

Si IGBTs & SiC MOSFETs: Happy coexistence?

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Whats to come?

- Introduction
 - Who are omdia?
 - What is our methodology?
- Power semi market update
 - Comparison to overall market
 - Power semi breakdown
- IGBT market focus
 1. Where is it going?

Introduction

Who are Omdia?



4,000+ Deliverables annually
Market Analysis



350+ Analysts and consultants
Enterprise



80,000+ Respondents annually
Primary research



AI



Automotive

WARDS
INTELLIGENCE



Channel



Cloud and Data
Center



Consumer
Electronics and
ProAV

canalys



Cybersecurity



Digital
Workplace



Displays



Enterprise IT



Internet of
Things



Manufacturing
Technology



Media and
Entertainment



Physical Security
and Critical
Communications



Semiconductors

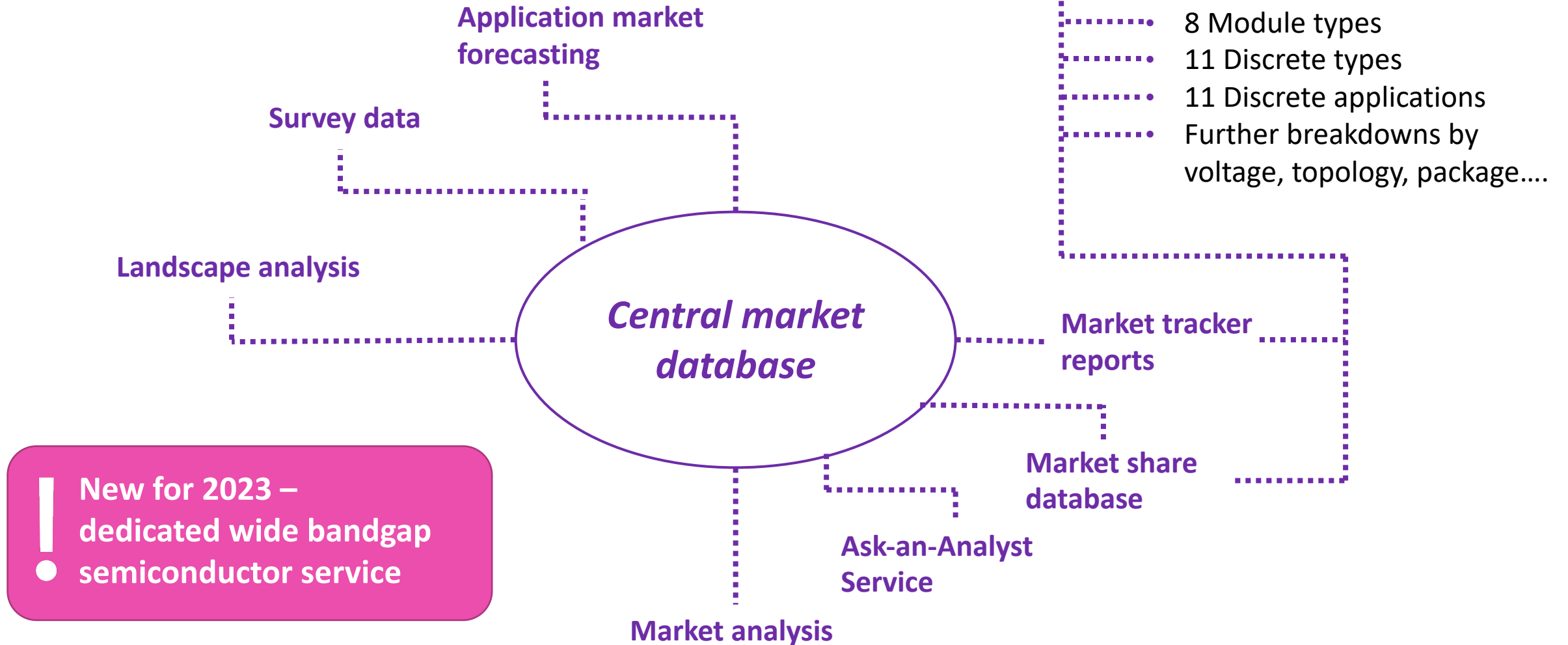


Service Providers
and
Communications



Smart Building
and Energy
Infrastructure

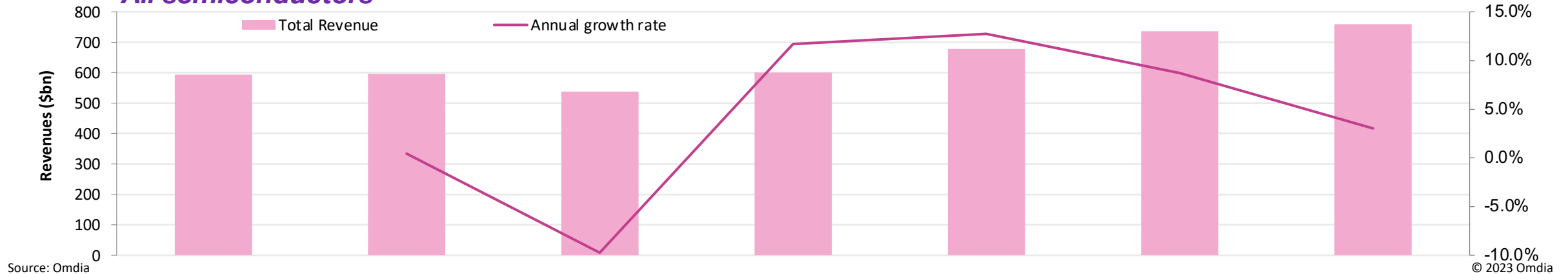
Methodology



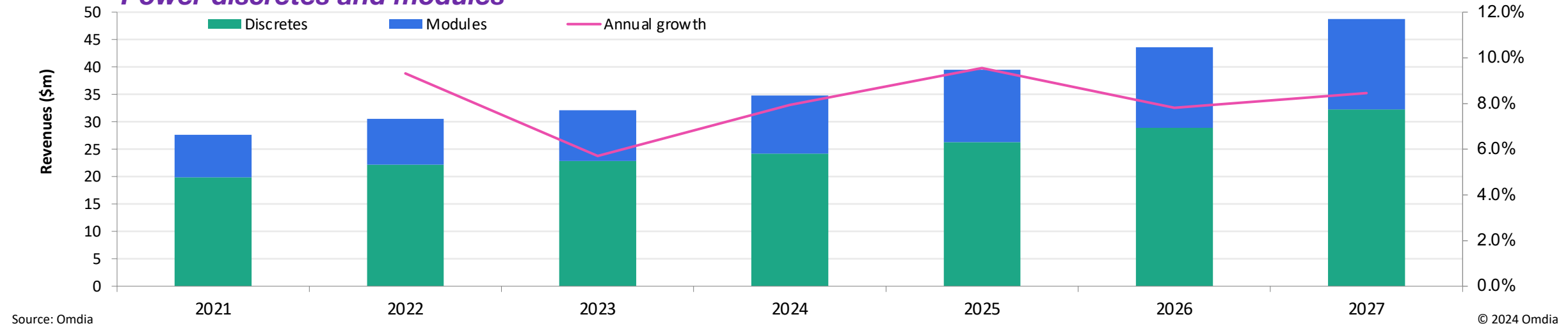
Power semi market update

Market forecasts

All semiconductors

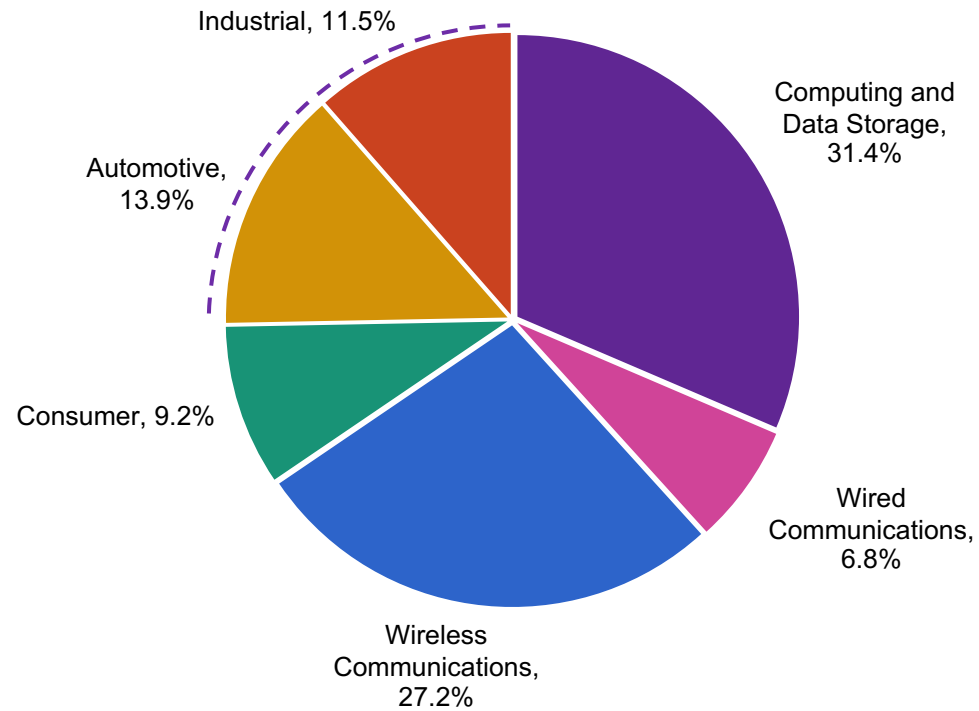


Power discretes and modules



Market application comparison

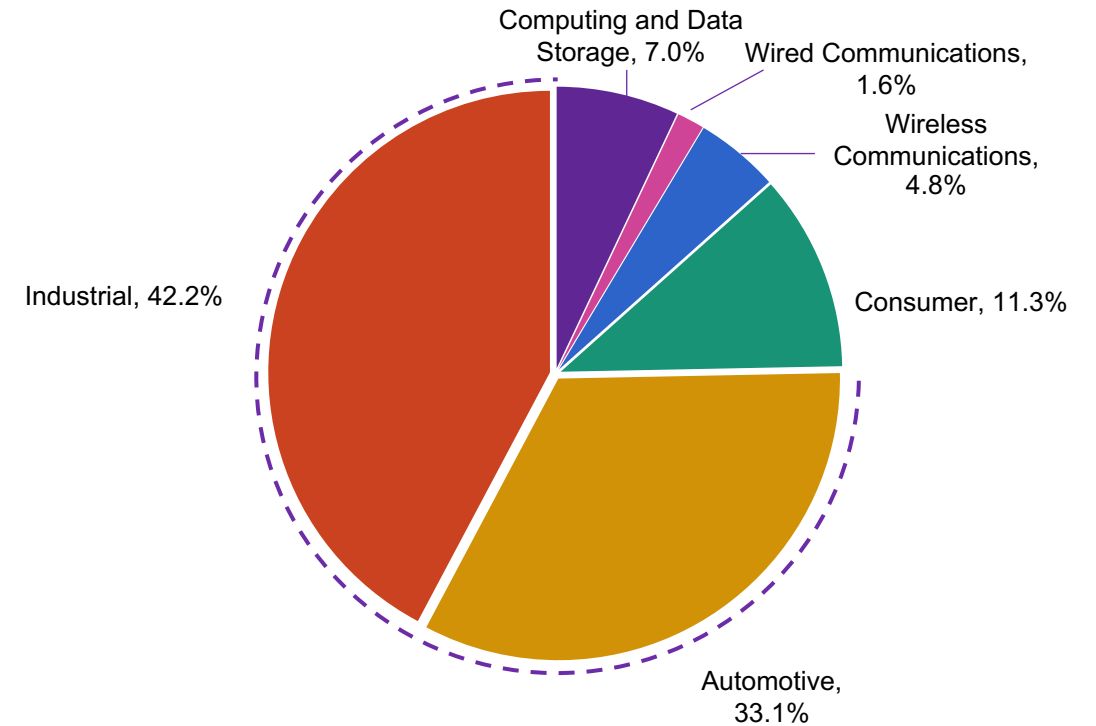
Semiconductor revenue split by sector - 2023



Source: Omdia

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Power discretes and modules revenue split by sector

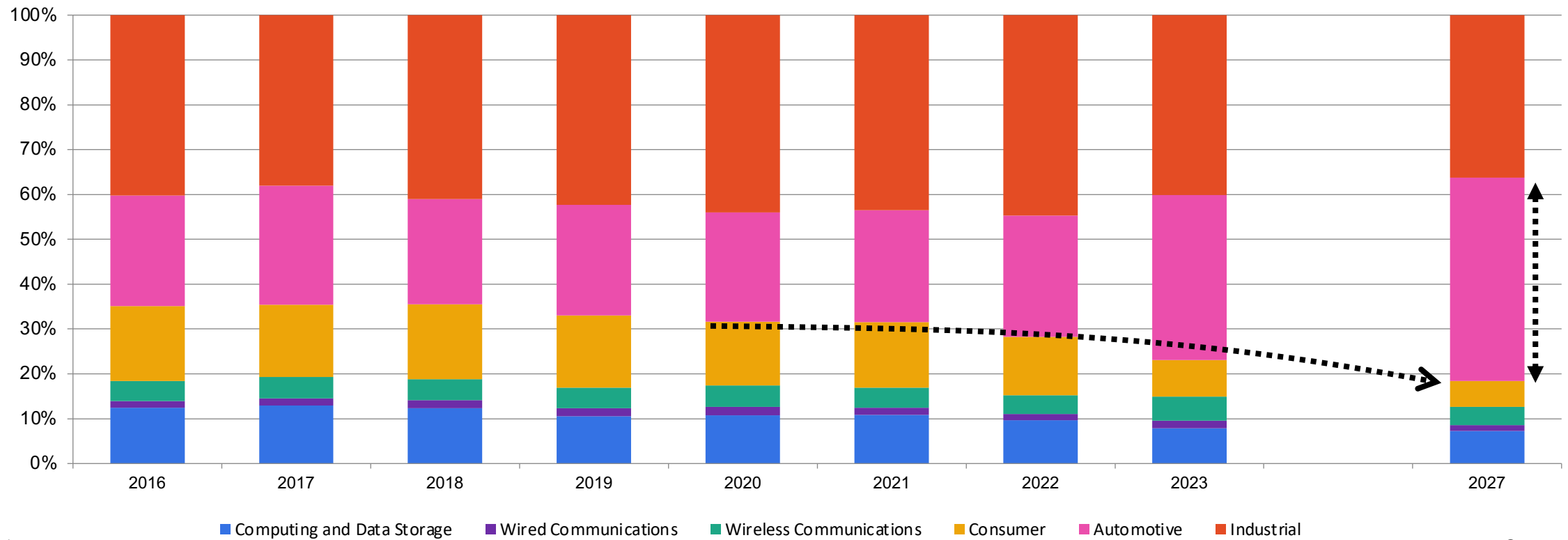


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Application market splits

Application development over time

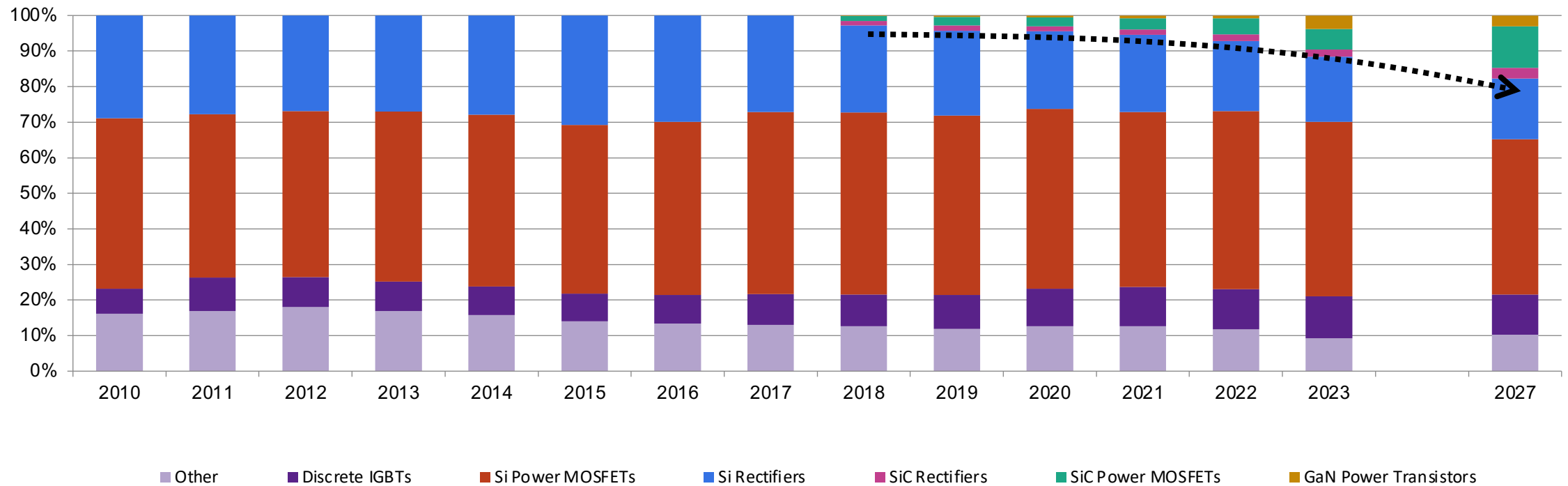


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Market breakdown by device

Discrete device evolution

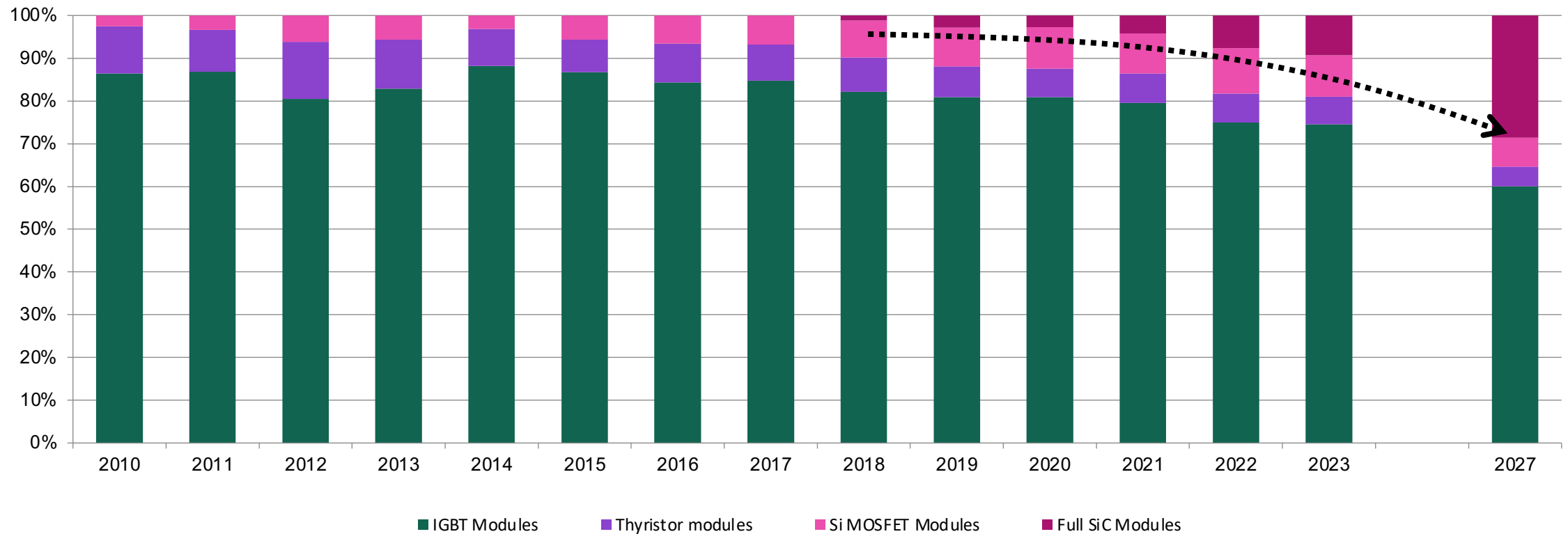


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Market breakdown by device

Module evolution

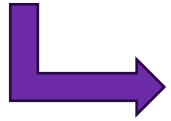


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Power semi market overview

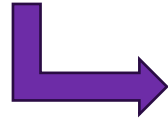
Seeing first major shift in the power semiconductor market for several years



Appearance of “new” markets allow for growth in both wide bandgap and silicon based devices



Availability of wide bandgap devices is expected to increase, whilst cost is expected to decrease



This will lead to increased competition in some of the replacement markets.

Competition between Si IGBTs and SiC MOSFETs

Competitive analysis - Discretes

Top 10 SiC discretes companies by revenue



Top 10 IGBT discretes companies by revenue



Competitive analysis - Modules

Top 10 SiC Module companies by revenue

Top 10 IGBT module companies by revenue

Wolfspeed®


life.augmented

TOSHIBA

infineon

 MITSUBISHI
ELECTRIC

onsemi™


Vincotech

starpower

BYD

 SEMIKRON
DANFOSS



Silan

 CRRC

Developments in IGBT technology

Partnership for True Multiple Sourcing:
Semikron Danfoss Power Modules with ROHM IGBTs

April 25th, 2023

Infineon Says New 4.5 kV IGBT Modules May Transform Transport Designs

December 21, 2023 by [Arjun Nijhawan](#)



Features | Zurich, Switzerland | 06-03-2024 | 2 min read

Hitachi Energy advances its semiconductor technology with first 300 mm wafer for IGBT

Onsemi Intros 7th Gen IGBT-based Intelligent Power Modules

February 26, 2024 by [Jake Hertz](#)



Hyundai and Kia agree semiconductor supply partnership with Infineon

By [Roger Brown](#) - October 18, 2023

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Infineon unveils Gen7 650V TRENCHSTOP IGBTs for efficient power

By [Kajal Mehra](#) - August 23, 2023

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Hybrid and electric vehicles

Hybrid and electric vehicles

On board charger



Inverter

DC-DC converter

— Average Semiconductor value in:

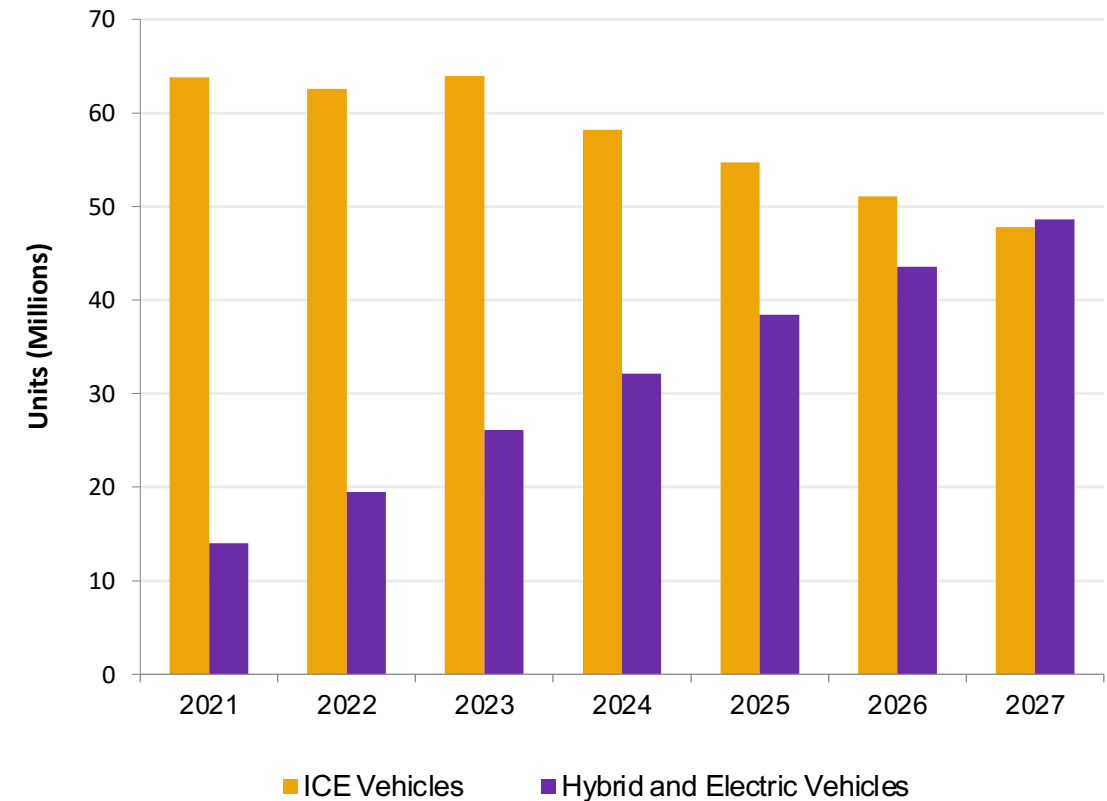
— ICE Vehicle: \$629.3

— HE Vehicle: \$904.3

— PHE Vehicle: \$1305.8

— BEV: \$1614.1

Vehicle production forecast



Source: Omdia

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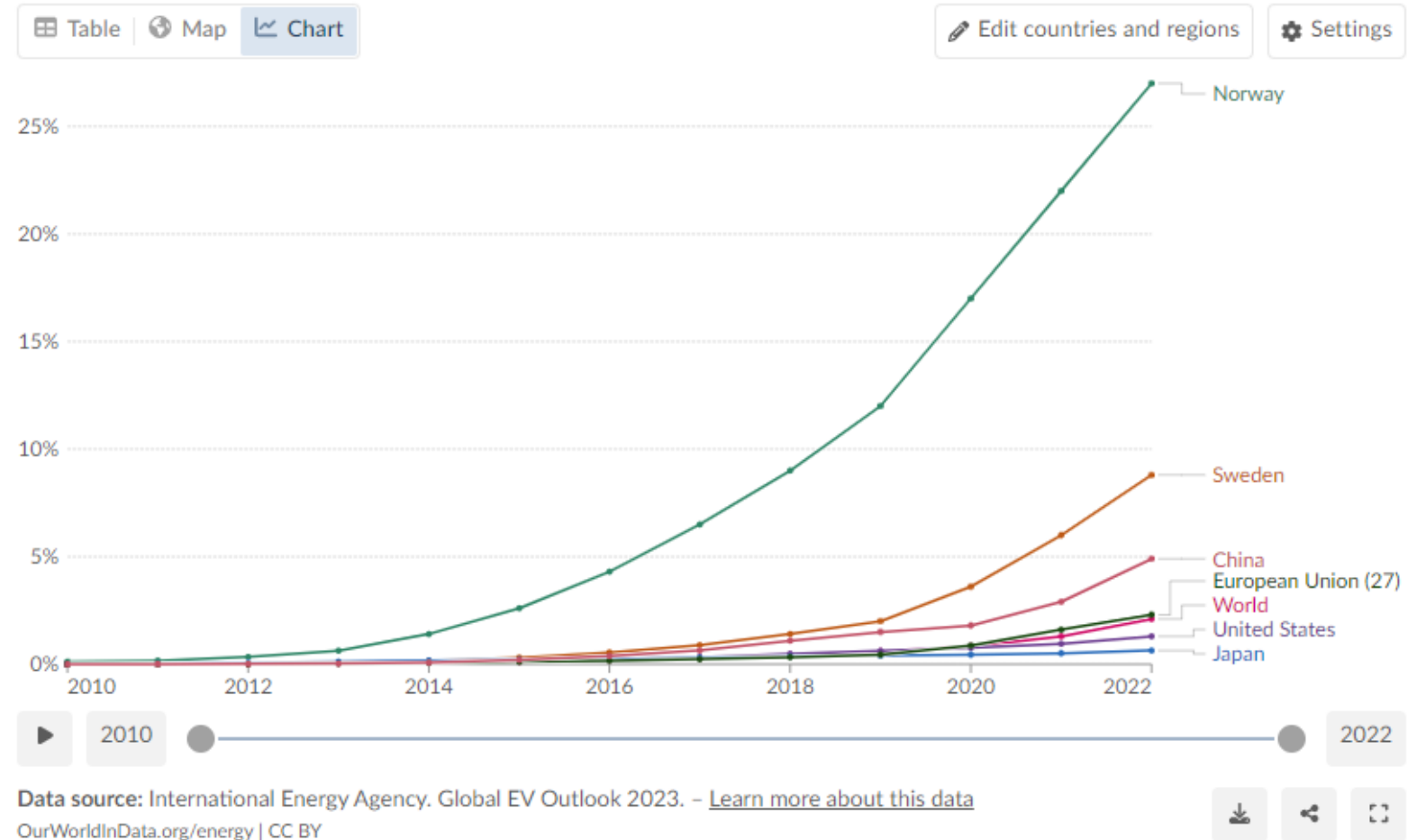
Hybrid and electric vehicles

- Questions over EV adoption:
 - Will there be the infrastructure?
 - What about people who don't own their homes or don't have off street parking?
 - Will significant penetration happen with prices where they currently are?
 - What percentage of people are just fundamentally opposed to EVs?
- Reasons for optimism
 - Barely scratching the surface of what is possible
 - Some countries are proving that mass penetration can happen
 - Big shifts happening in availability and costs of vehicles.

Share of cars currently in use that are electric, 2010 to 2022

Electric cars include fully battery-electric and plug-in hybrids.

Our World
in Data

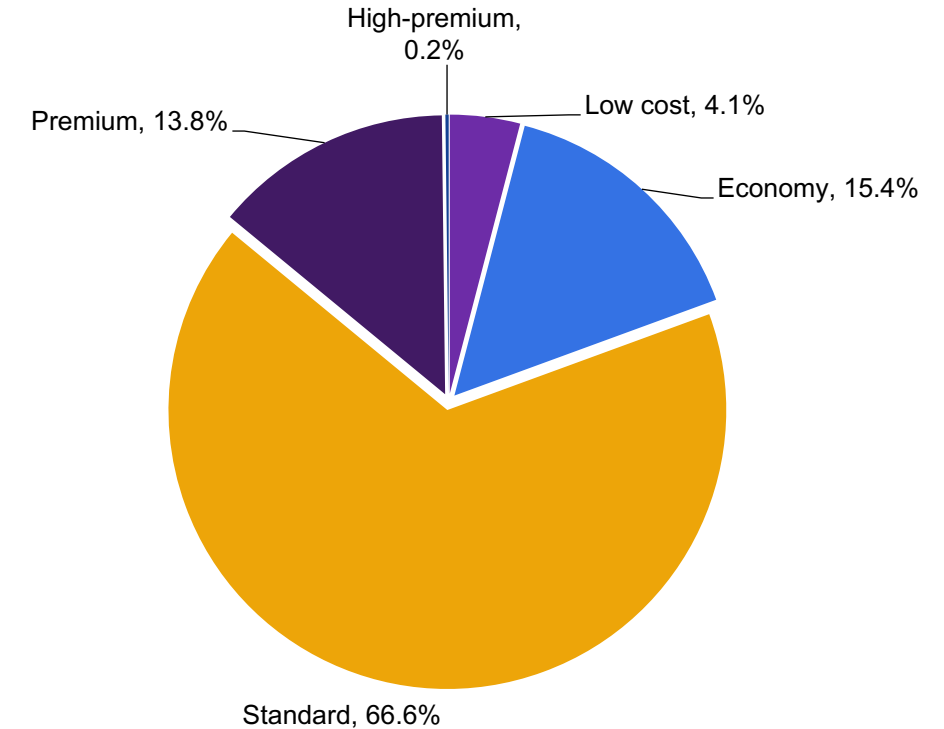


Hybrid and electric vehicles

SiC MOSFETs vs Si IGBTs

- ➡ SiC price point and availability
- ➡ BEV shift to more affordable vehicles
- ➡ Intended use of the vehicles
- ➡ Battery voltage
- ➡ Intended inverter design usage

2023 vehicle production by price (all engine types)

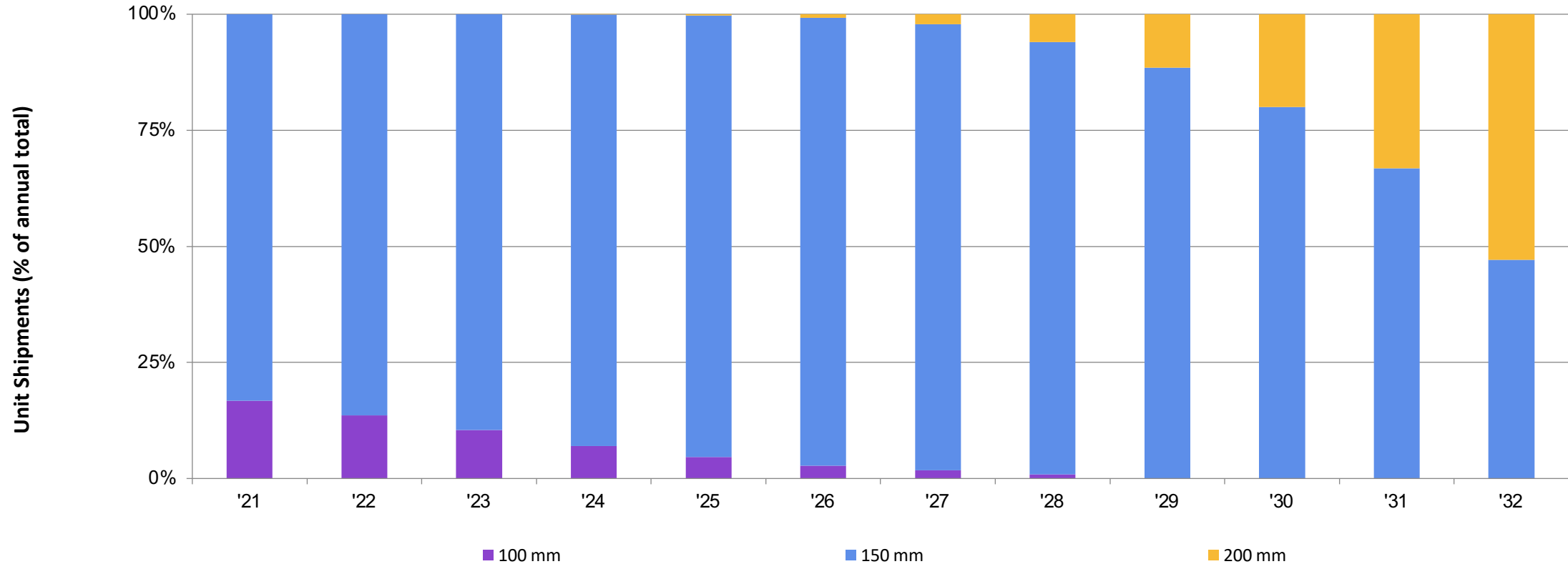


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Si IGBT and SiC MOSFETs forecasts

SiC wafer demand forecasts



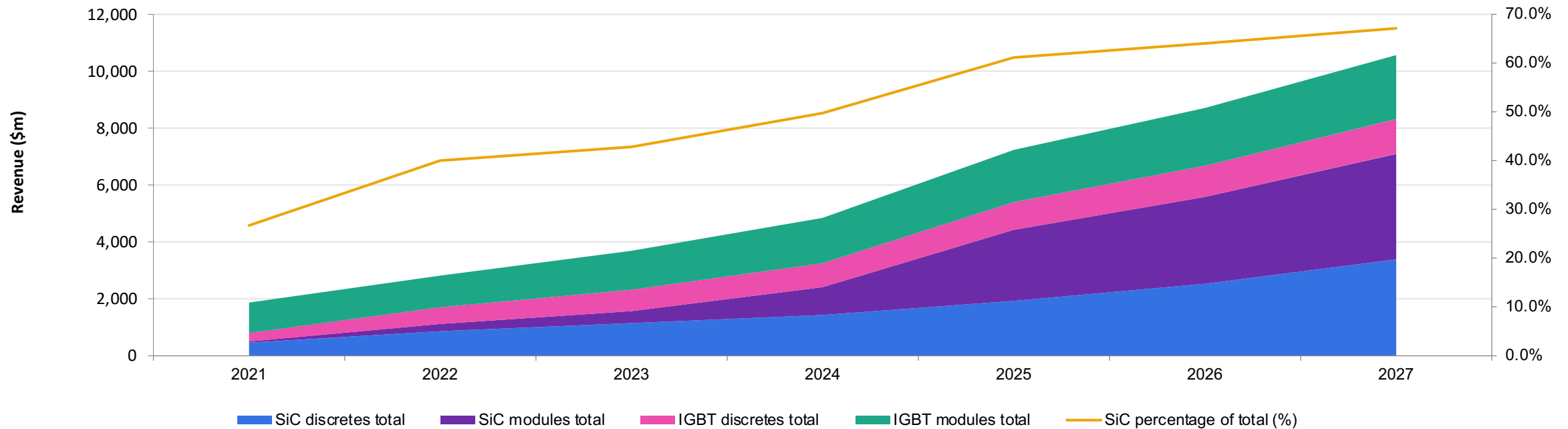
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WBG penetration in HEV

- Overall market → \$10 bn in 2027.
- Current SiC technologies account for ¼ of the revenue for devices in HEV power trains.
- Full SiC modules are forecast to reach \$3.7 bn in 2027, → power semi device with largest revenue in HEV.

Power semiconductor revenue forecasts in HEV applications

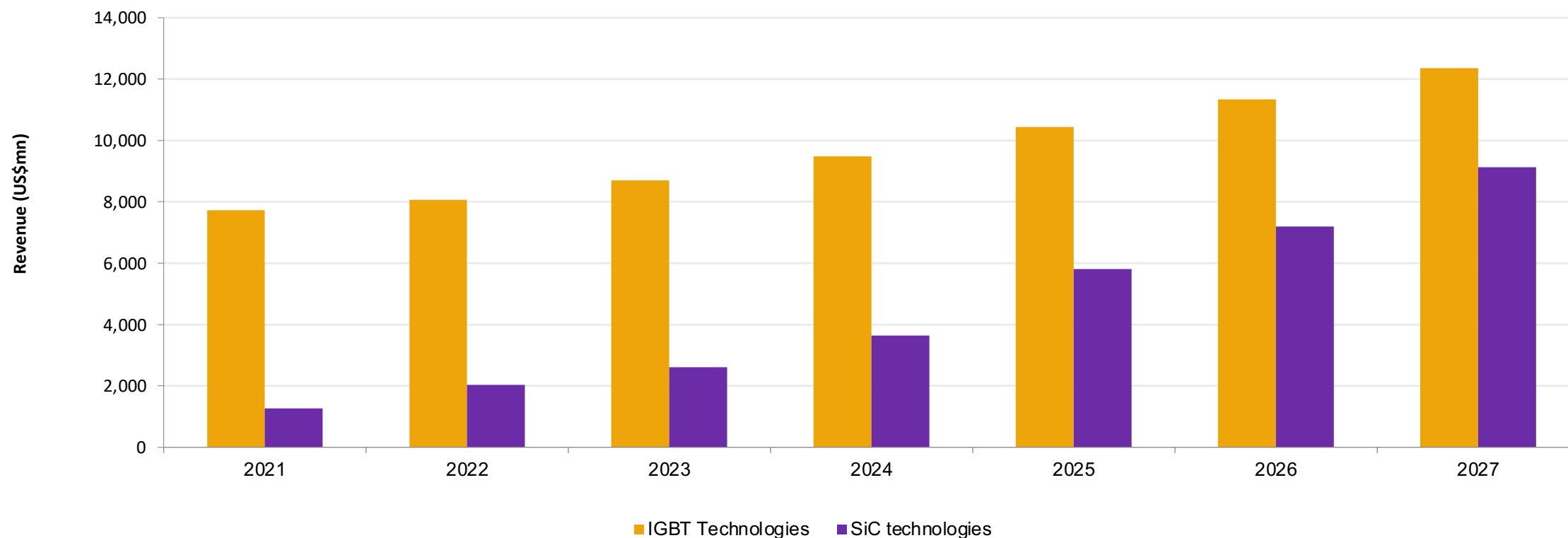


Source: Omdia

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Revenue forecasts

Revenue forecasts of Si IGBTs and SiC MOSFET technologies



Source: Omdia

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Summary

Summary

Power semiconductor market undergoing major changes

For the first time in many years, the power semiconductor market is undergoing a systemic shift. This is due to the combination of novel technologies (SiC, GaN) and a number of new challenges in the application space. These two factors are coming together to create a perfect storm.

Plenty of overlap between the manufacturers of SiC MOSFETs and Si IGBTs

There will be sustained competition between Si IGBTs and SiC MOSFETs in many applications for the foreseeable future. Many companies offer both of these types of devices. This could either be seen as managing a shift from Si IGBTs to SiC MOSFETs, or having a vested interest in the success of both device types. There is still R&D being performed on IGBTs.

Hybrid and electric vehicles are a key battleground of the future

The shift from ICE vehicles to HEV's is a major boost for the power semiconductor market. The value of semiconductors within a fully electric vehicles is 2.5x that of an ICEV, and HEVs are expected to out-sell ICEVs in 2027. Due to its size it is an incredibly important market and one which will likely be shared by the different devices.

IGBTs have a strong lead in other applications, and aren't going anywhere, any time soon

The Si IGBT market is still significantly larger than the SiC MOSFET market and whilst SiC is catching up fast it is not predicted to overtake Si IGBTs during our forecast period. IGBTs offer some advantages in price, availability and even performance depending on the application.