



Energy Efficient Semiconductors

Industry's Needs and Challenges

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CONVERTEAM
THE POWER CONVERSION COMPANY

Agenda

- Converteam
- Power Conversion
- Naval Propulsion
- Renewable Generation
- The Role of Universities
- Conclusions

- **Converteam is an engineering company providing customized solutions and systems converting electrical energy into productive performance**



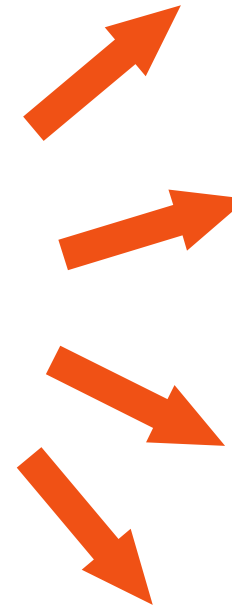
Power generation



Power transmission & distribution



Converteam



O&G and Offshore



Marine



Energy



Industry

- **Converteam: a company with more than 100 years experience in power conversion**

- **Conventional Motoring (Pumps, Compressors)**
 - Motor supplied with fixed voltage and frequency AC input.
- **Variable Speed Motoring (Propulsion, Mining, Steel)**
 - Motor supplied with variable voltage and frequency AC input.
 - Need “Black Box” to convert fixed voltage and frequency AC supply to variable voltage and frequency AC output.
- **Conventional Generation (Coal, Gas, Nuclear)**
 - Generator produces fixed voltage and frequency AC output.
- **Renewable Generation (Wind, Wave, Tidal)**
 - Generator produces variable voltage and frequency AC output.
 - Need “Black Box” to convert variable voltage and frequency AC input to fixed voltage and frequency AC output.

The “Black Box” is a power electronics converter, built using power semiconductor devices.

■ Type 45 Destroyer

- World's most Advanced Warship
- Air Defence Role
- Converteam Power & Propulsion System and power management system
- 7500 tonnes
- 50% bigger than the Type 42
- Uses half the fuel of Type 42



■ System Needs

- High reliability and availability (“keep fighting”)
- High power density
- High efficiency
- Minimise capital and operating costs
- Typically 35-year service life

■ Semiconductor Challenges

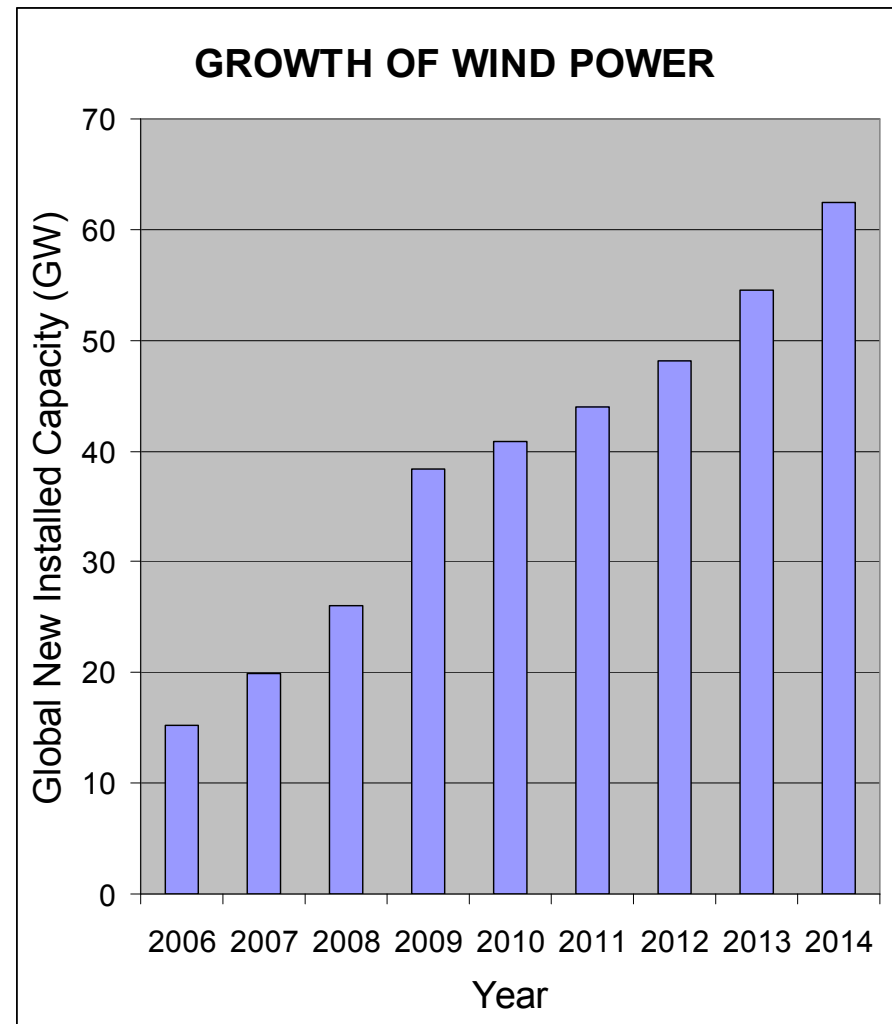
- Short-circuit failure mode (N+1 redundancy)
- High thermal and power cycling capability (packaging)
- High junction temperatures
- High operating voltages
- High switching frequency
- Low conduction and switching losses
- Ease of control (gating)
- Obsolescence Management



Dynex SCR



Dynex IGBT



Source: GWEC – GLOBAL WIND 2009 REPORT March 2010



Network Bridge



Machine Bridge

■ System Needs

- Minimise cost of energy (£/MWh)
- Low capital and operating costs
- High reliability and availability
- High efficiency
- Maximise power density
- Typically 20-year service life

■ Semiconductor Challenges

- Low cost design
- High thermal and power cycling capability (packaging)
- High junction temperatures
- High operating voltages
- High switching frequency
- Low conduction and switching losses
- Ease of control (gating)
- High volume production



Semikron IGBT

- Working closely with industry
- Undertake the “Research” part of R&D
- “Technology Watch” for industry
- Enable leveraged funding of long-term research
- Supply trained Engineers into UK industry (undergraduate and postgraduate)
- Postgraduate research is a vital part of Education
- Specialist knowledge but broad skills

- Entering a “Golden Age” for Power Electronics
- UK Industry is well positioned to play a leading role
- Power Semiconductors is a technology driver
- Universities will play a vital part in ensuring that UK companies remain competitive in the global market

Thank you for your attention

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