

HIGH VOLTAGE POWER ELECTRONICS MARKET AND TECHNOLOGY TRENDS

An analysis focused on application segments over-1.7kV

MARKET TRENDS

The power electronics market is booming at all voltage ranges!

More importantly, power devices for application markets >1.7kV like wind power converters, electricity transportation and distribution (T&D), rail traction and ship & vessel propulsion correspond to high added-value businesses.

It is sure that their total 2010 expected market size of \$405 million (including power devices and power modules) is small compared to lower voltage markets, but they remain very dynamic and offer the potential of high margins.

These market developments are primarily driven by energy saving considerations and green

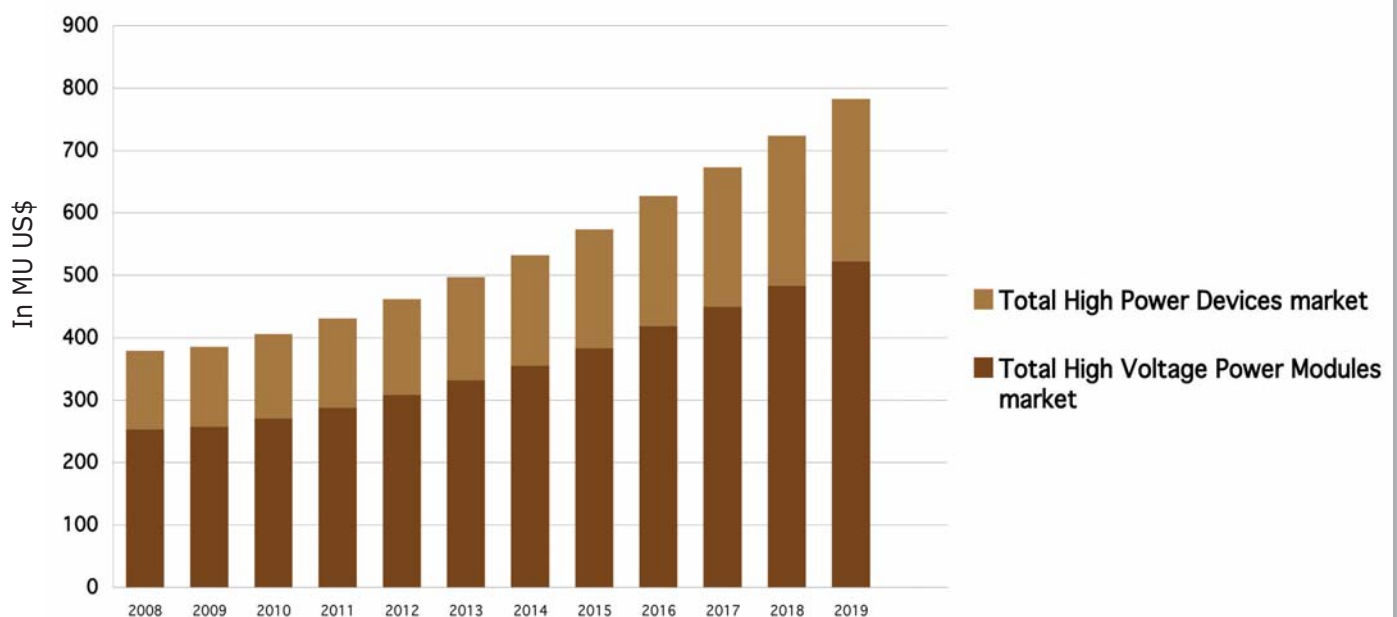
technology developments. They are actively supported – e.g. electricity T&D – by several governments and leading companies are working to improve their technology.

As such, silicon IGBTs, thyristors (GTOs and IGCTs), diodes and future SiC devices will get access to more and more technological improvements like transition to 8" wafer platforms and use of silicon carbide (SiC) materials among others.

However, the long time period of order contracts, the low volume production they imply and the issues to increase voltage to use SiC-based components induce quite light competition between the well-established players of those markets.

Total high voltage power devices and modules market

(Source: Yole Développement, Feb. 2010)



MARKET METRICS

Total market for high power devices and modules (including IGBTs, thyristors and diodes) was \$390 million in 2009 and is expected to ramp up to more than \$570 million by 2015.

Rail traction will contribute more than 65% of this value because of the high level of production it represents and the number of inverter units per locomotive.

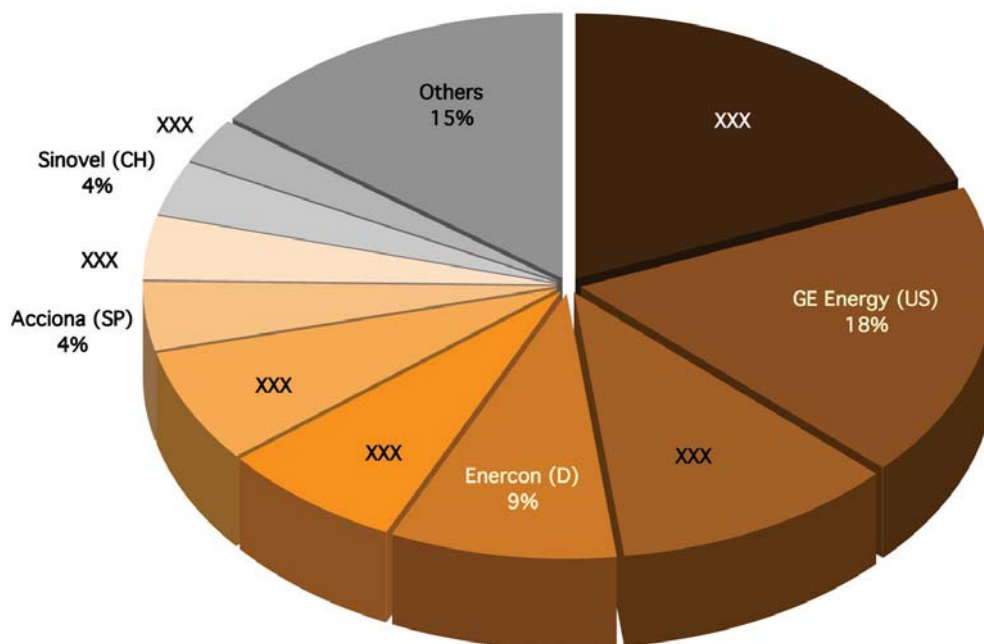
Electricity T&D will benefit from the strongest CAGR between 2010 and 2015: 11.1%. Indeed, we expect plenty of work to be realized for HDVC transportation, and ABB to provide an important contribution to HVDC light architecture by making IGBTs.

Wind turbine converters have not suffered so much from the 2009 crisis, and their growth is expected to be the second strongest, with 2010 – 2015 CAGR of more than 9%.

Finally, ship and vessel markets have been impacted unevenly in 2009. Military vessels have kept on growing – relatively to the long time period of ship manufacturing – whereas passenger yachts acquired for private use have drastically decreased. As a consequence, we estimate the global IGBT module market for ships and vessels to resume in 2013 and reach \$26 million by 2015.

2009 wind turbine makers market share

(Source: Yole Développement, Feb. 2010)



REPORT HIGHLIGHTS

Power electronics represent a daily challenge in several systems today (photovoltaic inverters, hybrid electric and electric vehicles, cameras, white goods,...) from a market point of view, but also from a technology development aspect.

Plenty of companies are pushing R&D efforts hard in order to provide the most cost-effective, efficient and reliable materials, devices and systems. And some more "hidden" applications, like the over-1.7kV segment described in this report benefit from those efforts.

The 4 following segments have been investigated in this report:

- Wind turbine converters,
- Electricity T&D,
- Rail traction,
- Ships and vessels.

With deep understanding of these application markets, Yole Développement provides a detailed analysis for each of them on:

- The technical developments provided by the leading companies
- The architectures of inverter units
- Market data of macro market: wind turbine installed base, shipments of vessels and trains, and number of existing power installations for electricity T&D
- Market metrics of related power devices and modules: IGBTs, thyristors and diodes
- Market estimation of silicon wafers and SiC substrates penetration
- Deep understanding of the value chains
- Market shares of leading companies

TABLE OF CONTENTS

Executive summary

Definition

- IGBT module definition
- Main manufacturing steps of IGBT-based power inverter modules
- Comparison between GTO/IGCT/IGBT
- Which device for which application?
- Power vs. frequency

Market topology

Methodology of investigation

General introduction

Over-1.7kV application business and technology analysis:

- Wind turbine converters
- Electricity Transmission & Distribution
- Main T&D company profiles
- Rail Traction
- Ships & Vessels

High voltage power electronics wafer market

- SiC adoption
- Thin wafer: the next step for lower voltage applications

Synthesis

Appendix

- Overall IGBT market
- European regulations in Power & EMC/EMI

WHO SHOULD BUY THE REPORT

- Power device manufacturers
- Power module manufacturers
- Material and substrates makers
- Electricity suppliers and distributors
- System integrators
- Companies willing to enlarge business on low volume markets
- Financial & strategic investors
- R&D centers

REPORT METHODOLOGY

Our report is a compilation of the day to day contacts of the 20 full time analysts of YOLE, interviewing more than 2,500 companies per year, from system integrators to device manufacturers.

Market & technical information has been gathered directly at:

- System manufacturers: ship & vessels manufacturers, trains manufacturers, inverters manufacturers, Electricity transport & distribution power system makers...
- Devices & modules manufacturers: IGBT packs makers, diodes makers, thyristors makers...
- Materials suppliers for high voltage Power Electronics applications (Silicon, SiC)...

Our analysis is also the result of the daily work of the analysts at Yole who update the forecasts as soon as the information is obtained.

Data from thousands of interviews every year (50 to 70 industrial interviews every week) provide the primary data we are using for analysis and forecasts.

COMPANY INDEX

ABB, Schneider Electric, Areva, Alstom, Mitsubishi Electric, Convertteam, Fuji, Hitachi, Infineon, Siemens, Mitsubishi Heavy Industries, NEG Micon, Northern Power Systems, PacWind, Raum Energy Inc., Samsung Heavy Industries, Scanwind, General Electric, Southwest Windpower, Toshiba, Ansaldo-Breda, Bombardier, Dynex Semiconductor, Talgo, Stadler, Semikron, Powerex, Vishay, Cableform, Polovodice, Vossloh, SEPSA, Ingeteam, Hyundai Rotem,...

BIO



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He was granted a Master of Science degree in semiconductor physics and microelectronics from the National Institute of Applied Sciences in Toulouse, France.

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- MEMS Devices and Equipment & Materials for MEMS manufacturing
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- Nanomaterials
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- Microfluidics
- 3D IC/TSV & Advanced Packaging

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- Technology analysis
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- M&A support and due diligence
- Magazine Publication Micronews (print version and on line services)
- Exclusive newsletters in MEMS, 3D IC, photovoltaic,
- compound semiconductors and microfluidics
- Market reports & Database

Yole Développement is the world leader in the analysis of disruptive semiconductor applications and markets. Each day, Yole Développement's team of 20 market analysts is in contact with industrial companies, R&D institutes and investors worldwide in order to help them understand the market and technology trends. In its analysis, Yole Développement takes into account the complete value chain including materials, equipment suppliers, device & system manufacturers and end users.

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