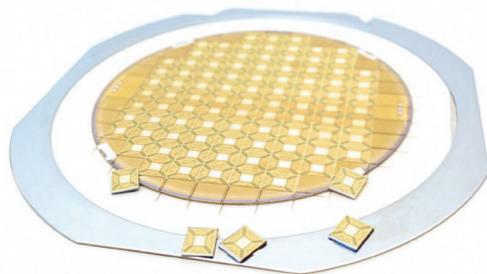


At the centre of  
**net zero**  
**technology**



**CATAPULT**  
Compound Semiconductor Applications

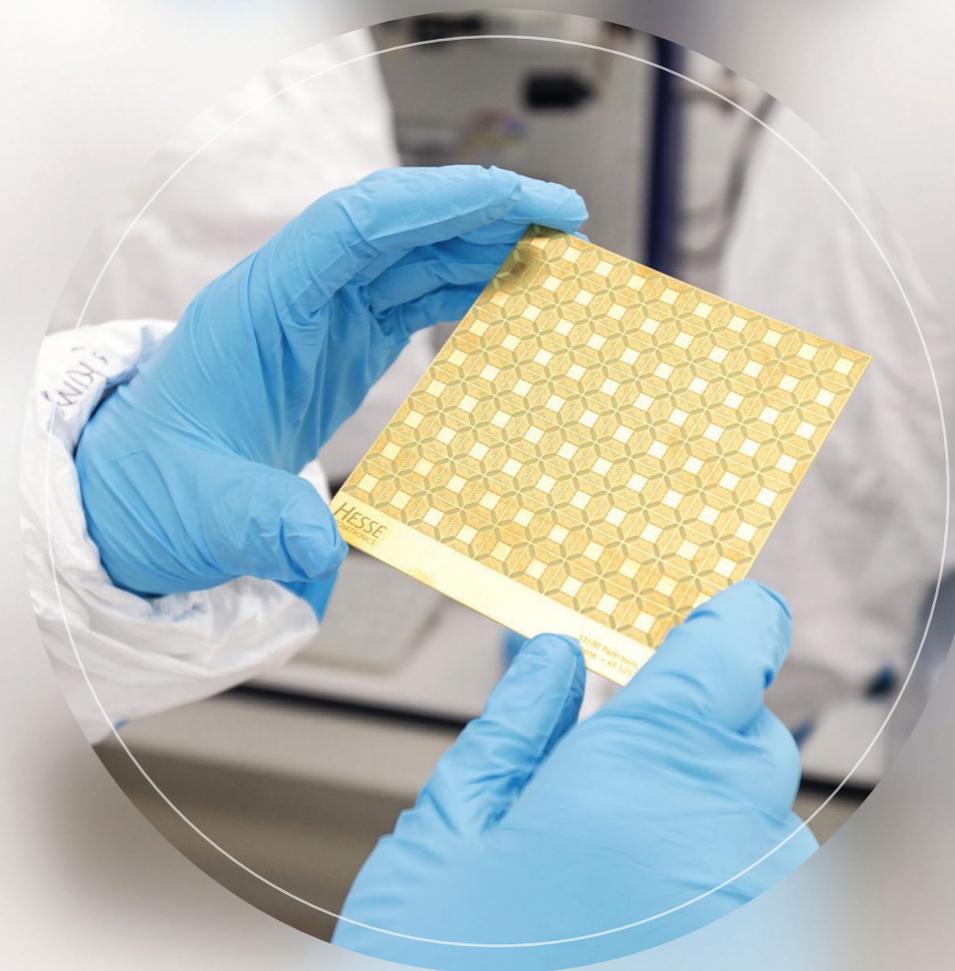


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At the centre of  
**advanced electronics**

Tiny chips made using compound semiconductors are at the heart of a new breed of advanced electronics controlling the renewable energy networks and electrified vehicles that will help reduce our carbon emissions. Compound semiconductors will generate considerable benefit, not only for the UK electronics sector, but also for UK companies that successfully apply them.

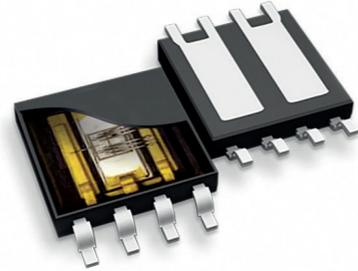
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### **Innovating to Net Zero**

In 2019, the UK became the first major economy in the world to commit to ending its contribution to global warming by 2050. Meeting 'Net Zero' will require innovation across the economy – in new technologies and deployment of existing technologies, in new business models and consumer offerings and in new ways of designing, regulating and operating energy markets. Compound semiconductor technology has such potential that it has triggered a cascade of innovation at UK companies.

But these companies need expertise and cutting-edge facilities to develop and commercialise their prototypes. The Compound Semiconductor Applications (CSA) Catapult, a not-for-profit industrial research organisation offers expertise and facilities here in the UK – accelerating the development of innovative net-zero technologies, and securing skilled jobs and supply chain investment in our economy.



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At the centre of

# flexible energy networks

Achieving a Net Zero energy system means integrating and managing increasingly diverse energy sources. This is only possible by using a new class of power electronics components which offer greater flexibility, efficiency and reliability than ever before. CSA Catapult is currently working with industrial and academic partners to support the development and rapid industrialisation of these advanced power electronics components and systems.

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### Realising new designs

CSA Catapult is working to help manufacturers of solid-state transformers to bring new products to market more quickly. These transformers provide flexibility that does not currently exist in the electricity grid. This flexibility is required to store energy from renewable sources when it is generated, and then direct the energy to consumers when it is required. Solid state transformers are expected to lead to new localised, highly flexible, micro-electricity grids in the future.

### Building supply chains of the future

Major energy suppliers in the UK recognise that they need to find new ways of working with a wider range of companies. Networks need to adopt new designs that take advantage of the latest thinking in advanced power electronics. By working with innovative companies large and small, CSA Catapult is acting as the gateway to an innovative ecosystem, thus enabling new business and supply chain models that will benefit both energy suppliers and end users.



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At the centre of

## zero emission vehicles

The transition to Net Zero is supported by bold targets to reduce emissions from vehicles.

Power electronics are at the heart of vehicle electrification, managing and optimising the power transfer between the battery (or fuel cell) and the electric motor. Incorporating compound semiconductors into power electronics can deliver significant performance and cost advantages – delivering vehicles that are lighter, more powerful and have greater range.

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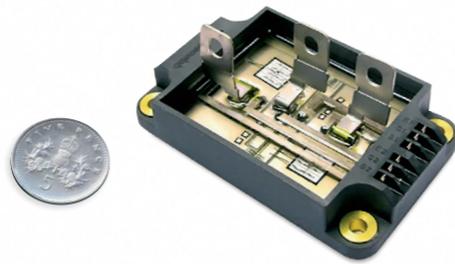


### Increasing UK competitive strength

CSA Catapult is part of a consortium building a unique supply chain for SiC-based power electronics. Led by McLaren Applied, the £20M project involving 12 UK partners is developing components and systems for electric vehicles. A new £30M project involving BMW will leverage these capabilities to deliver the components needed for volume production. The demonstrators being developed within the project could be incorporated into new battery electric vehicles as soon as 2024.

### High performance components

Although vehicle manufacturers and their supply chains have been working on electrified vehicle powertrain designs for many years, it is widely accepted that there is still significant scope for improvement. CSA Catapult is leading a project to develop a compact power inverter that is small enough to mount directly onto an electric motor, offering significant weight and space savings which will translate into greater vehicle range, lower running costs and more flexibility for the vehicle designer.



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At the centre of  
**advanced research  
and development**

Cementing its role in electrification, CSA Catapult has been appointed as the co-ordinator of a new centre of excellence in materials and components within an Industrial Strategy Challenge Fund initiative called Driving the Electric Revolution. The centre will enable industrial and academic partners to collaborate to develop and industrialise new technologies that can be applied to cross-sectoral electrification challenges, in sectors including rail, marine and aerospace.

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#### **Developing skills**

CSA Catapult is working with local and national organisations to improve curricula and promote the skills that the sector needs. It is also bringing its own expertise and that of renowned academics to a wider audience, training engineers and PhD students in the practical skills needed to successfully use compound semiconductors in products.

#### **Beyond passenger cars**

The power requirements for heavy-duty and off-highway vehicles, ships and planes are significant compared to passenger cars, presenting unique electrification challenges that can be addressed with compound semiconductors. In the aerospace sector, CSA Catapult is working on next generation power electronics which will support increased electrification of aircraft.



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At the centre of  
**the net zero economy**

CSA Catapult is already accelerating the UK towards its Net Zero goal. It is working with over 60 partners on projects worth in excess of £70m which will directly impact our ability to use more renewable energy and further electrify vehicles. Over the coming months, we will be showcasing the work of our consortia projects as they progress and examining the opportunities for UK companies to benefit from electrification.

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#### **Delivering Net Zero**

CSA Catapult has created a state-of-the-art innovation centre within the compound semiconductor campus at Imperial Park, in South Wales. The centre includes not just offices and space for collaboration, but a design studio and world-leading test and verification laboratories – facilities of strategic importance to the sector which do not exist together elsewhere.

Combining these facilities, its deep technical expertise and the ability to build new supply chains, CSA Catapult is helping the UK to build the advanced technologies at the centre of the new Net Zero economy. Through this support, it is contributing to the long term success of the UK electronics industry and the companies that successfully apply compound semiconductors.

## A unique set of engineering capabilities – turning concepts into reality

### Modelling

Every additional hardware iteration adds expense and delays market entry. Simulating system performance in software helps technology developers to design new systems in a flexible way – before committing time and money to a real-world prototype.

### Characterisation

Detailed application-specific characterisation of a new compound semiconductor device's electrical/optical, thermal and mechanical behaviour eliminates the guesswork involved in prototype development. Development time is reduced and new products can be brought to market much more quickly.

### Integration

Making a compound semiconductor work in a product, requires a 'package' which protects the delicate device and connects it to surrounding electrical or optical systems. Our packaging design and optimisation capabilities deliver more reliable products which can gain regulatory approval more quickly and are ready to use in finished products.

### Validation

Our specialist laboratories perform a wide range of tests to ensure new designs can withstand the relevant vibration, temperature and power cycling conditions found in the real-world. Accelerated lifetime tests check and verify system performance before full-scale manufacture begins.

## Get involved

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