

ANNUAL REVIEW 2023

CSconnected SIPF is supported by UKRI





WELCOME

2023 has in many ways been a landmark year for the UK semiconductor industry.

Whilst the South Wales based semiconductor cluster has been building a solid reputation for more than thirty years, the COVID-19 pandemic highlighted the importance of our industry sector when supply chains were disrupted in a way that caused major shortages across multiple industry sectors. Our dependence on semiconductors had never before been so evident.

Governments around the world suddenly took notice and our industry was under the spotlight with the emergence of major political commitments to secure sovereign capability in the design, prototyping and manufacturing of semiconductor technologies.

There is no doubt that silicon based semiconductors have been and will continue to be at the heart of the technologies that support modern life. These silicon "chips" are used to process and store digital data. However, sensing, power, high speed and quantum processes are increasingly becoming an important part of the technology mix and these activities depend on non-silicon technologies based on compound semiconductors.

South Wales is home to the world's first compound semiconductor cluster that already supports global technologies from handsets to healthcare, robotics to electrification along with data security and artificial intelligence. The activities of the South Wales based CSconnected compound semiconductor cluster were highlighted in the UK National Semiconductor Strategy that was published in May 2023.

Wales already plays a key role on the global semiconductor stage. We are confident that our position in this key sector is poised for major growth over the coming years.

Chris Meadows Director of CSconnected

About us

CSconnected is the world's first compound semiconductor cluster, based in and around South Wales.

With a coordinated manufacturing hub spanning a 90-mile corridor, from Chepstow to Swansea and a robust partnerships between government, academia, and industry, CSconnected has fostered the development of a unique value network driven by collaboration, interdependency and common goals.

In 2020, CSconnected received government funding provided through UK Research and Innovation's flagship Strength in Places Fund (SIPF) to build on Wales' regional strength in compound semiconductor manufacturing.

Our vision

Our vision represents not just a regional aspiration but a national commitment to develop and grow its sovereign capabilities in key enabling technologies that will allow the UK to increase trade globally in critical sectors such as quantum technologies, artificial intelligence, electrification, robotics, healthcare and data.

To achieve this, CSconnected is supporting an ecosystem that drives sustained private and public investment, skills development, and continuous advancements in research and development as the global demand for advanced semiconductor products continue to rapidly grow.

The world's first compound semiconductor cluster

COMPOUND SEMICONDUCTOR MARKET VALUE*





ANNUAL COMPOUND SEMICONDUCTOR MARKET GROWTH (2022-2030)*

A GLOBAL OPPORTUNITY

The semiconductor industry is already a key growth sector in the global economy and the demand for high speed, sustainable and next generation devices are accelerating the adoption of advanced semiconductor materials.

With global sales in excess of \$500B annually, semiconductors represent the World's fourth largest industry sector that is forecast to double over the next decade. Compound semiconductors makes a growing proportion of the global semiconductor market.

Home to the world's first dedicated compound semiconductor cluster, CSconnected has a competitive edge to be at the forefront of this exponential market opportunity valued at \$40.904B in 2023, rising at a compound annual growth rate (CAGR) of 6.1% to \$61.911B in 2030.*

*Based on P&S Intelligence compound semiconductor market research report from 2023.

5 KEY PILLARS TO SUPPORT GROWTH

The CSconnected cluster focuses on five key pillars to support sustainable growth, productivity and innovation in the region and beyond. As you delve into this report, you will read more about our collective effort to drive lasting positive impact, building on the legacy of the CSconnected SIPF project.

RESEARCH & DEVELOPMENT

From "Blue-sky" concept to prototyping and first commercial sampling made in Wales, we support and foster collaborative R&D in the cluster, one of the core activities of the CSconnected project, to enable new compound semiconductor technologies at the heart of the devices of today and tomorrow.

INFRASTRUCTURE EXPANSION

We support organisations seeking to establish or expand in the region. Since the beginning of the project new companies have been attracted to the cluster, taking advantage of the South Wales' value chain; recent industrial and manufacturing expansions have been driven by our core partners and two new industrial scale state-ofthe-art facilities at Cardiff University & Swansea University have opened for business leveraging new CS fab facilities.

OPEN ACCESS

We are contributing to the UK wide efforts in rapidly expanding vertical sectors reliant on a robust compound semiconductor ecosystem to enhance national sovereign capability and unlock opportunity for new technology and applications. This is reflected in the many projects we support in Quantum Technologies, Power Electronics, Telecoms, and Defence and Security.

TALENT PIPELINE

We address the skills shortage by working with industry and educational stakeholders to identify skills needed in the sector, attract talent and build a robust talent pipeline. From classroom activities, attendance at careers events to reskilling and upskilling training, we promote education and career awareness by supporting short and long term efforts to increase regional skills capacity and bring practical skills development into the industrial workplace.

GLOBAL IMPACT

We actively engage with Government agencies and organisations to cement our role as a key voice for the semiconductor industry. We regularly meet with and brief policymakers, deliver roundtables with key politicians in Wales, the UK and beyond and facilitate meetings between our partners and key clusters and organisations, creating a pathway to support continuous growth for the cluster.

CSCONNECTED SIPF

In 2020, CSconnected received government funding provided through UK Research and Innovation's flagship Strength in Places Fund (SIPF) to build on Wales's regional strengths in compound semiconductor manufacturing.

At the core of the project are four major collaborative R&D programmes:

- Next generation optical communications and sensing
- Large Scale GaAs-based wafer manufacturing
- Novel and efficient CS Wafer Fabrication Tools
- Advanced processes for 5G and EAV systems.

In addition, the project supports a central coordination activity that represents and promotes the cluster, and delivers regional educational and skills capabilities for the sector.

The CSconnected SIPF is collaborative project with government, academic and industry partners



Map of CSconnected SIPF partners - December 2023

£381M GVA

Total value of direct and indirect Welsh GVA supported by CSconnected SIPF partners

£543M GVA

CSconnected SIPF partners in Wales supports an estimate of £543M of GVA in the UK economy

£560M SALES

Total estimated manufacturing sales by CSconnected SIPF partners

2,661 JOBS

Total number of direct and indirect jobs supported by CSconnected SIPF partners

These figures are estimates taken from the 2023 Annual Report: Compound Semiconductor Cluster in South Wales published by Cardiff University Welsh Economy Research Unit

CSCONNECTED SIPF KEY ACHIEVEMENTS

CSconnected SIPF uses a number of Key Performance Indicators (KPIs) to measure our impacts and achievements. An overview of the project cumulative figures from November 2020 up to December 2023 is detailed below.



*These figures are estimates taken from the 2023 Annual Report: Compound Semiconductor Cluster in South Wales published by Cardiff University Welsh Economy Research Unit

CSCONNECTED SIPF 2023 INFRASTRUCTURE HIGHLIGHTS



In 2023 the new £55M CISM facility on Swansea University's Bay Campus opened. This building has been created with the purpose of bringing together semiconductor and advanced materials platforms and processes to deliver new technologies and products, and is home to a CSconnected landing space . More page 24.

Significant progress has been made on the research-anddevelopment (R&D) and manufacturing center for the SPTS division at KLA, in Newport which will include 67,000 sq ft of cleanrooms and be home to 750 employees. More page 22.





Formally opened in May 2023 the Translational Research Hub (TRH) at Cardiff University brings together specialists from the Institute for Compound Semiconductors (ICS) and Cardiff Catalysis Institute (CCI) to solve complex global challenges. The TRH is home to a CSconnected landing space. More page 23.

In addition to two landing spaces co-located with brand new facilities at Cardiff University and Swansea University, work has started on the dedicated CSconnected cluster headquarters co-located at the CSA Catapult in Newport. More page 31.





Early 2023, Rockley Photonics successfully relocated its UK operations to Sbarc|Spark and TRH at Cardiff University, with the support of the CSconnected SIPF project.

CSCONNECTED SIPF 2023 TECHNICAL HIGHLIGHTS



Microchip Technology demonstrates high-performance SiC Power modules. Microchip have designed, developed and tested a new prototype 3.3 kV mSiC[™] modules where initial static and dynamic test results have met or exceeded target specification. More page 27.

MicroLink Devices UK Ltd. demonstrates 'Made in Wales' multijunction flexible Solar Cells fabricated using the Swansea University facilities. The cells were the first to be fabricated in the UK under the CSconnected SIPF project. More page 28.





CSC leads regional efforts to deliver a UK National supply chain for compound semiconductor lasers, light sources and detectors to enable a wide range of Quantum Applications.

IQE has developed 6" InP-based emitter epiwafers on state-of-the art tooling, including a process-ready 6" distributed feedback (DFB) InP laser platform, used for device fabrication development with cluster partners. More page 25.





Rockley has begun sampling for their first wearable product – Bioptix. Bioptix enables Rockley to demonstrate its full stack, non-invasive bio-sensing platform to potential customers and development partners, a crucial first step towards commercialisation of the technology. More page 26.

CSCONNECTED SIPF 2023 PROJECTS HIGHLIGHTS

CSconnected has a strong track record of contributing to the UK's semiconductor industry, which is reflected in the many projects and activities we are supporting:

START-SEMI

The START-SEMI project, led by Swansea University, will engage, inspire and train a new generation of students, upskilled and re-skilled employees. The project focus is to develop a unique range of blended CPD and Training Materials for post-16 participant. START-SEMI is funded by Innovate UK. More page 29.

CSconnected is forging closer links with Smart Nano Northern Ireland (NI), a UKRI SIPF funded project, in the area of advanced semiconductors and nanomaterials to share best practices in complementary areas of research, skills development and manufacturing scale up.

SMART NANO NI

PLACE BASED IMPACT ACCELERATOR

Cardiff University, in partnership with Swansea University, is set to play a role in driving economic growth and innovation in South Wales as it secures a share of £41 million in the Place Based Impact Accelerator project. More page 30.

Realising Enabling Architectures and Solutions for Open Networks (REASON) is a project funded under the UK Telecommunications diversification programme that brings together an ecosystem representing the entire communications R&D supply chain. CSC is leading a regional consortium to supply highly customised semiconductor components to the project.

REASON

DER-IC

CSconnected is a network in the Driving the Electric Revolution Industrialisation Centres (DER-IC), funded by UK Research and Innovation in 2020 as part of the Driving the Electric Revolution (DER) Challenge. DER-IC provides access to PEMD manufacturing equipment across the UK.

MAJOR PUBLIC INVESTMENTS ANNOUNCED IN 2023





New £1 billion strategy for UK's semiconductor sector

The UK National Semiconductor Strategy sets out how up to £1 billion of government investment will boost the UK's strengths and skills in design, R&D and compound semiconductors, while helping to grow domestic chip firms across the UK. Working in tandem with industry, investment made by the government will drive research, innovation and commercialisation through the sector – helping to deliver products from lab to market.

Specialising in compound and advanced semiconductors, one of the key strategic opportunities outlined in the UK Semiconductor Strategy, CSconnected aims to develop a global advantage in a sovereign, key enabling technology which will allow Wales and the UK to increase trade globally in critical sectors.

CSconnected is named in the Strategy which recognises the South Wales cluster as a UK strength.

Investment Zone heading for Cardiff Capital Region

£160M funding from UK Government and Welsh Government announced in the Autumn Statement to support intensive economic growth in Southeast Wales. Key considerations by both Governments in terms of awarding Investment Zones included the clear evidence of economic potential, innovation potential, strong knowledge anchor institutions and recognised sector and cluster specific strengths with the Region. In CCR's case this included the potential for growth in the world leading compound semiconductor cluster.

CSconnected looks forward to working closely with the Welsh Government and Cardiff Capital Region to design the Investment Zone interventions that will accelerate growth in prosperity, talent and economic value from our thriving semiconductor sector across the region and beyond.

POLICY ENGAGEMENT IMPACT

CSconnected is recognised as a key voice for the semiconductor industry in the UK. We support and collaborate with key policymakers in advising and shaping policy. Underlying the pivotal role we play, CSconnected is regularly mentioned and highlighted by government officials in whitepapers, interviews and official speeches.



Welsh Select Affairs Committee

We welcomed representatives from the Welsh Select Affairs Committee at the Compound Semiconductor Applications (CSA) Catapult, IQE and KLA in Newport to discuss the potential for growth and opportunities in the region with the committee and our partners.



UKRI Board visit

Members of the UKRI Board visited the CSconnected compound semiconductor cluster in Newport, Cardiff and Swansea to hear more about the collaborative vision across the cluster that has enabled unparalleled progress and commercial partnerships. This visit follows on from Sir Andrew McKenzie, Chair of UKRI, visit to the Cluster in 2022.



miconductor Strategy launch visit to South Wales clu lav 2023 - 28K Views

Launch of the UK Semiconductor Strategy

Highlighting the strategic importance of the launch of the UK Semiconductor Strategy, we hosted a visit by the Rt Hon Chloe Smith MP along with the Rt Hon David TC Davies MP, Secretary of State for Wales, who experienced first-hand the technical facilities, capabilities and close collaboration in the cluster.







Credit: Orchard Media

IfM Engage visit

The IfM Engage consortium has been commissioned by DSIT to undertake a study into infrastructure to grow the UK semiconductor industry. As part of their key semiconductor clusters tour around the UK, we welcomed the team in South Wales to present and discuss the current outputs of the study showcasing significant fields of interest.

Chief Scientific Advisers

CSconnected hosted a roundtable cluster session with the Chief Scientific Advisers of the UK and Welsh Governments: Professor Jas Pal Badyal FRS, Chief Scientific Adviser for Wales, and Professor Dame Angela McLean, the UK Government Chief Scientific Adviser. During the session we showcased the history of cluster development and outlining ambitions for the future.

SEMICON Europa conference

CSconnected took part in SEMICON Europa to represent the Welsh semiconductor cluster. We were joined by the Welsh Government's Economy Minister Vaughan Gethin and the Secretary of State for Wales in the UK Government, David T C Davies, who met with the European and Global presidents of SEMI and cluster partner KLA.

Minister Saqib Bhatti MP

CSconnected was honoured to host the newly appointed Minister Saqib Bhatti MP for his inaugural engagement as Parliamentary Undersecretary of State for the Department for Science, Innovation, and Technology (DSIT). The visit featured tours of state-ofthe-art facilities within the compound semiconductor cluster, showcasing significant recent industrial and manufacturing expansion in Newport.

INTERNATIONAL IMPACT

CSconnected is developing strong relationships with key organisations around the world to promote and grow the cluster.

Wales joins the European Semiconductor Regional Alliance

CSconnected welcomes the news that the Welsh Government has joined the European Semiconductor Regional Alliance (ESRA). Participating in the Alliance will enable Wales' semiconductor sector to strengthen value chains with Europe by working closely together through joint research & innovation, skills & talent development as well as cluster development & cooperation.



CSconnected and the Welsh Government are also associated members of the Silicon European Alliance, the European cluster alliance for innovative electronics & software technologies.



Paul Meredith, Professor of Materials Physics and Sêr Cymru National Research Chair at Swansea University (left) and Wyn Meredith, Director of CSC and Chair of CSconnected Board (right) with former US President Bill Clinton

Strengthening US-Wales collaboration in semiconductors with the Clintons

CSconnected partners at Swansea University recently had the pleasure of hosting former US Secretary of State Hillary Rodham Clinton and former US President Bill Clinton. An exciting day demonstrating the capabilities of the compound semiconductor cluster in South Wales and showcasing the new Centre for Integrative Semiconductor Materials (CISM) to an international audience.

CSconnected becomes member of PLG

PHOTONICS

The Photonics Leadership Group collects and disseminates input from the full spectrum of UK photonics industry to provide expert informed guidance to government, support agencies, users and developers of photonics to highlight opportunities for maximising the growth and adoption of this key enabling technology.

FDI visits to the Cluster

In 2023, we welcomed a number of organisations seeking to establish or expand in the region with tours of the CSconnected cluster. With the support of the Welsh and UK Government we facilitated meetings and introduction to our partners and showcased our unique value network driven by collaboration, interdependency and common goals.

German State of Saxony Visit

We were delighted to welcome representatives from the German State of Saxony to the cluster. The visit was hosted by the Compound Semiconductor Applications (CSA) Catapult, and attendees were given a tour of their technology laboratories. Thanks to members of the Saxon State Chancellery, British Embassy Berlin, German Embassy London, Chamber of Industry and Commerce Dresden and Welsh Government for visiting us.

The CSconnected semiconductor eco-system: a regional cluster making a global impact event with the Welsh Government

The Welsh Government Brussels office organised an interactive session with Chris Meadows, Director, to showcase CSconnected and the role of compound semiconductors in supporting Europe's ambitions for high-tech industries.





SEMICON Taiwan

Chris Meadows, Director of CSconnected, joined delegates to SEMICON Taiwan and a range of associated company visits and events arranged by the UK's Department for Business and Trade (DBT) along with representatives from the Welsh Government. The delegation was led by DBT Chief Scientific Advisor (CSA) Professor Julia Sutcliffe who saw first-hand the opportunities between UK and Taiwan semiconductor companies and the importance of the UK's Compound Semiconductor sector.

Welsh Tech Showcase

COMPOUND SEMICONDUCTORS PANEL



CSconnected were at the Welsh Tech Showcase today to represent the compound semiconductor cluster and discuss how Wales became home to the world's first compound semiconductor cluster with CSconnected Director, Chris Meadows, alongside Wyn Meredith, Director of the Compound Semiconductor Centre Limited , Martin McHugh, CEO of the Compound Semiconductor Applications (CSA) Catapult and Tamsin Heath, Deputy Director for Economic Security for Department for Science, Innovation and Technology.

SEMI UK

CSconnected and cluster partners have been appointed to the newly formed SEMI UK Advisory Board that has been established to help promote the UK's semiconductor sector. The Advisory Board is made up of senior decision makers from across UK and international companies.



ColnnovateCS

We hosted our flagship conference, ColnnovateCS in Orlando, Fl, colocated with CS Mantech. It was great to witness leading experts in the compound semiconductor industry collaborating to overcome industry challenges around Sensing, Electrification and Beyond 5G Communications.



In 2023, CSconnected actively participated in 80+ events, including:

JANUARY

SPIE Photonics West, San Francisco CA

FEBRUARY Wales Week, London UK

MARCH

Catapult Network: Shaping Future Skills, Newport UK German Ambassador's Visit to Wales UK Electric Revolution Skills Conference, Birmingham UK

APRIL

CS International, Brussels Careers Conference, Cardiff UK Unleash Conference, Newport UK

ΜΑΥ

Cardiff Commitment Teacher Growth Sector Event, UK CS Mantech, Orlando, FL ColnnovateCS, Orlando, FL Launch of UK Semiconductor Strategy Germany Delegation Visit UK - Trade Horizons, Bristol UK

JUNE

Saxony State Visit to Wales UK DSIT Levelling Up Visit, Wales UK LASER World of PHOTONICS, Munich Germany

JULY

Policy Forum for Wales keynote seminar: Next steps for skills development in Wales House of Commons Welsh Affairs Committee Visit

AUGUST CDT Student and ECR Consultation UK-SIFS, Wales

SEPTEMBER

Cenex-Events, Bedford UK SEMICON Taiwan, Taiwan iMAPS UK EMPC, Cambridge UK Semi Impact Summit, London UK The Importance of Insider Risk Mitigation Event, Newport UK

OCTOBER

ECOC, Glasgow UK Wales Tech Week, Newport UK

NOVEMBER

UK National Quantum Technologies Showcase, London UK Engage with... LIVE! 2023, Birmingham UK SEMICON Europa, Munich Germany

SKILLS & OUTREACH IMPACT

Governed through the Compound Semiconductor Education Group (CSEG), the CSconnected SIPF Skills and Outreach endeavours reflect a collective effort with partners spanning semiconductor companies, education institutions, the Compound Semiconductor Applications Catapult, Cardiff Capital Region Skills Partnership, Careers & Working Wales, and the Welsh Government.

Education knowledge exchange program

In 2023, we collaborated with the CSA Catapult and Swansea University on a knowledge exchange program. This initiative aimed to enhance the subject knowledge of delivery staff across education partners, contributing to elevating the educational landscape in Wales.



Talent for Tech Event

In October we took part in the 'Talent for Tech' at Wales Tech Week. We were supported by partners from Swansea University, University of South Wales, Merthyr College, and KLA; our members hosted a compound semiconductor panel session on the "Get Into..." stage where they highlighted the potential career pathways available in the sector.

Vocational Qualifications in Wales

Our engagement with the Review of Vocational Qualifications in Wales, featuring a visit from lead expert Sharron Lusher, demonstrates our proactive involvement in shaping the educational framework. This has positioned CSconnected as a key stakeholder in the ongoing evolution of vocational qualifications.



Cross-collaboration initiatives

CSconnected has collaborated with prominent institutions and initiatives. This includes welcoming visitors from the Bragg Centre at Leeds University, meetings with the Electric Revolution Skills Hub run by Coventry University, facilitating Magnet in Motion kits to schools across Wales, discussions with Oriel Science regarding potential installations, engaging with Cardiff Commitment's curriculum development team, and hosting NPSA workshop.



Educational workshop

The CSEG group has delivered a comprehensive educational workshop to Careers & Working Wales staff to inform skills, education, and careers routes in the sector. Further workshops have also been designed, which are aimed at teachers.

Community Involvement

Beyond our immediate stakeholders, members of the CSEG actively engage with the wider community. This year we have explored and established links with wider outreach provisions, sharing best practices and opportunities with entities such as Tech Valleys, Cardiff Commitment, Educational Achievement Service (EAS)/CEJES, and Engineering Education Scheme Wales.



Development & dissemination of resources online

A milestone in our outreach efforts has been the development and dissemination of resources through the CSconnected website. These resources serve as a knowledge hub accessible to a wide range of stakeholders and partners, also shared for the benefit of the wider community.

Business Support

We support the development of business support workshops that benefit the broader cluster and supply chain, such as IP and information security. This year CSconnected and the Compound Semiconductor Applications Catapult, in partnership with the National Protective Security Authority (NPSA) hosted a workshop focused on the importance of protective security and insider risk mitigation.

Looking ahead

We will continue to forge impactful collaborations and initiatives, further solidifying our commitment to advancing the compound semiconductor sector, such as with our involvement in the development of curriculum with the WJEC and the Welsh Government. CSconnected's CSEG group has successfully fostered a culture of open communication and collaboration within the group. We actively contribute to the collective knowledge of the sector, paving the way for solutions and continuous improvement.

CPD IMPACT

CSconnected SIPF CPD objective is to coordinate the strategic planning and development of Continuing Professional Development (CPD) activities designed to up-skill, re-skill and/or new-skill those already in the workplace. CPD is needed to help support growth of the sector and to match skills demand with supply. Cardiff University is leading on the CPD activities for the CSconnected SIPF project.

2023 Highlights

Collaboration between Cardiff University academics and external specialists in creative production has led to the development of high-quality e-learning materials for two key courses (Introduction to Compound Semiconductor Electronics and Introduction to Compound Semiconductor Photonics) that will position the cluster as a provider of CPD activities for the compound semiconductor sector. This year there has been stronger and deeper relationships across the CSconnected cluster partners for CPD activities under the UKRI Strength in Places Fund project.

CPD Pilot events



Cluster partners came together in-person to participate in three CPD pilot events that informed the content of courses that will now support the growth of the compound semiconductor sector across South Wales.

The three pilot courses were:

INTRODUCTION TO COMPOUND SEMICONDUCTOR ELECTRONICS INTRODUCTION TO COMPOUND SEMICONDUCTOR PHOTONICS

INTRODUCTION TO THE THEORY OF ETCHING

Cleanroom Protocols

The first of the CPD short courses – Cleanroom Protocols – was launched in 2023. This online activity provides an overview of what it is like to work in a cleanroom environment and covers typical working practices as well as general principles for safe working. It's ideal for those new to working in a cleanroom for nanoscale production.

Scoping activity

Cardiff University and Swansea University consulted with the cluster partners to better understand and define their requirements for new CPD content centred around the semiconductor supply chain.

Key areas of focus for 2024

- Launch 'Introduction to Compound Semiconductor Electronics'
- Launch 'Introduction to Compound Semiconductor Photonics'
- Run a second pilot and launch 'Introduction to the Theory of Etching'
- Pilot and launch 'Introduction to Wire Bonding'
- Oversee the development and piloting new CPD course centred around the semiconductor supply chain.
- Continue to scope new and relevant CPD skills requirements of the CSconnected cluster partners and their supply chains

Content Calendar Announcements Discussions of	Gradebook Messages Groups
Course Staff	Course Content
Chenguang Wang	How to use this course
Details & Actions	Cleanroom Protocols
	Start Not started
	Welcome and Introductions
	Cleanroom Classifications Content Isn't available
	Test your knowledge - Cleanroom Classifications Content isn't available
CSconnected 2023 Annual Review	Cleanroom Layout and Working Environment

Screenshot of Cardiff University CPD Cleanrooms course material

INFRASTRUCTURE IMPACT KLA

In late 2022, KLA broke ground on their new R&D and manufacturing facility in Newport, Wales, UK. With an investment of over 100 US\$ million, construction on the new development is on target to complete early in 2025. This will deliver a state-of-the-art innovation center and manufacturing facility which will include offices, cleanrooms, storage and support facilities for up to 750 employees. "Expanding in South Wales allows us to tap into the region's attractive talent pool and benefits from an appealing quality of life with access to many international sporting events, historic parks and outdoor activities. This area is also home to some of UK's leading universities and research institutes with strong semiconductor competencies and industry ties for collaborative research."

Oreste Donzella, executive vice president of the Electronics, Packaging and Components (EPC) Group, at KLA

Scheduled for completion in early 2025

Picture showing the outside of KLA's new R&D and manufacturing center. Courtesy of KLA



INFRASTRUCTURE IMPACT CARDIFF UNIVERSITY

Formally opened by Nobel Peace Prizewinning climate scientist, Professor Donald J. Wuebbles, in May 2023 the Translational Research Hub (TRH) at Cardiff University, brings together specialists from the Institute for Compound Semiconductors (ICS) and Cardiff Catalysis Institute (CCI) to solve complex global challenges.

ICS is a bespoke facility for researching, testing and commercially developing compound semiconductor technologies.

TRH specialised in device fabrication for photonics and RF applications

Inside the TRH

The ICS has built a state-of-the-art 8inch fabrication line adjacent to the TRH. It will combine cutting-edge research, technology transfer, business development and student enterprise. In addition to the 1500 square metre cleanroom, dedicated characterisation and back end processing areas will carry out the end-to-end processing of CS wafers up to 8-inches in diameter under one roof.

The TRH is home to a CSconnected dedicated landing space supporting activities for collective benefit in the cluster.



Left to Right: Professor Donald J. Wuebbles, co-recipient, 2007 Nobel Peace Prize; Professor Colin Riordan, President and Vice-Chancellor, Cardiff University and Pro Vice-Chancellor Professor Rudolf Allemann, Head of the College of Physical Sciences and Engineering. Courtesy of Cardiff University.

INFRASTRUCTURE IMPACT SWANSEA UNIVERSITY

The Centre for Integrative Semiconductor Materials (CISM) is a new initiative, including a £29.9 M research and innovation facility, to bring together semiconductor and advanced materials platforms to research and develop new technologies and products at Swansea University's Bay Campus.

The facility offers R&D, prototyping and process development capabilities and also offers opportunities for incubation and industry partners to have development space and support and provide access to training and development.

CISM capabilities

- Manufacturing grade, ISO-qualified clean rooms for process development.
- Backend materials integration and packaging capability.
- Advanced next generation and "nextnest generation" (NNG) research laboratories.
- II/VI, chalcogenide and wide gap oxide MOCVD epitaxial growth facility
- Customer Bays for SME incubation.
- Access to advanced characterisation and analysis & access to state-ofthe-art materials and device-level theory and simulation.

CISM is located at the heart of Swansea University Bay Campus within the existing engineering quarter. This location allows for collaboration and shared facilities with the existing surrounding engineering buildings.



TECHNICAL IMPACT IQE

IQE launches first 6" InP DFB laser platform for AI and data-center applications

IQE has developed a process-ready 6" distributed feedback (DFB) InP laser platform which will be used for device fabrication development with cluster partners CSC, Swansea University and Cardiff University on CSconnected SIPF Collaborative RD+I programme: next generation optical comms and sensing.

Outcomes and impact

This is the industry's first 150mm (6") indium phosphide (InP) platform enabling the scaled production of electro-optic devices at the core of artificial intelligence (AI), machine learning and cloud data-center networks.

Screenshot of the announcement published on Semiconductor Today



TECHNICAL IMPACT ROCKLEY PHOTONICS

Alpha prototype BioptixTM biosensing band

Rockley has begun sampling for their first wearable product – Bioptix.

The BioptxTM Biosensing Band incorporates Rockley's breakthrough short-wave infrared (SWIR) biosensing technology based on their proprietary photonic integrated circuit (PIC) chipset. By incorporating the SWIR spectrophotometer into a wearable capable of several days of measurement, Rockley has demonstrated continuous collection of spectral data which provides unique insights into tissue composition and dynamics. Funding from the CSconnected SIPF project has leveraged the development of key manufacturing processes at Rockley's facilities in Wales and supported critical facilities relocation to TRH, Cardiff University.

Outcomes and impact

The platform delivers real-time streaming of the SWIR-based biomarkers of body temperature and hydration, alongside the LED-based photoplethysmography () biomarkers of heart rate, heart rate variability, respiratory rate, and blood oxygen saturation. By creating a spectroscopybased technique to indicate hydration status, Rockley Photonics is developing an innovative new capability to improve people's health and wellbeing

Screenshot of the Rockley website

Rockley® Bioptx™ Biosensing Band

TECHNICAL IMPACT MICROCHIP

Microchip Technology Demonstrates High-performance SiC Power Modules

Microchip have designed, developed and tested the new prototype 3.3 kV mSiC[™] modules where initial static and dynamic test results have met or exceeded target specification.

Outcomes and impact

This family of SiC power modules will help contribute to net-zero targets by delivering improved efficiency in high power motor drives in applications such as transportation and public transport, and also in areas such as electric grid power conversion.

These power modules will be marketed across the world by leveraging Microchip's global presence in these emerging markets.

TECHNICAL IMPACT MICROLINK DEVICES

MicroLink Devices demonstrates 'Made in Wales' Multi-junction Flexible Solar Cells

Six cells were fabricated in the UK using the Swansea University facilities and engineers from MLD. The cells (from a single wafer) were multijunction cells and were the first cells to be fabricated in the UK under the SIPF project. The cells are the MLD fully flexible, lightweight, high efficiency cells that are used on projects such as Zephyr.

Outcomes and impact

MLD's European base 'MicroLink Devices UK' was formed in 2019 in South Wales in response to growing demand for European solar cells. This demonstration through SIPF is the first step towards offering a vital power source into the rapidly growing HAPS/HALE and Space markets, as well as drones and other aircraft.



Microlink Devices flexible solar cells diced onto a wafer

WIDER IMPACT IMERSIFI

CSconnected partners with Imersifi and Swansea University to spark curiosity and passion for semiconductors

We were pleased to partner with Imersifi, a leading Virtual Reality (VR) company, at the Wales Tech Week event where it presented an educational outreach app developed as part of the START SEMI project.

This project, led by Swansea University in collaboration with Imersifi, CSconnected, University of Leeds, and University of Warwick, is funded by Innovate UK and aims to revolutionise the field of semiconductor education. The START SEMI project is a pioneering initiative designed to empower students with the knowledge and skills needed to thrive in the semiconductor industry, inspiring the next generation of talent in the sector.

Imersifi plays a pivotal role within this consortium by spearheading the development of cutting-edge virtual reality applications for outreach and training. Visitors at Wales Tech Week had the opportunity to experience the Sand 2 Semiconductor VR demo, that immersed the user in different environments as the processes of Epitaxy, Photo-lithography, Etching, Deposition and Dicing are explained.



Imersifi Innovative Semiconductor VR App at Wales Tech Week. Courtesy of Wales Tech Week / Mike Hall

WIDER IMPACT PBIA

Cardiff University, in partnership with Swansea University, is set to play a role in driving economic growth, innovation, and addressing regional needs in a project funded by the Engineering and Physical Sciences Research Council (EPSRC), part of UK Research and Innovation (UKRI).

The South Wales Compound Semiconductor Place Based Impact Accelerator Account (PBIAA) led by Cardiff University's Institute for Compound Semiconductors and in partnership with Swansea University's Centre for Integrative Semiconductor Materials, is at the forefront of these transformational endeavours.

This joint-initiative aims to bridge critical skills gaps by providing specialised training to the workforce, attracting academics and researchers from across the UK with expertise in compound semiconductors to establish themselves in South Wales, and promote an environment that fosters innovation and engagement "Cardiff and Swansea Universities illustrates the importance of a collective effort to advance CSconnected and position the cluster at the forefront of driving economic growth and innovation in the South Wales. This project will enable us to bridge skills gaps, attract talent, with the vision to create an innovation-rich ecosystem."

Chris Meadows, Director of CSconnected



Proposed drawing of the CSconnected Front of House. Courtesy: Powell Dobson Architects

FRONT OF HOUSE

In addition to two landing spaces co-located with brand new facilities at Cardiff University and Swansea University, which includes a CSconnected Boardroom with a video wall and display, the CSconnected cluster will have dedicated headquarters colocated at the CSA Catapult in Newport. Plans are now underway for the new CSconnected Front of House HQ that will host a conference suite for events, CSconnected cluster branding and a CSconnected office to promote the project and compound semiconductor activities in South Wales.



CSconnected landing space at Swansea University



CSconnected landing space at Cardiff University

FORWARD LOOK

2023 has been a pivotal year during which CSconnected has undertaken a high level of activity and has in turn been centre stage across a number of key areas including government policies from the £1bn UK National Semiconductor Strategy to the announcement of a £160m South-East Wales investment zone focusing on semiconductors.

The stage is now set for the CSconnected cluster to undergo stratospheric growth over the next decade as it plays its part in delivering innovative products and services that will enable a wide range of new and emerging technologies across multiple global markets.

The South Wales cluster has focussed on the core partners that form the key capabilities within the South Wales semiconductor eco-system but as we look forward, we aim to extend the reach of the cluster beyond the well established sector by encouraging and facilitating the growth of supply chains that support the cluster and to develop long-term, sustainable relationships with new partners including the building of start-up, scale-up and inward investment opportunities.

A spotlight has been shone on the strategic importance of semiconductor supply chains in our changing world. The pandemic and geo-political shifts over the last few years have awakened world leaders to the need for sovereign capabilities across a number of key technology sectors, all of which depend on robust and resilient semiconductor supply chains.

Working with the Welsh and UK Governments, the CSconnected cluster has been recognised as a unique vehicle through which the region can continue to grow and prosper.

CSconnected started 2024 with a new £3.1M grant agreement supported by the Cardiff Capital Region (CCR) to enable and facilitate the growth and expansion of technical capabilities in supply chain activities around the compound semiconductor eco-system in South Wales. Expectations of CSconnected's involvement in delivering aspects of the UK national semiconductor strategy and in the South Wales investment zone, will help ensure the maintenance and growth of the South Wales region as a global power house for compound semiconductors.