innoscience 英诺赛科
- transphorm
- HUAWEI
- GaN Systems
- life.augmented

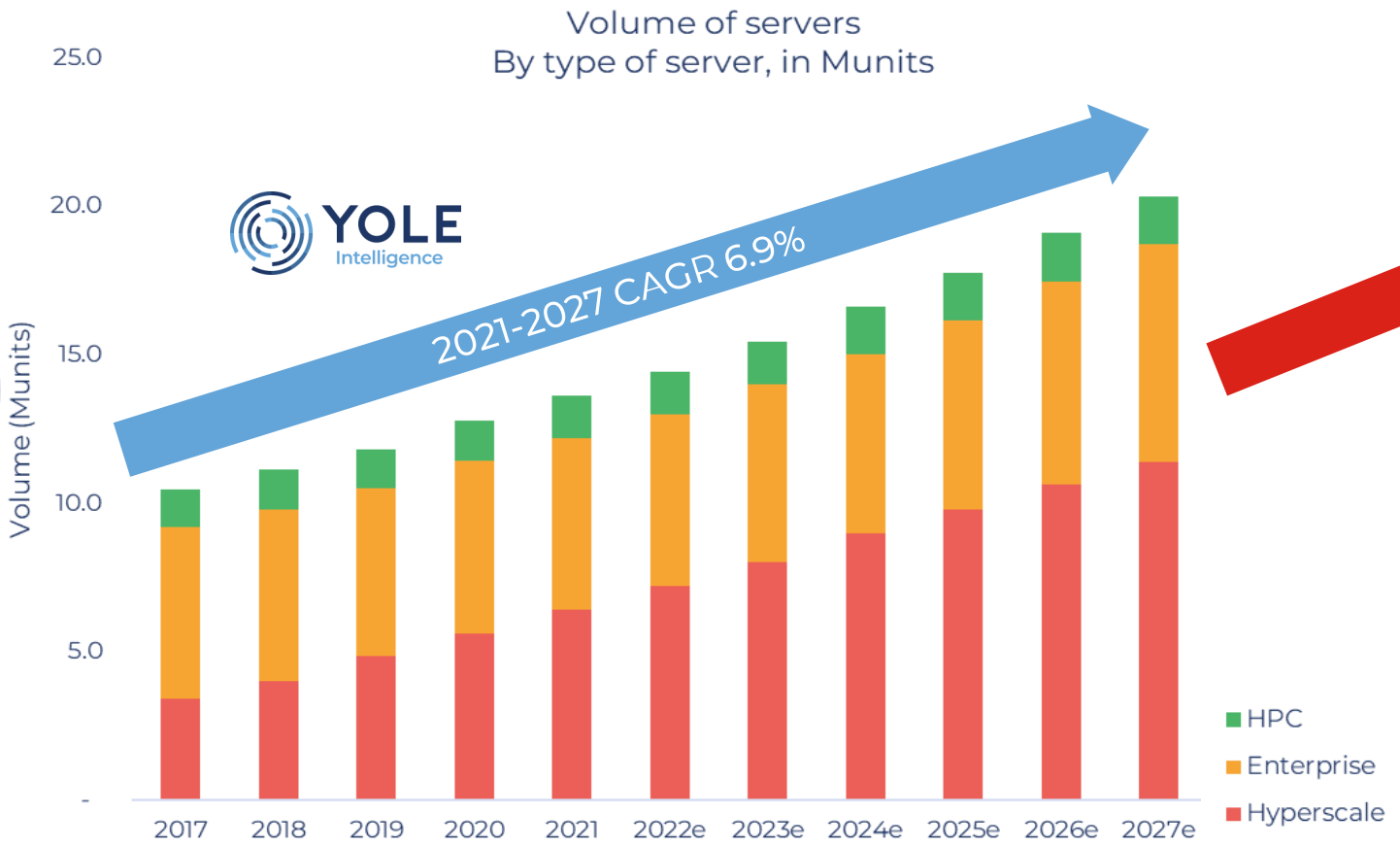
... and MORE!

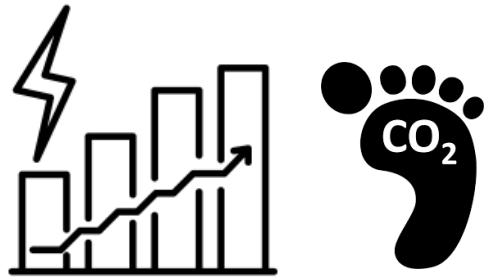
Infineon announced to acquire GaN Systems in Q1-2023.

Future growth engines

MEGA-TRENDS : DATACENTERS ENERGY CONSUMPTION KEEP INCREASING

There is a need to implement high efficiency system for greener datacenters.





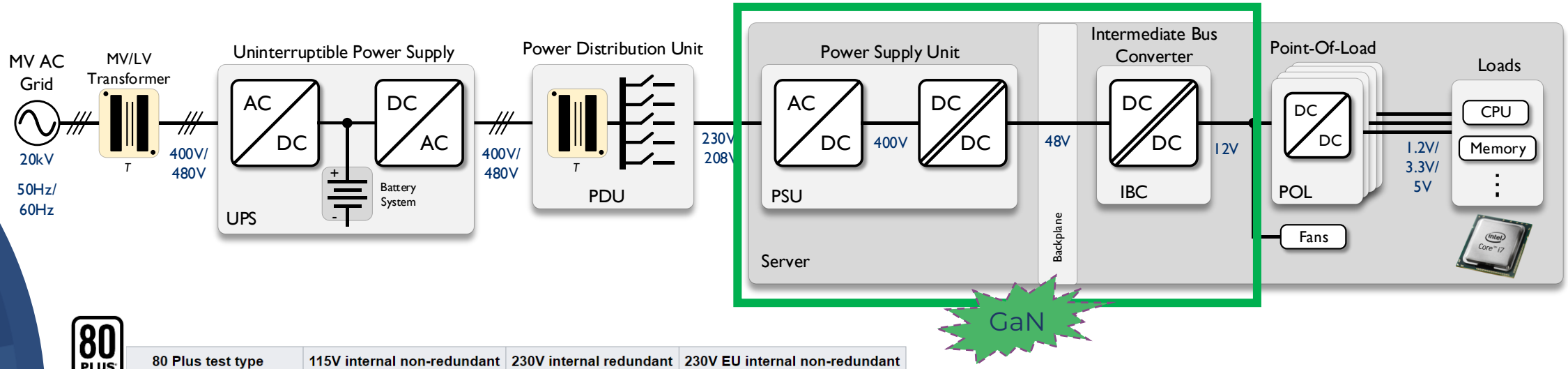
Tighter energy efficiency regulation

GaN

Source: Computing and AI technologies for data center 2022, Yole Intelligence

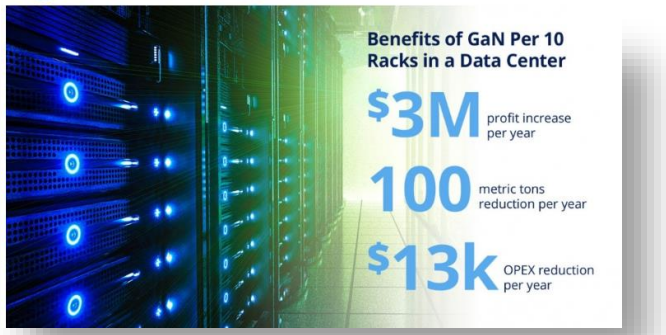
GAN IMPLEMENTATION IN DATACENTERS ?

GaN-based efficient and compact systems acheive sustainable datacenter with lower CO_2 footprint and higher revenues.



80 Plus test type	115V internal non-redundant				230V internal redundant				230V EU internal non-redundant			
Percentage of rated load	10%	20%	50%	100%	10%	20%	50%	100%	10%	20%	50%	100%
80 Plus		80%	80%	80%						82%	85%	82%
80 Plus Bronze		82%	85%	82%		81%	85%	81%		85%	88%	85%
80 Plus Silver		85%	88%	85%		85%	89%	85%		87%	90%	87%
80 Plus Gold		87%	90%	87%		88%	92%	88%		90%	92%	89%
80 Plus Platinum		90%	92%	89%		90%	94%	91%		92%	94%	90%
80 Plus Titanium	90%	92%	94%	90%	90%	94%	96%	91%	90%	94%	96%	94%

GaN



Source: GaN Systems

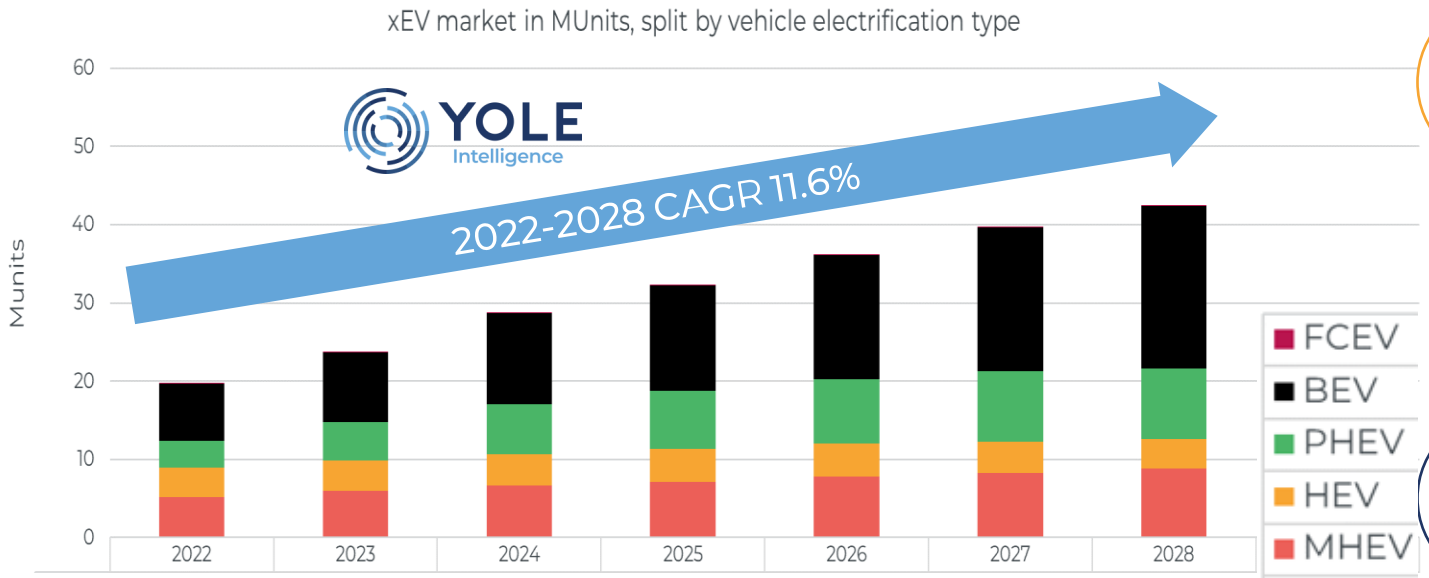
Who is already on-board?

bel POWER SOLUTIONS & PROTECTION · MPS · LITEON · TAIYO YUDEN · 肯微科技股份有限公司 Compuware Technology Inc. · DELTA · Infineon · GaN Systems · Texas Instruments · transphorm · EPC EFFICIENT POWER CONVERSION · Navitas

MEGA-TRENDS : ELECTRIFICATION OF AUTOMOTIVE

EV/HEV market will grow strongly and will exceed 40 million vehicles by 2028.

Among various types of EV, BEV is expected to take the biggest share in the years to come.



As electrification of vehicles continues, BEV and HEV are forecast to grow strongly in the coming 5 years.

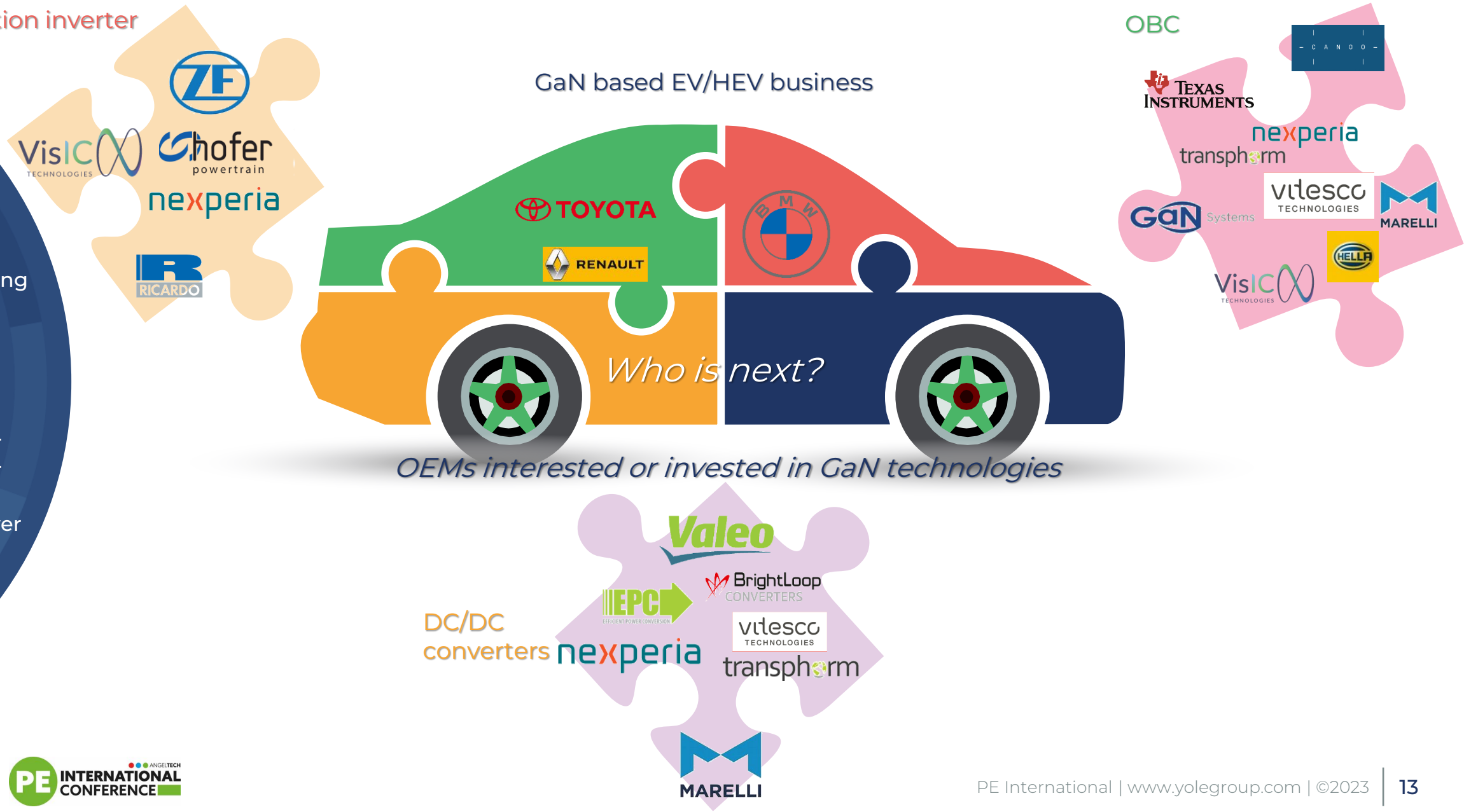
Passenger vehicles represent the majority of the EV market, while heavy duty vehicles are driven by battery cost and driving range.

BEV will grow as the biggest segment.

Source: Power Electronics for e-Mobility 2023 Part I: Passenger & Light Commercial Vehicles, Yole Intelligence, report to be released in Q2-2023

GAN IMPLEMENTATION IN EV ?

Car OEMs and Tier'1 are working closely to commercialize GaN based automotive system. GaN enables higher density, higher efficiency and potentially lower system cost.

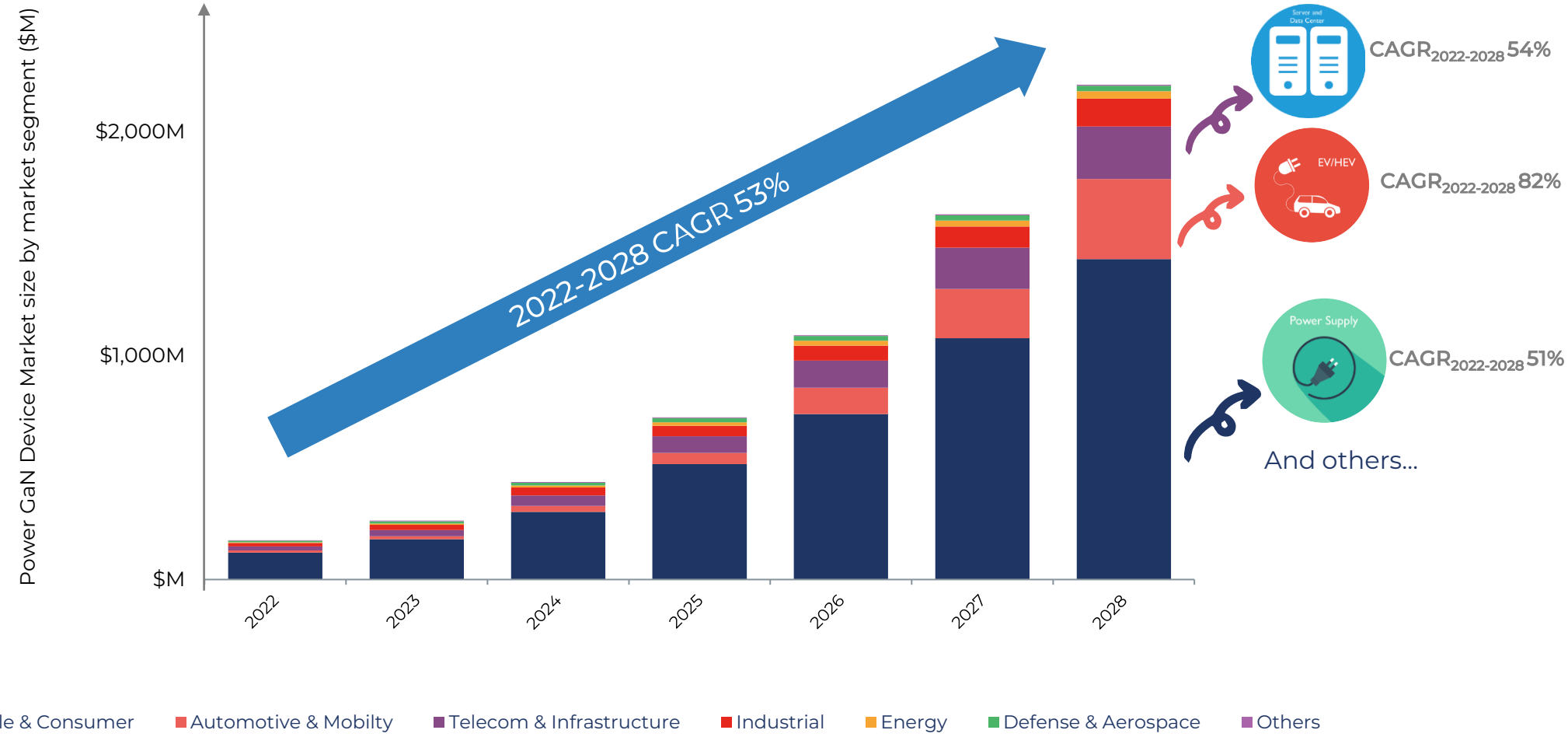


Power GaN device Market Forecast

GAN POWER DEVICE MARKET ($M)

Split by end-markets: 2022-2028

In 2028, consumer applications including power supplies and Class D audio amplifiers are expected to represent 65% of the total GaN market.



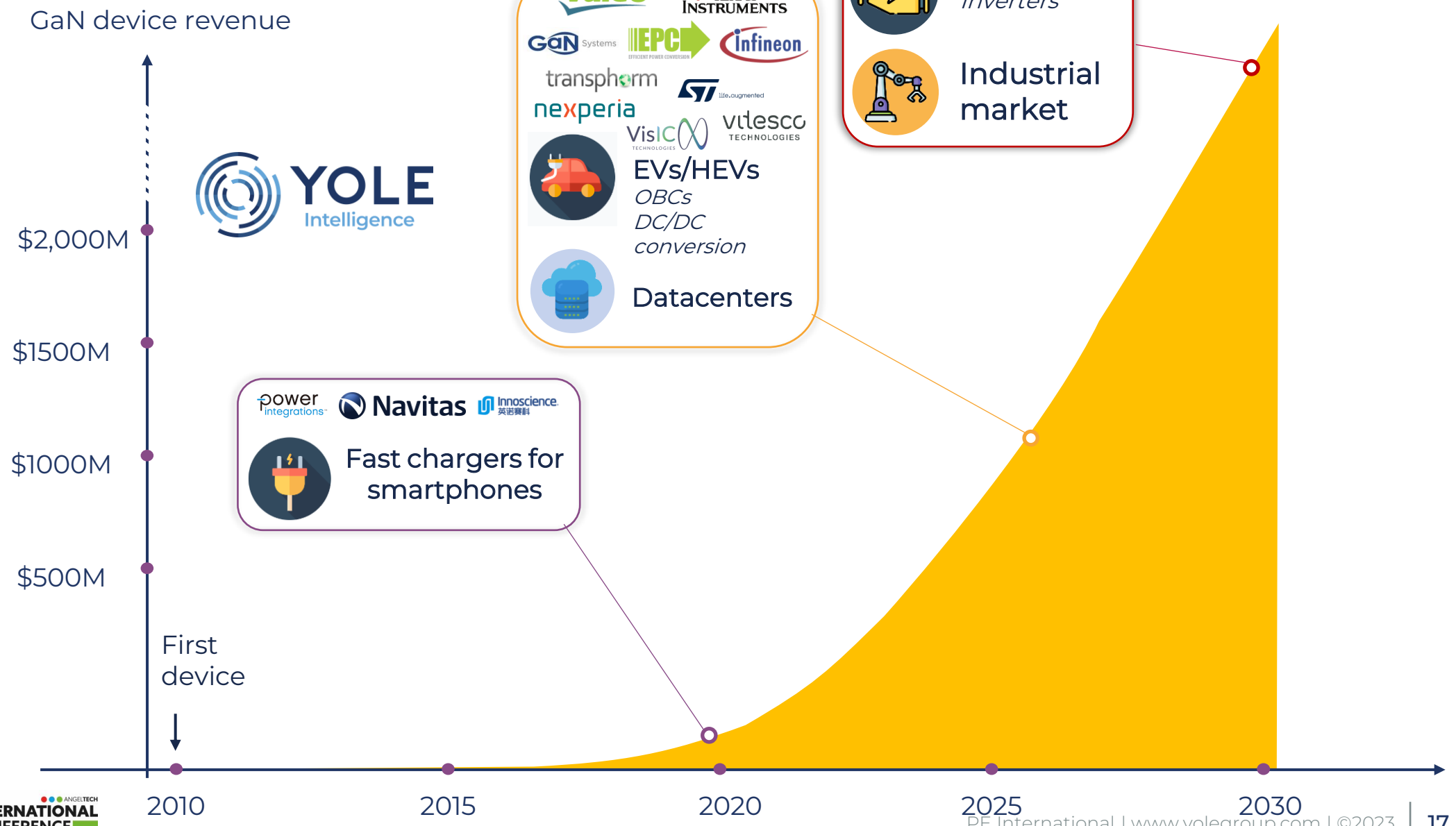
Source: Power SiC&GaN Compound Semiconductor Monitor , Q1-2023, Yole Intelligence

CONCLUSION

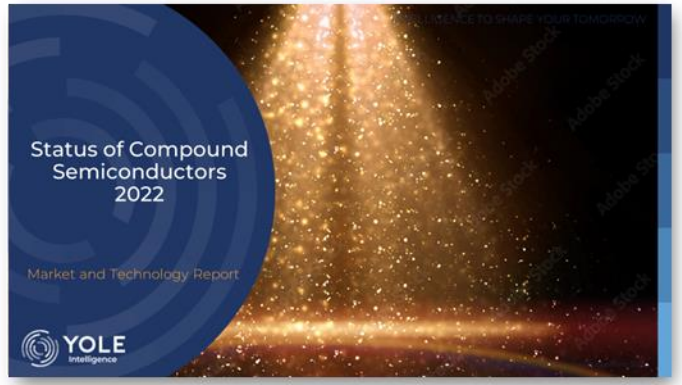
GAN POWER DEVICES: LONG-TERM EVOLUTION

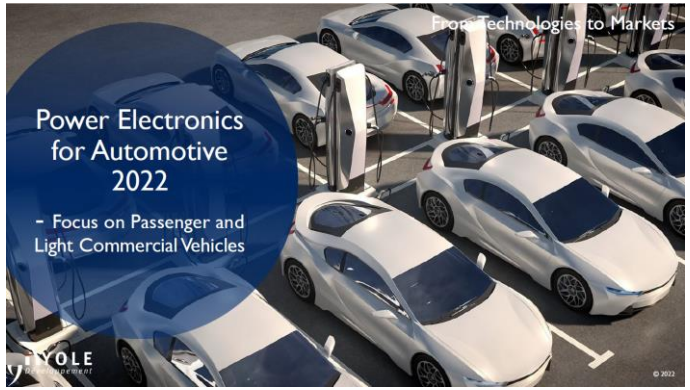
Roadmap of Power GaN devices

Consumer applications will still the main driver of the GaN market, while volume shipments will ramp up in datacenters and EVs/HEVs in the mid- to long term.



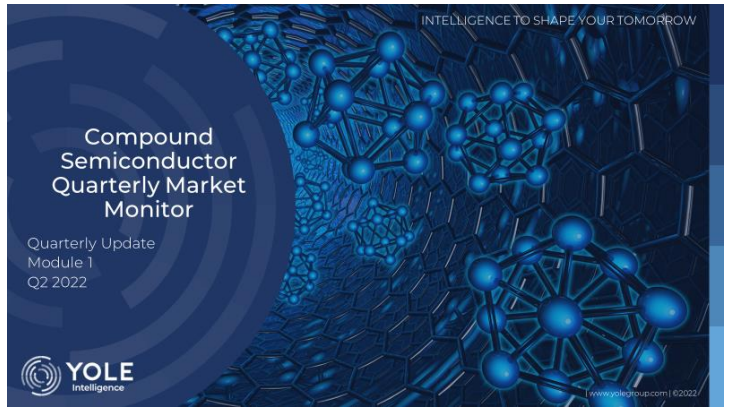
YOLE GROUP RELATED REPORTS





YOLE GROUP RELATED MONITORS

Yole Intelligence – Compound Semiconductor Monitor Service



Yole tracks GaN, SiC, GaAs, InP semiconductors on a quarterly basis through "The Compound Semiconductor Monitor Services". Within this offer there are 3 Monitor services:

- Power SiC and GaN Compound Semiconductor Market Monitor
- RF GaN Compound Semiconductor Market Monitor
- Photonics GaAs and InP Compound Semiconductor Market Monitor

Power GaN

power integrations, Navitas, EPC, Infineon, GaN Systems, transphorm, IQE, Innoscience 英诺赛科

Power SiC

COHERENT, Wolfspeed, MITSUBISHI ELECTRIC, ROHM SEMICONDUCTOR, onsemi, SHOWA DENKO, life.augmented, Infineon

RF GaN

COHERENT, qorvo, Wolfspeed, IQE, SUMITOMO ELECTRIC DEVICE INNOVATIONS, INC., SICC

GaAs Optoelectronics

COHERENT, IQE, Freiberger Compound Materials, SUMITOMO ELECTRIC, VPEC, ams OSRAM, LUMENTUM

InP Optoelectronics

LUMENTUM, COHERENT, LandMark Optoelectronics, axt, IQE, SUMITOMO ELECTRIC

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CONTACT DETAILS AND Q&A

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Taha Ayari, Ph.D., is a Technology & Market Analyst, Compound Semiconductors and Emerging Substrates, at Yole Intelligence. As a member of the Power Electronics & Wireless division at Yole, Taha's expertise is mainly dedicated to power, RF, and optoelectronics. He is fully engaged in the development of technology and market reports as well as custom projects.

Taha has 2 years' experience as a Technology & Cost Analyst at Yole System Plus, part of Yole Group, where he focuses on the development of compound semiconductor reverse engineering & costing analyses.

Prior to Yole, Taha was a research engineer at Georgia Tech Lorraine (Metz, France). He published numerous papers with a particular focus on III-N materials.

Taha holds an M.Sc. and a Ph.D. in Electrical and Computer Engineering from the Georgia Institute of Technology (Atlanta, USA).

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