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About the EPSRC Centre for Power Electronics

Transforming our energy and transport future through world-leading research

The Centre for Power Electronics is the UK's internationally recognised provider of world-leading, underpinning power electronics research. It has brought together the UK's best academic talent to transform our energy and transport future through outstanding research.

Consisting of a network of **12 core university partners**, with a hub at the University of Nottingham, EPSRC has made a direct investment of £23 million over a seven-year time frame.

The Centre's work has included the following elements:

- Underpinning power electronics research
- Project funding
- Support networks for postgraduates and researchers
- Building the power electronics community in the UK
- Strengthening international links and collaborations
- Knowledge exchange
- Policy influence
- Public engagement activities.

Welcome

The Centre for Power Electronics was founded in 2013 as part of a direct response to the Government's Strategy for Power Electronics. It brought together the very best research groups in a UK-wide, multi-disciplinary, virtual centre.

In this publication we look back over the last six years and provide an overview of the Centre's achievements during this time.

Our core research activities have focused on fundamental power electronics research at low technology readiness level, delivered by multi-institution, collaborative teams. These supported a wide range of application areas, with a medium to long-term time horizon.

Our funding calls targeted early career researchers, international exchange visits, impact acceleration and feasibility projects as well as knowledge exchange, which helped broaden participation in the Centre's activities.

Building skills and capacity were at the heart of our endeavours, with community support activities that included workshops, tutorials, postgraduate training events and an annual conference. The Centre supported the development of a successful bid for an EPSRC Centre for Doctoral Training (CDT) in Power Electronics for Sustainable Electric Propulsion launching in autumn 2019.

Through our collaborations with industry representatives and engagement in policy decision-making processes we have ensured that the views of industry and academia were shared and heard.

I am proud of what the Centre has achieved – it has brought together the UK's best academic talent to deliver transformative and exploitable new technologies that are of long-term strategic value to the UK power electronics industry.

Looking ahead, the Centre will continue to support an integrated UK academic community by encouraging sustained collaborative working to feed the knowledge pipeline and deliver timely and relevant knowledge exchange and commercialisation. The Centre will continue to support the training of the next generation of innovators and technology leaders and support the development and delivery of government policy through its Industrial Strategy.

Professor C Mark Johnson
Director of the Centre for Power Electronics

Executive Summary

360 academic papers published

Over 360 journal articles and conference publications reporting the Centre's research

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Support for cutting edge research projects

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9 multidisciplinary research themes, bringing leading UK universities together in unique collaborations

Young researchers supported

30 research fellows employed

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9 international studentships

Future Power Challenge competition

Annual Post Graduate Summer School

Research Associate network

Over 50 companies worked with

4 start-up companies established

Building the community

Annual Conference – held each year since 2014

Workshops

Road-mapping

17 projects funded involving

16 institutions

26 awards

including

- 6 feasibility projects **£405k**
- 4 early career researchers supported to develop independent research **£170k**
- 4 cross-cutting projects funded in structural and functional integration **£1.77m**
- 9 international exchange visits **£45k**
- 3 impact acceleration projects **£108k**

Policy

PEUK White Paper

Roadmaps

Consultations

Outreach activities

New Scientist Live

Cheltenham Science Festival

Science Museum event

Kit car project

Over 360 journal articles and conference publications reporting the Centre's research

The Centre's Research Themes

The Centre's research was organised into themes which were established through two sequential funding tranches. Through the research themes, the Centre brought together leading academic research groups from across the UK to:

- **Address key research challenges through a coordinated programme.**
- **Build critical mass in the area of power electronics.**
- **Develop a widely recognised, internationally leading research capability.**
- **Develop a UK research strategy for power electronics.**

> ***The Centre gave me and four other early career researchers the opportunity to lead a major research grant in power electronics and its applications. With the projects covering power devices, reliability, simulation, integration and converters, the research produced in each of these areas has been much greater than the sum of its parts.***
>
> ***Dr Peter Gammon,*** *University of Warwick*

Tranche 1

The Tranche 1 research theme programmes ran from 2013 to 2017 and were supported by £8 million of EPSRC funding. The key challenges addressed in this phase were increased efficiency, increased power density, increased robustness, lower electromagnetic interference, higher levels of integration, and lower costs. Ten core university partners were directly involved in this phase of the Centre's research.

The four themes were:

- **Components**
- **Converters**
- **Devices**
- **Integrated Drives.**

Tranche 2

Tranche 2 runs from 2017 to 2020, with an overarching focus on wide band-gap power electronics. Ten universities including two new partners, were directly involved in this phase of the Centre's research. £6 million of EPSRC funding was allocated to this phase covering:

- **Switch Optimisation**
- **Virtual Prototyping**
- **Reliability and Health Management**
- **Heterogeneous Integration**
- **Converter Architectures.**

Research Highlights

Tranche 1

Devices

Lead academic:

Professor Phil Mawby
University of Warwick

Universities:

- Bristol
- Cambridge
- Newcastle
- Warwick

The aim of the Devices Theme was to make a significant contribution to semiconductor power device technology performance in a number of strategic areas, including power IC technology, advanced super-junction IGBT structures in silicon, as well as wide band-gap devices in silicon carbide and gallium nitride.

Headline achievements

- Advanced Silicon Trench IGBT Architecture - a 20 percent improvement in on-state performance was demonstrated without affecting off-state performance.
- Improved SiC Gate Oxidation Processes – the team doubled the channel mobility compared to standard oxidation processes.
- Trench SiC MOSFET development – the team delivered the first 1.2kV, 3.3kV and 10kV power MOSFETs devices to be built in the UK.

Converters

Lead academic:

Professor Andrew Forsyth
University of Manchester

Universities:

- Bristol
- Imperial College London
- Manchester
- Nottingham
- Strathclyde

The Converters Theme carried out research into grid-scale converters and compact, low voltage converters.

Headline achievements

- Thyristor-based architectures with IGBT auxiliary switching legs were identified which led to an increase in the efficiency of very high voltage, grid-scale DC-DC and DC-AC converters.
- Soft-switching topologies were developed for wide band-gap devices in DC-DC converters and resonant inverter applications, which enabled reductions in passive component size and led to significant advances in core-less wireless power systems.
- An holistic design optimisation framework was developed for multi-kW DC-DC and DC-AC converters leading to an 80 kW SiC DC-DC demonstrator (30 kW/litre, liquid cooled) and a 5 kW SiC MOSFET/BJT DC-AC demonstrator (3.5 kW/litre, air cooled).

Research Highlights

Tranche 1

Components

Lead academic:

Professor Phil Mellor
University of Bristol

Universities:

- Bristol
- Greenwich
- Imperial College London
- Manchester
- Nottingham
- Warwick

The Components Theme drew together underpinning research into packaging technologies, passive components, device switching control, reliability modelling and operational management. The overarching focus was to deliver new capabilities in reliable switch units to maximise the potential offered by wide band-gap power semiconductor devices.

Headline achievements

- Integration of wide band-gap power semiconductor devices into very high frequency power converters has been achieved using a novel high-efficiency regenerative gate drive. A 3 kW Class E inverter operating at 3 MHz has been demonstrated with >95% efficiency and is being used to develop high power wireless power transfer.
- A novel gate drive capable of actively profiling the gate signal to wide-bandgap devices has been realised. The use of the gate drive has been demonstrated in improved power electronic conversion efficiency with reduce electromagnetic emissions.
- New approaches to real-time condition monitoring of wide band-gap power semiconductor devices have been developed. Temperature sensitive parameters which can be actively monitored through the gate drive have been identified.

Integrated Drives

Lead academic:

Professor Barrie Mecrow
Newcastle University

Universities:

- Bristol
- Manchester
- Newcastle
- Nottingham
- Sheffield

The Integrated Drives Theme investigated technologies to enable a step-change in electric drives that would provide greatly increased power density, efficiency and reliability alongside lower lifecycle cost.

Headline achievements

- AC input filter inductors integrated into the machine with an 85 percent reduction in mass.
- Built and tested an open-ended inverter for fast switching drives.
- Increased understanding of high frequency iron loss.
- Created a new system for online monitoring of insulation degradation.
- Built a triple redundant, fault tolerant permanent magnet drive.
- Built and tested an induction motor with windings operating at over 300^{o}c.

Research Highlights

Tranche 2

Reliability and Health Management

Lead academic:
Professor Layi Alatise
University of Warwick

Universities:

- Bristol
- Newcastle
- Nottingham
- Warwick

The Reliability and Health Management Theme aims to develop technologies that can improve the reliability of wide band-gap semiconductors by providing a condition monitoring and health management platform for wide band-gap based power electronic modules.

Headline achievements

- Developed novel techniques for investigating threshold voltage shift in SiC and GaN power devices using device coupling capacitances as well as 3rd quadrant conduction characteristics. This is useful for condition monitoring of gate dielectrics in wide band-gap devices known to have less reliable gate dielectric characteristics compared to silicon devices.
- Developed advanced current source gate drivers capable of dynamic control of SiC devices. This can be used for optimising the switching performance and potentially implementing condition monitoring in SiC power devices.
- Made significant progress in the integration and characterisation of copper metallisation for improved reliability in power devices. This is important for improving the reliability of interconnects in power devices which are traditionally based on aluminium and are susceptible to failure modes like wire bond lift-off.

Converter Architectures

Lead academic:

Professor Xibo Yuan
University of Bristol

Universities:

- Bristol
- Imperial College London
- Manchester

The Converter Architectures Theme brings together academic and industrial expertise to investigate optimal converter architectures, advanced passive components design methods, fast speed control techniques and holistic optimisation to realise the full potential of wide band-gap devices in achieving higher efficiency, high power density with extended voltage, frequency and power handling capability.

Headline achievements

- Demonstration of efficient, light-weight shielding of open core magnetic components at 6.78 MHz.
- 40 percent reduction in high-current inductor weight through split-core, loss mitigation techniques and embedded thermal structures.
- New multilevel converter topologies with reduced number of required power devices and capacitor voltage control over the full modulation index and power factor range.

Research Highlights

Tranche 2

Virtual Prototyping

Lead academic:
Dr Paul Evans
University of Nottingham

Universities:

- Bristol
- Greenwich
- Nottingham

The Virtual Prototyping Theme is working to develop the tools that power electronic system designers need to be able to design optimal wide band-gap systems, right-first-time, on a computer using virtual prototyping techniques.

Headline achievements

- Development of fast thermo-mechanical simulation capability that can predict degradation in interface such as wirebonds.
- Production of an electrical-electromagnetic simulation capability that can predict losses due to current and magnetic flux in power converters.
- Working towards a Fast Computational Fluid Dynamics implementation for automatic estimation of thermal boundary conditions at fluid interfaces.
- Validation and integration into the Centre's design tool is now underway and in the second phase of the project, the efficiency of these simulation techniques is to be improved.

Heterogeneous Integration

Lead academic:

Professor Lee Empringham
University of Nottingham

Universities:

- Loughborough
- Nottingham

The Heterogeneous Integration Theme aims to develop design and manufacturing methodologies to enable the integration of power devices, interconnect, passive components, EMI reducing structures and thermal management techniques in a single manufacturing process.

Headline achievements

- Use of gelcasting to create versatile magnetic core components with controllable magnetic characteristics.
- Development of embedding technologies for high current power conversion.
- Validation of methodologies for the creation of low inductance commutation loops for high speed switching devices.
- Development of embedded structures for containment of EMI within power modules.

Switch Optimisation

Lead academic:

Dr Peter Gammon
University of Warwick

Universities:

- Cambridge
- Coventry
- Newcastle
- Warwick

The Switch Optimisation Theme is seeking to develop 10-15 kV silicon carbide insulated-gate bipolar transistors for grid-level applications.

Headline achievements

- Designed and simulated SiC IGBT and Power MOSFET devices at the crossover voltage rating of 10 kV.
- Developed a novel 'Retrograde P - well design' that will enhance the reliability of both the MOSFET and IGBT.
- Developed numerous design splits that will allow comparisons between the different technologies.

Funded Projects

The Centre's programme of funding calls targeted early career researchers, impact acceleration and feasibility projects with the aim of broadening participation in the Centre's activities.

Feasibility Studies

The feasibility studies funded by the Centre addressed topics that complemented the Centre's work, and which had the potential to be integrated within its core activities and secure subsequent standard grant funding.

£405k funding was allocated to six projects, each lasting up to 12 months.

- Patterned magnetic cores (PaMaCore) for efficient power devices, Dr Jonathan Terry, University of Edinburgh.
- Novel under-bump metallisation to enable low cost Pb-free solder interconnects for power electronics, Professor Changqing Liu, Loughborough University.
- Dielectric properties of thin diamond layers, Dr Oliver Williams, Cardiff University.
- Structural and functional integration of power electronics for harsh environments, Dr David Flynn, Heriot-Watt University and Dr Robert Kay, Loughborough University.
- PowerPassives: innovative on-line passive component thermal modelling in drives, Dr Martin Foster, University of Sheffield.
- M+POWER: magnetic field controlled switching device for power IC technology, Dr Petar Igic, Swansea University.

More than £4.5 million has been secured by investigators working on these projects to further develop their research in these areas.

> *"The Centre has played a crucial role in providing support via small projects that has enabled me to explore new concepts in emerging areas of societal importance."*
>
> **Professor Merlyne De Souza**
> **University of Sheffield**

Early Career Researchers

In 2015, the Centre introduced an early career award for research fellows or academics, to enable them to develop independent research within its framework. Applicants were required to demonstrate how their work would fit into one or more of the Centre's themes, and explain how the award would help them to develop their career.

£170k was allocated to four early career research projects:

- Optimisable system-level thermal models for power electronic converters, Dr Dan Rogers, Cardiff University.
- A new packaging structure of power module with integrated substrate and heat sink, Dr Jiangfeng Li, University of Nottingham.
- Novel power integrated semiconductor device technology for energy efficient power electronic systems, Dr Marina Antoniou, University of Cambridge.
- Addressing the range anxiety problem – a dual function integrated drive/charger for future EVs, Dr Nandor Bodo, Liverpool John Moores University.

Impact Acceleration Awards

This funding call was open to projects that could accelerate impact in the following areas:

- Knowledge transfer from academia to industry
- Business engagement activities
- Technology translation.

Three awards were made, totalling £108k.

- A heterogeneous platform for GaN power electronics (Het-GaN), Professor Merlyne De Souza, University of Sheffield.
- A robust, compact, high-efficient, soft-switched AC chopper for smart residential distribution network using SiC power electronics, Dr Arash Amiri, Loughborough University.
- A high reliability platform for integration in GaN on Sapphire (PlatGaN) Professor Merlyne De Souza, University of Sheffield.

Cross-Cutting Projects

The Centre's cross-cutting activities allowed different parts of the Centre to work together in the pursuit of common goals.

Four projects were funded, with an overall value of £1.77 million.

Operational management and control of SiC power modules in press-pack

Professor Layi Alatise
University of Warwick

This project combined research expertise from the devices, components and converters themes to model, design, assemble and test the first SiC power devices in pressure packages. The devices demonstrated excellent thermo-mechanical reliability by undergoing over power 15000 cycles with no change in transient thermal impedance and excellent ON-state performance.

Multi-domain optimisation and virtual prototyping for high-density power electronics systems

Professor Xibo Yuan
University of Bristol

This project addressed the design and development of a multi-domain modelling and design tool based on virtual prototyping approaches to enable the co-design and optimisation of power-dense and highly-integrated power electronic converters. This work involved the converters, components and integrated drives themes.

Compact and efficient off-line LED drivers using 800V lateral IGBTs and chip-on-board assembly

Professor Florin Udrea
University of Cambridge

Involving all four themes from Tranche One, this project targeted the design, assembly and demonstration of a fully functional, compact, AC-DC LED driver using for the first time 700V rated Lateral Insulated Gate Bipolar Transistors (LIGBTs) and flip-chip and chip-on-board (COB) packaging techniques.

Next generation integrated drives

Professor Barrie Mecrow and Dr Simon Lambert
Newcastle University

Bringing together all four themes from Tranche One, this project developed an application-targeted prototype drive featuring a modular, silicon carbide inverter mounted within the machine housing and a common liquid cooling circuit.

The Centre for Power Electronics has links with over 50 companies

Outreach Events

Science Museum 2014

In 2014, representatives from the Centre took part in a three-day Antenna Live event at the the Science Museum, London. The aim of the event was to capture the imagination of future engineers and inspire them to find out more about a career in electrical engineering and power electronics. The world land-speed record holding electric vehicle (itself full of state-of-the-art power electronics) was placed at the centre of an exhibition which showcased technologies including ultra high-density power circuits, silicon carbide device wafers, and a wireless charging system.

New Scientist Live 2016

In September 2016, the Centre showcased power electronics technology applications from across the UK at New Scientist Live, London. Exhibits included an electric superbike, a green taxi aircraft wheel, demonstrations of wireless energy transfer and a fuel cell car.

Centre partners also took part in a panel discussion about Cars of the Future, chaired by renewable energy advocate, Robert Llewellyn.

Cheltenham Science Festival 2016

Also in 2016, the Centre took part in the Cheltenham Science Festival. Attracting visitors of all ages, this was a fantastic opportunity to promote electronic engineering to the scientists and engineers of the future.

Postgraduates and Researchers

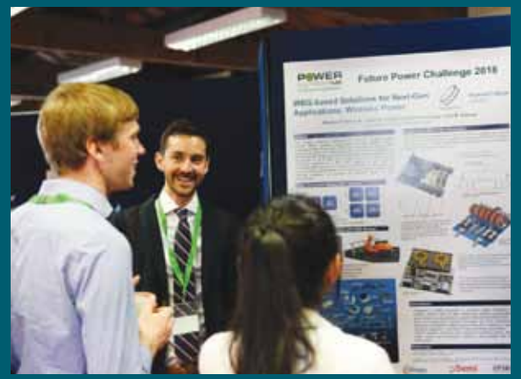
Supporting those embarking on a career in power electronics research was an important part of the Centre's activities. For three years it supported a postdoctoral research network, and since 2015 has held an annual postgraduate summer school.

> ***"Being involved in the Centre's great events has really made a difference to me - from the start of my PhD in 2015 right up to the point of writing my thesis in 2019."***
>
> ***Juan Manuel Arteaga***
> *Imperial College London*

Postgraduate Summer School

Each year, the postgraduate summer school has been organised by a group of postgraduates, supported by the Centre's Hub team. Open to all UK-based postgraduates working within the field of power electronics, it provided an opportunity for them to hear what industry was looking for in researchers, make contact with potential employers and network with other postgraduates. The summer school agenda varied each year, but included workshops on communicating research, speeches from invited guests and exhibitions by power electronics companies.

Postdoctoral Research Community Network



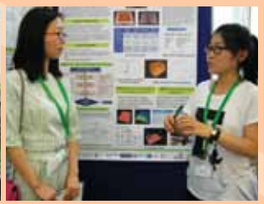
This network was supported by the Centre to encourage interaction between researchers in the field of power electronics. An annual workshop was held in each year from 2014 to 2016 providing an opportunity for the community to come together to discuss technical aspects of their work and share ideas and best practice in an informal environment.

Centre for Power Electronics Annual Conference

Since 2014, the Centre has held an Annual Conference in the summer, providing an opportunity for the power electronics academic and industrial communities to get together. Attracting speakers from all over the world, the conference became a "must" in the power electronics calendar. With its mix of international keynote speakers, updates from the Centre's theme leads, an exhibition by leading companies, debates and a poster competition showcasing the latest in power electronics research, the conference was always a sell-out.

Just some of our world-renowned keynote speakers over the years:

- **Professor Frede Blaajberg** Aalborg University (Denmark)
- **Professor Dushan Boroyevich** Virginia Tech (USA)
- **Professor Rik De Doncker** Aachen University (Germany)
- **Professor Braham Ferreira** Delft University of Technology (Netherlands)
- **Dr Kimimori Hamada** Toyota (Japan)
- **Professor Alex Huang** University of Texas at Austin (USA)
- **Professor Johann W. Kolar** ETH Zurich (Switzerland)
- **Professor Alan Mantooth** University of Arkansas (USA)
- **Dr Galina Mirzaeva,** University of Newcastle (Australia)
- **Professor Annette Muetze** Graz University of Technology (Austria)
- **Professor Leon Tolbert** University of Tennessee (USA)
- **Professor Xiaoming Yuan** Huazhong University of Science and Technology (China)

> ***"The conference exceeded my expectations in many aspects and I gained not only the scientific research progress but also the chance to network. This event really encouraged all levels of participation, discussion and debate, encompassing the UK, Europe and Asia, academic and industrial. I truly admire the organiser's courage, honesty and creativity."***
>
> **Dr Zhaoxia Zhou**
> **Loughborough University 2018**

International Community

The Centre supported researchers who wanted to undertake an overseas secondment through its Researcher Exchange Scheme. Funding was available to support:

- UK-based researchers who wanted to work on a collaborative project with an external research organisation.
- Researchers based overseas who wanted to initiate a collaborative project with a UK university, affiliated to the Centre.

The scheme covered travel and subsistence as well as a contribution towards the cost of the research. Nine projects totalling £45k were funded:

- Christina DiMarino from Virginia Tech, USA visited the University of Nottingham.
- Hui Zhang from Shanghai Institute of Ceramics, Chinese Academy of Sciences, China visited the University of Nottingham.
- Michael Merlin from Imperial College, London, visited the University of Toronto, Canada.
- Zheng Wang from Southeast University, China, visited the University of Liverpool.
- Ke Li from the University of Nottingham visited the University of Lille, France.
- Stefano Nuzzo from the University of Nottingham visited the University of Pisa, Italy.
- Qingzeng Yan from the China University of Petroleum visited the University of Bristol.
- Mohamed Diab, from the University of Strathclyde visited the University of Hanover, Germany.
- Enric Sánchez-Sánchez, from the Universitat Politècnica de Catalunya , Spain visited Imperial College London.

> ***"The researcher exchange programme gave me an excellent opportunity to start my independent research. During the programme, I collaborated with leading European academics in power electronics and published novel results of GaN power devices characteristics. I believe future collaborations on high efficient electrical energy conversion can be established based on this programme."***
>
> ***Ke Li,*** *University of Nottingham*

Policy

Since its inception, the Centre for Power Electronics has ensured that the voice of the power electronics community has been heard by those making policy decisions.

It has held workshops and other consultations to gauge opinion; the outcomes from these have influenced the Automotive Council Roadmaps and the IEEE Heterogeneous Integration Roadmap.

In 2017, members of the Centre were involved in the development of the Powerelectronics UK White Paper. The Centre has also been instrumental in bringing industry and academia together to provide input into the development of the Driving the Electric Revolution Challenge as part of the Government's Industrial Strategy.

> ***"As the number of electrified vehicles on the road increases, more sophisticated power electronic solutions will be needed to reduce electrical losses, system weight and cost."***
>
> **The Roadmap Report Towards 2040:**
> A Guide to Automotive Propulsion Technologies -
> *Page 86*

Industry Engagement

The Centre's industry engagement strategy built on established links that Centre members already had with UK industrial organisations. Its aim was to create an environment where academia and industry could collaborate on a number of levels – with industrial partners ranging from SMEs to global corporations.

The Centre was guided by its Steering and Advisory Group made up of members representing industry and academia. This group advised the Centre on its engagement with industry, ensured that its research was of strategic relevance and that the results were available for exploitation.

The Centre also provided an environment for relationships between academia and industry to thrive – through its events programme, and through its links with industry-facing organisations such as the Advanced Propulsion Centre and Power Electronics UK.

Knowledge Exchange

The Centre's Business Champion, Geoff Haynes, was tasked with identifying research carried out by partners that could have commercial applications.

Business Champion puts two and two together

Geoff helped researchers from the University of Bristol work with a major semiconductor company, RAM Innovations. As a result of the collaboration, the team patented a wide-band current sensor and the technology has now been adopted by a number of companies.

The Thinking Pod Innovations

Geoff Haynes also worked with a group of researchers at the University of Nottingham. This team developed a way of building fast converters based on a 'block design' which addressed the challenges of working with fast switches. The Thinking Pod Innovations Ltd was formed and its converter-in-package technology will benefit from a range of market opportunities for high speed switching systems.

Bumblebee Power

In 2016, a team from Imperial College London won the first Future Power Challenge Award (see page 36 for details) for their pioneering work in wireless charging. In 2017, the team was the first in the world to demonstrate inductive powering of small drones in flight, gaining significant attention at global conferences and exhibitions. The project was featured in the BBC "Click" programme. A spinout company - Bumblebee Power - has now been set up and the team is collaborating with several companies, including Thales Group, Govecs and GaN Systems.

Outreach activities

Kitcar inspires engineers of tomorrow

For three years, the Centre has supported the annual Institute of Engineering and Technology /Greenpower Formula Goblin nationwide competition. This initiative was supported by the Power Electronics Spoke of the Advanced Propulsion Centre (APC) working with the Centre for Power Electronics.

The Centre supported a number of schools to take part in the competition giving youngsters of primary school age the opportunity to see what a career in engineering is really like.

From January to June each year, researchers from CPE helped pupils and their teachers to experience first-hand an engineering challenge. Teams from the UK then took part in races over the summer. The following schools were supported by the Centre to take part in this outreach activity:

2017 Round Hill Primary School Nottinghamshire

2018 Abbey Road Primary School Nottinghamshire

2019 Bramcote Hills Primary School Nottingham

> ***"It was encouraging to see the excitement with which the children embraced the project. It's been fantastic working with them. The car was easy to build, lightweight, low cost and massive fun and it's been a great way to explain the science behind the driving."***
>
> ***Dr Liliana De Lillo***
> *Senior Research Fellow, University of Nottingham*

Future Power Challenge

The Future Power Challenge was a competition supported by the Centre for Power Electronics that also attracted industry sponsorship.

It was aimed at PhD researchers working in the field of power electronics and took the form of a poster submission, followed by a poster and pitch presentation to a panel of judges. Winners and runners up were awarded a cash prize, as well as the opportunity to work with the Centre's Industry Champion, Geoff Haynes.

CPE's Industry Champion, Geoff Haynes (left) with the winner of the Future Power Challenge 2018, Zhe Zhang from the University of Nottingham

The 2016 winners, from Imperial College London went on to present a joint paper with GaN Systems on wireless charging at APEC in 2017, and created a spin out company. (See page 34 for details.)

In 2018, Zhe Zhang from the University of Nottingham was awarded first prize for a demonstration of his PhD research into the suppression of electrical interference from fast switching converters. His work has since been further developed in an industry-led project funded by InnovateUK.

> ***"The Future Power Challenge was a great chance to challenge myself and pursue a greater achievement in the field of power electronics. Also, it was a great opportunity for exchanging ideas between industry and academia."***
>
> ***Zhe Zhang***
> *University of Nottingham, Winner 2018*

Member institutions

University of Bristol

University of Cambridge

Coventry University

University of Greenwich

Imperial College London

Loughborough University

The University of Manchester

Newcastle University

University of Nottingham
UK | CHINA | MALAYSIA

The University Of Sheffield.

University of Strathclyde Glasgow

Warwick
The University of Warwick

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