



ANNUAL REVIEW

CSconnected 2022 Year in review

20
22



CSconnected is supported by UKRI



UK Research
and Innovation

WELCOME

By Chris Meadows, Director of CSconnected

In a year that continued to shine the light on the importance of semiconductor technologies in our everyday lives, the CSconnected cluster became a key voice in promoting the UK's global dominance in the design, development and manufacture of compound semiconductor enabled applications.

From making net-zero a reality through highly efficient energy devices to wireless and photonic connectivity, compound semiconductors play an essential role. The same applies to sensing and quantum technologies that are to be found in a range of new and emerging healthcare, AI, robotic and other autonomous applications. The UK, and in particular, the South Wales CSconnected cluster commands unrivalled global capabilities that enable today's advanced technologies and those of the future.

The CSconnected brand has continued to expand its reach both nationally and internationally and has been frequently cited in case studies and reports. The cluster has also been prominently quoted and referenced in Welsh and UK government articles and in consultations around the development of a UK National Strategy for Semiconductors.

Along with CSconnected, cluster partners hosted a range of high-profile visits with senior dignitaries from both public and private sectors and have successfully delivered on a number of capital investment programmes as well as major technological breakthroughs.

Whilst CSconnected continues to make its mark on the national stage as well as globally, the next few years will be critical if Wales and the UK are to remain globally relevant in the field of advanced semiconductor technologies. Support for growth and expansion of the cluster will need the continued support of regional and national governments to ensure that there is a national infrastructure that promotes and encourages new businesses, foreign investment and skills development. All of which can only be enhanced through an appropriate UK national strategy.

2022 IMPACT

NEW ENTITY IN THE REGION



Siemens established a Power Electronics Innovation Hub at CSA Catapult in Newport, Wales

STRENGTHENING SUPPLY CHAIN



40% growth in UK supply chain at KLA in 2022

IN NUMBERS

\$1B

The Cluster represents private & public investment of around \$1B

2,400

Cluster organisations train and support more than 2,400 highly skilled semiconductor specialists

\$600M

Cluster organisations contribute more than \$250M to the Welsh economy with annual sales of \$600M

Source: Annual Report: Compound Semiconductor Cluster in South Wales (published by the Welsh Economy Research Unit)

LEVERAGING CUTTING-EDGE FACILITIES



Expansion: New KLA facility underway to include 25,000 sq ft of R&D cleanrooms in Newport, Wales



New CS fab facility at ICS, Cardiff University including 1,500 m2 cleanroom with dedicated end-to-end processing of CS wafers up to 8-inches in diameter



Construction of new centre for integrative semiconductor manufacturing (CISM) at Swansea University, comprising more than 4,000m2 clean room, research and office facilities

R&D ACTIVITIES

200mm (8") VCSEL epiwafer

IQE has developed the world's first 200mm (8") VCSEL epiwafer, supported by CSconnected SIPP

3-J solar cell fabrication process

MicroLink successfully demonstrated 3-J solar cell fabrication process in Wales, supported by CSconnected SIPP

JANUARY

CSconnected at Photonics West 2022



We kicked off the year with Photonics West, the world's largest annual event for the photonics, laser, and biomedical optics industries, on 25-27 January in San Francisco, CA. CSconnected exhibited at the conference to showcase the photonics and quantum opportunities available from the cluster. Highlights from the week included a meeting with the Welsh Government Deputy Head of North America, Eoghan O'Regan to discuss the continuing growth of the Compound Semiconductor Cluster and related activities in the USA...

...and a reception event with Joe White MBE, Consul General in San Francisco, and Glen Delaney, Vice Consul Department for International Trade (DIT), where CSconnected was introduced to two USA Photonics Clusters: Arizona Technology Council Optics Valley and Florida Photonics Cluster.



Eoghan O'Regan • 1st
Deputy Head of North America

11mo ***

Great to meet with you and to discuss areas of collaboration. Really excited with what you've got planned!

Skills development at the heart of the cluster's growth

A new report which identifies the short to mid-term CPD needs and demand from the compound semiconductor industry in South Wales was made available. This CPD Scoping Report forms an important first-stage deliverable in the CSconnected SIFP skills work package that seeks to resource and accelerate the development of skills initiatives that will create the skilled workforce of the future for the region.

The CPD priority topics for 2022, highlighted in the report are:

- Introduction to Compound Semiconductors (with content also covering semiconductors and photonics)
- Cleanroom Protocols
- Practical Cleanroom Skills (semiconductor manufacturing technologies in etching, wafer cleaving and wire bonding)

FEBRUARY

Semiconductors continue to add more value to Welsh economy

The new report published by the Welsh Economy Research Unit at Cardiff University highlighted the robust growth of the compound semiconductor community:



- The compound semiconductor sector as a whole out-performed the wider economy in key areas including job growth and exports.
- Employment in the CSconnected community grew by around 14% year on year to around 1,600 full-time employees.
- The sector directly contributed around £194M of Gross Value Added to the Welsh economy.



Welsh Economy
Research Unit
Yr Undeb Ymchwil
i Economi Cymru



The report was written by Professor Max Munday, Dr Annette Roberts and Professor Robert Huggins, Cardiff University.

The report can be downloaded and viewed at [CSconnected.com](https://csconnected.com).

Welcome to the team



In February, we welcomed the new Programme Manager to lead the administration of the CSconnected Strength in Places Fund (SIPF). In this role, Hazel is supporting the SIPF consortium and the South Wales semiconductor community at a dynamic stage of its evolution and growth.

When the chips are down

A new report on the future of Europe's semiconductor industry and published by Welsh Economy Research Unit at Cardiff University highlighted the importance of innovation, clusters and deep tech. The full report is available at: [The Future Of Europe's Semiconductor Industry Report](#)

MARCH

Dydd Gŵyl Dewi Hapus

As we marked the celebration of St David's Day, CSconnected represented Wales' thriving compound semiconductor ecosystem at Expo 2020 Dubai. Hosted by Aled Miles, Welsh Government Envoy to the United States, CSconnected Director, Chris Meadows, was joined by Professor Mike Jennings, Swansea University, Paul Jarvie, DER Industrialisation Centres - Compound Semiconductor Applications Catapult & Robert Harper, Compound Semiconductor Centre to deliver a session on **"Powering: Compound Semiconductors"**, showcasing the role of the CSconnected cluster in placing Wales at the centre of new and emerging technologies to a global audience.



APRIL

World of Quantum

CSconnected and partners attended the World of Quantum, part of Laser World of Photonics 2022. Compound semiconductors are essential in enabling quantum technologies and the CSconnected cluster is excited to play a key role in a number of quantum related projects such as QFoundry.

QFoundry is a UKRI/Innovate UK funded programme that aims to deliver a national open-access quantum photonic component foundry. Such a capability will build on the UK's enviable reputation for innovation by creating the foundations for robust, scalable component manufacture in the UK to enable the scaling of a quantum technology system industry.



MAY

IQE announces the world's first commercially available 200 mm (8") VCSEL wafer

IQE announced the world's first commercially available 200 mm (8") VCSEL epiwafer.

IQE is leading the compound semiconductor industry in the development of 200mm epiwafers for wireless, sensing and display markets. IQE's 200mm epiwafers will enable a step-change in unit economics for compound semiconductors, leading to the expansion of the market for IQE. The increase in wafer size will expand to new foundry partnerships, including Silicon-based foundries. Furthermore, it enables the integration of compound semiconductors on silicon, allowing adoption across a wider range of devices and applications.

IQE's 200mm VCSEL development is an example of the Company's continued innovation with the aim of expanding the market for wireless and 3D Sensing. 3D Sensing was made economical within premium smartphones in 2017 when IQE developed and scaled VCSEL epiwafers from 100mm to 150mm. The introduction of 200mm creates opportunities beyond the smartphone, into a broad range of intelligent connected devices and also enabling applications in the Metaverse.

The development of the world's first 200mm (8") VCSEL epiwafer by IQE was supported by the CSconnected SIPF project.



JUNE

CSconnected sponsored and exhibited at CS International 2022, the “must attend” event within the global compound semiconductor, photonic integrated circuit and sensors sector.

CSconnected Director, Chris Meadows chaired the conference, with leaders from industry and academia delivered almost 40 talks covering compound semiconductor devices and related materials. Those presentations were delivered in five sessions entitled: Fast, more fugal networks; Exploiting GaN's glorious potential; Building a multi-billion dollar SiC industry; Superior surface-emitters; and Multiple markets for the microLED.



Inside the mysterious world of semiconductors

Chris Meadows was invited by Cardiff University Professional Development Unit to deliver the "Inside the mysterious world of semiconductors" session at the Virtual Summer School. This session introduced delegates to the sometimes mysterious world of semiconductors, the unique position Wales commands and the opportunities the sector offers. The Virtual Summer School was filled with free sessions from the University's Research Centres and Institutes to support professional development.

Skills and outreach

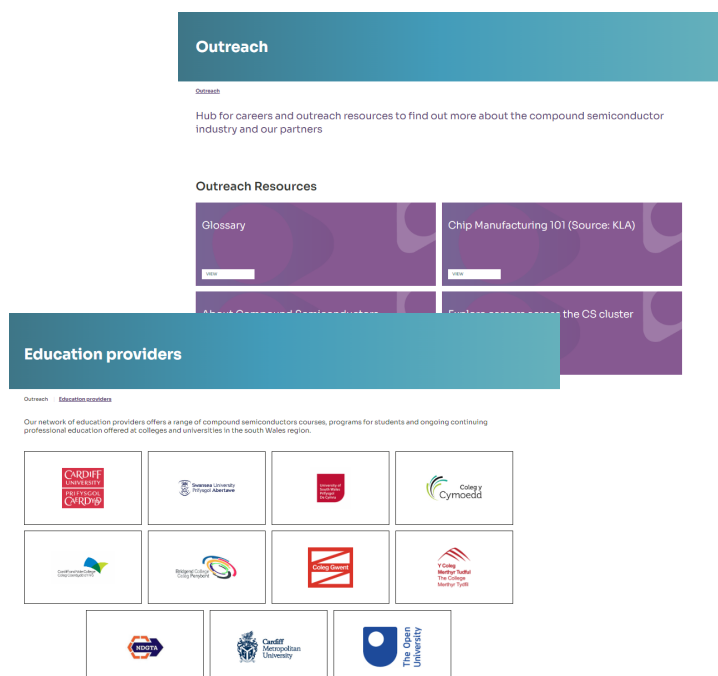
CSconnected SIPF skills and outreach objective is to coordinate the strategic planning and development of skills and outreach activities in collaboration with the CSconnected partners and wider education providers.

Key activities in 2022



In November we hosted the first workshop of an intended series of events in collaboration with the CSA Catapult and the CPD unit at the CSA Catapult. We welcomed 22 ‘Heads of Science’ teachers from five Local Authorities across South Wales to promote the CSconnected cluster. The events will focus on educating partners, providers and influencers on pathways into future engineering and semiconductors-related jobs.

We have developed with the CSconnected partners and providers a hub for careers and outreach resources to find out more about the compound semiconductor industry and our partners on the CSconnected website. The hub is an open-source resource for all. Visit: <https://csconnected.com/outreach/> to access our library of videos, interviews and resources.



In 2022, the CSconnected skills group have begun to engage with students across the cluster education providers to work collaboratively on projects for the CSconnected cluster partners.

JULY

CSconnected at Westminster

Our Director, Chris Meadows, and our Business Development Manager, Phillip Cornish, along with representatives from the National Physical Laboratory joined the All-Party Parliamentary Group (APPG) showcasing British Photonics and Quantum capabilities featuring a novel miniature atomic clock.



Covering optical fibre and lasers, to cameras and lighting, the APPG on Photonics and Quantum aims to raise awareness of the critical contribution these technologies make to manufacturing productivity, healthcare, connectivity and security and their enormous future potential.

Innovation Strategy for Wales

In July, the Welsh Government published the consultation for the new “*Innovation Strategy for Wales*”. The compound semiconductor cluster was highlighted as one of the key assets supporting Welsh industrial innovation strengths.

Link: [Innovation strategy for Wales | GOV.WALES](https://gov.wales/innovation-strategy-for-wales)

Siemens Establishes Power Electronics Innovation Hub In The UK With The Compound Semiconductor Applications Catapult

CScconnected welcomes the announcement from Siemens plc to enter a strategic innovation partnership with our cluster partner, the Compound Semiconductor Applications (CSA) Catapult, in Newport to accelerate the development of leading-edge power electronics capability.

The partnership between Siemens and CSA Catapult will deliver a series of joint projects and potential future collaborative supply chain programmes with other UK companies with a dedicated Siemens power electronics innovation hub at CSA Catapult in Newport, Wales, to facilitate engagement with the UK power electronics ecosystem such as universities, Catapults, RTOs, industrial partners, start-ups, and grant funding organisations.

Siemens employees will be based on site at the Catapult, they will host Siemens colleagues from new recruits to sponsored students and PHDs. Siemens and CSA Catapult will jointly work on initiatives with other UK partners to address the skills gaps in power electronics.



AUGUST

Launch of the new CSconnected website

Project

[Project details](#)

Project Title: CSconnected SIFP
Total Investment: £43 million
Funded Period: Nov 2020 - May 2025



Project summary: This UKRI Strength in Places Fund (SIFP) project, led by Cardiff University, is building on regional strengths in advanced semiconductor materials and manufacturing. It will help South Wales' compound semiconductor industry to create 5,000 jobs by 2025, increase its direct contribution to the local economy to £205m per year, and improve skills among local people. It will also give the UK a global advantage in technology for sectors such as 5G communications and autonomous vehicles.

Key collaborative research and development (CRD) programmes:

- Next generation optical communications and sensing
- Large Scale GaAs-based wafer manufacturing
- Novel and efficient CS Wafer Fabrication Tools
- Advanced processes for SoC and ECU systems

Activities: In addition to the four CRD programmes, activities also include the formation of a central coordination activity to represent and promote the cluster, and to develop regional educational and skills capabilities for the sector. The project will also encompass the setting up of a dedicated 'home' for the CSconnected cluster that will include meeting & conference facilities, an outreach hub and a visitor centre.

Contact: projects@csconnected.com

Related:

- [CSconnected project receives UK government funding provided through the Strength in Places Fund](#)

Evaluation and Economic Impact analysis

CSconnected Inward Investment Cardiff Business School Report

The Future of Europe's Semiconductor Industry: Innovation, Clusters and Deep Tech Report

The CSconnected reports from the [Welsh Economy Research Unit](#), a local semiconductor cluster.

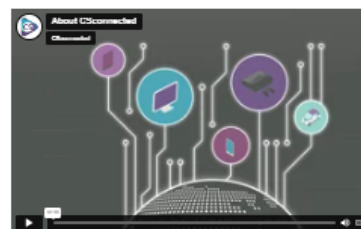
About CSconnected: Videos

[Outreach](#) / [About CSconnected Videos](#)

Visit our video library to find out more about CSconnected and the industry: [CSconnected](#)

About CSconnected

Watch the CSconnected video to find more about the industry and the role of the cluster



UKRI presents CSconnected

Find out more about how CSconnected is creating jobs and boosting the economy in so



CSconnected at BSW 2022

British Science Week, run by the British Science Association is a ten-day celebration of science, technology, engineering and maths. Watch Chris Meadows' presentation



Explore careers

[Outreach](#) / [Explore careers](#)

Careers opportunity

Explore careers across the compound semiconductor industry in Wales



KLA: Chanel

Find out about Chanel's journey from Graduate Production Engineer to Team Lead Engineering Systems at KLA, Newport.

[KLA employee spotlight: Chanel Stanley](#)



KLA: Matt

Find out more about Matt Hillys' journey at KLA, from apprentice in Newport to manufacturing manager in Alton, BA.

[KLA employee spotlight: Matt Hillys](#)



KLA: Mark

Find out more about Mark Ford, senior director of platform engineering at KLA in Newport, Wales.

[KLA employee spotlight: Mark Ford](#)



Microchip

Watch how our video featuring a day in the life of an engineer:

[CSconnected presents 'A day in the life of an engineer' at Microchip](#)



IQE

Watch how our video featuring a day in the life of an engineer:

[CSconnected presents 'A day in the life of an engineer' at IQE](#)



Customer Support Engineer

How to become a Customer Support Engineer (SPTS, a KLA company)

[Customer Support Engineer](#)



Graduate Process Engineer

How to become a Graduate Process Engineer (SPTS, a KLA company)

[Graduate Process Engineer](#)



Graduate Equipment Development Engineer

How to become a Graduate Equipment Development Engineer (SPTS, a KLA company)

[Graduate Equipment Development Engineer](#)



Test Engineer

How to become a Test Engineer (SPTS, a KLA company)

[Test Engineer](#)



Production Engineer

How to become a Production Engineer (SPTS, a KLA company)

[Production Engineer](#)



Other careers

What other careers can you pursue in the CS industry (SPTS, a KLA company)

[Other Careers](#)



Software Development Engineer



Research & Development Engineer

Continuing Professional Development

CSconnected SIPP 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 SIPP project.

Key activities in 2022:

- CPD Scoping Report endorsed by the CSconnected CTO Management Group
- Cardiff University collaborated with CSconnected partners in development activities for the first five priority courses.

Cleanroom Protocols	Introduction to Compound Semiconductor Electronics	Introduction to Compound Semiconductor Photonics	Introduction to Etching: Theory	Introduction to Wire Bonding
---------------------	--	--	---------------------------------	------------------------------

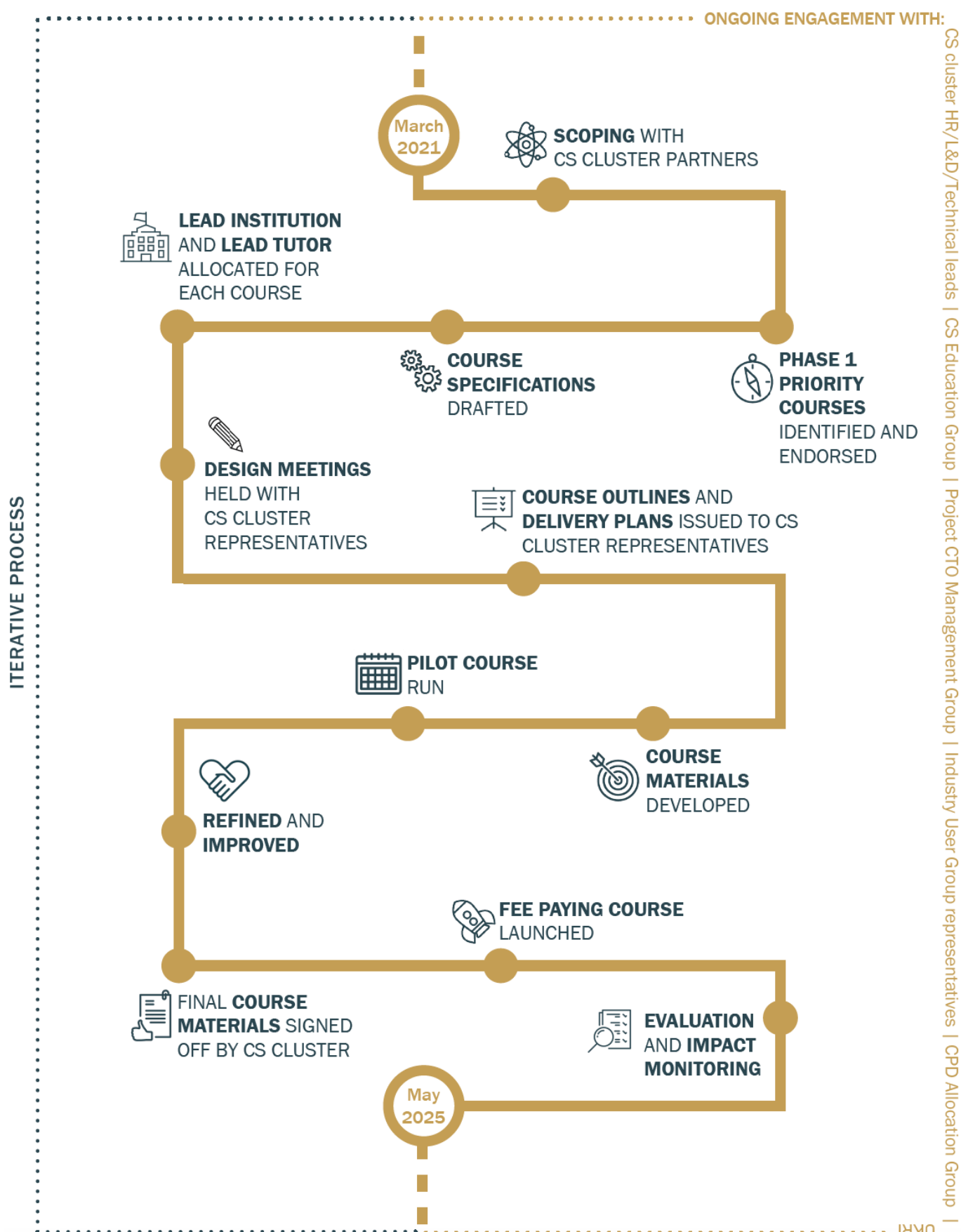
Outlines and delivery plans for the courses completed in 2022.
All courses to be made available on a chargeable basis, with regular intakes scheduled in 2023.

- Cleanroom Protocols course: a 1-hour online course designed to provide an overview of what it is like to work in a cleanroom environment:
 - Onsite filming at KLA to illustrate typical working environment and gowning procedure
 - Onsite filming at Cardiff University’s Institute for Compound Semiconductors for introductory video
 - Voice over recordings for presentations
- CPD Work Plan developed for the period Jan ’22 – Dec ‘23



DEVELOPING CPD COURSES WITH THE CSCONNECTED CLUSTER

The world's first compound semiconductor cluster



SEPTEMBER

KLA Announces Plans to Build a New R&D and Manufacturing Facility in Newport

KLA announced plans to build a new research-and-development (R&D) and manufacturing center for the SPTS division, in Newport, Wales, UK. The new development designed to meet BREEAM standard of sustainability rating of excellent is expected to include a capital investment of more than \$100 million and create a 20,000m2 facility. The new state-of-the-art innovation center and manufacturing facility will include offices, cleanrooms, storage and support facilities and accommodate up to 750 employees.



KLA groundbreaking event to mark the commencement of the new development



3D pictures showing the outside of KLA's new R&D and manufacturing center, which the company anticipates will open early in 2025

The new facility to accommodate

750 employees

Size of the new facility

200,000 sq. ft.

OCTOBER

A night of celebration



CSconnected was thrilled to sponsor a prize at the Wales Tech Awards, organised by Technology Connected! An amazing opportunity to celebrate the achievements of the people and organisations who are working in the technology industry in Wales. A special congratulations to our partners, MicroLink Devices UK and Compound Semiconductor Applications Catapult, with Wideblue, for winning the Best Photonics Application.

Inspiring the next STEM generation

CSconnected, Cardiff University and the Compound Semiconductor Applications Catapult organised a workshop for the Education Achievement Service (EAS) and Head of Science teachers from local authorities in and around South East Wales. Teachers heard about the compound semiconductor industry, CSconnected, as well as education pathways into future engineering jobs.



Making an impact

The CSconnected SIPF project has been highlighted as a case study in a London Economics report: [The economic and social impact of Cardiff University](#). The report shows Cardiff University contributed £3.68 billion to the UK economy in a single year.

Economic evaluation & regional analysis

The economic evaluation and regional analysis work package, led by Welsh Economy Research Unit, aims to monitor and examine the economic impacts of CSconnected SIFP activity, and how far these are strengthening economic conditions and opportunity in the defined South Wales area.

Annual Report: Compound Semiconductor Cluster in South Wales

Published in 2022, the second report in a series of annual reports revealed strong growth in cluster employment and gross value added supported. It is estimated that at the end of 2021 the cluster directly and indirectly supported as many as 2,400 FTE jobs and around £277m of gross value added.

CASE STUDIES PUBLISHED IN 2022

The Future of Europe's Semiconductor Industry: Innovation, Clusters and Deep Tech

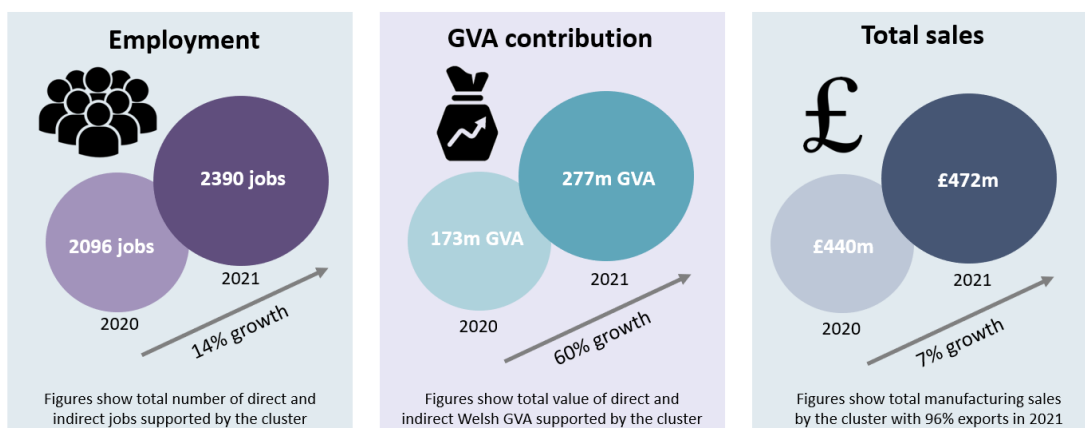
Does CS cluster inward investment improve regional economic prospects?

The Role of the Region's Compound Semiconductor Industry

All published reports and case studies are available on the CSconnected website: [Reports | CSconnected](#)

2022 also saw the development of two academic papers linked to the annual report series and case studies being undertaken in connection with the CSconnected project and members of the team have provided regular briefing on the economic contribution of the cluster to organisations including Welsh Government and the Office for National Statistics.

ECONOMIC OUTPUTS OF THE CSCONNECTED CLUSTER



Source: Annual Report: Compound Semiconductor Cluster in South Wales (published by the Welsh Economy Research Unit)

NOVEMBER

Driving Technology with Compound Semiconductors at Semicon Europa and the EV Show



CSconnected attended SEMICON Europa, the event for electronics manufacturing in Europe. Chris Meadows shared how the compound semiconductor industry is powering and driving technology for next-gen applications in the Electrification & Power Semiconductors session.

Later in the month the team exhibited at the EV Show in London to promote the cluster activities in Power Electronics that support the drive for global electrification. The EV Show brings the EV value chain under one roof.



Prototype of McLaren Applied's 800V SiC Inverter

ESCAPE was one of the projects highlighted by CSconnected at the EV Show. ESCAPE is a £20M consortium project which aims to establish a globally unique and cohesive end-to-end supply chain capability for innovative SiC power electronics. Partners involved in this project from the CSconnected cluster are Compound Semiconductor Applications (CSA) Catapult, Compound Semiconductor Centre Limited and Microchip Technology Inc.

ESCAPE is partially funded by the Collaborative Research and Development programme delivered by the Advanced Propulsion Centre UK. More at: <https://escape.sc>.

Networking for the technology industry in Wales

CSconnected was invited to a private roundtable lunch organised by Technology Connected with the Secretary of State for Wales, the Rt Hon David TC Davies MP, to discuss the impact that the tech industry has on the economy in Wales.



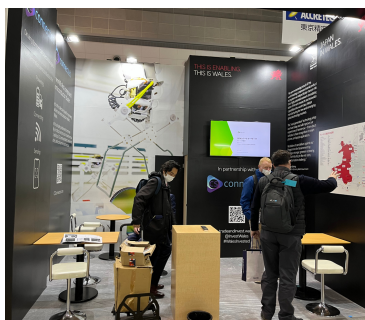
DECEMBER

BT visit to CSconnected

A team from BT, including Professor Tim Whitley, BT's MD of Research and Network Strategy visited the cluster, with stops at Cardiff and Swansea universities, the Compound Semiconductor Applications Catapult, and met a number of industry players. The universities described their focus on "manufacturable research" and how that was made possible by working with organisation like the Centre for Integrative Semiconductor Materials (CISM) and industry partners like IQE. The team donned hard hats, high viz and safety boots for a tour of the soon-to-be-completed Centre for Integrative Semiconductor Materials (CISM) fabrication facility on Swansea University's Bay campus. This was followed by a trip to IQE's impressive production facility at Newport. They finished at the Compound Semiconductor Applications Catapult, who explained their model of working across the value chain to optimise devices and systems for specific applications.

CSconnected at Semicon Japan

The Welsh Government and CSconnected welcome delegates at Semicon Japan, the premier event that brings together the semiconductor manufacturing supply chain, on 14-16 January in Tokyo, Japan. CSconnected also joined the Welsh Government and SiC Alliance for a briefing seminar and evening reception at the British Embassy in Tokyo. Following an opening address to more than 70 delegates by George Freeman MP, the UK government's Minister for Science, Research and Innovation, the seminar included presentations by the SiC Alliance (Japan), the Welsh Government, CSconnected and Swansea University.



Compound Semiconductor Cluster connects at SPIE Photonex



CSconnected was honoured to present at an industry workshop at SPIE Photonex, focused on UK regional Photonics initiatives that have been enabled by compound semiconductor technologies. South Wales is home to the first compound semiconductor cluster in the world with a large number of collaborations across the partners.

Sir Andrew Mackenzie visit to the cluster

The Chair of UK Research and Innovation, Sir Andrew Mackenzie, visited the CSconnected cluster to learn about the compound semiconductor capabilities and investments in South Wales. Sir Andrew took a tour of the Translation Research Hub (TRH) at Cardiff University, home to the Institute for Compound Semiconductors, the Compound Semiconductor Applications (CSA) Catapult, and IQE's mega foundry in Newport, demonstrating the strength of the value chain in the region, from world-class R&D through product and process innovation to high-value, large-scale manufacturing.



UK Consortium awarded £12m to develop future 6g network solutions

The Compound Semiconductor Centre is a key partner in a consortium that has been granted £12 million funding from the UK Department for Digital, Culture, Media and Sport (DCMS), in a project led by Bristol University to develop and industrialise technologies and solutions for future 6G mobile networks.

The project, 'Realising Enabling Architectures and Solutions for Open Networks' (REASON) brings together an ecosystem representing the entire telecommunication R&D supply chain, from major mobile network equipment vendors, Ericsson, Samsung and Nokia through to advanced component solutions developed by partners of CSconnected.

The Semiconductor team in the consortium is led by CSC and includes teams at Cardiff, Bangor and Swansea Universities, the Compound Semiconductor Applications Catapult, and Integrated Compound Semiconductors Ltd. The team will develop novel semiconductor components designed to optimise system performance of new solutions in LiFi, RF and Optical transmission modes.



DCMS Secretary of State Michelle Donelan with members of the REASON team

About CScnnected

CScnnected is the brand that represents a growing number of advanced semiconductor related activities in across South Wales, home to a unique community of academic institutions, prototyping facilities and global, high-volume manufacturing capabilities that collaborate across a range of research and innovation programs. CScnnected is uniquely positioned 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 such as 5G communications, autonomous and electric vehicles, advanced medical devices, and consumer electronics of the future. In 2020, CScnnected received government funding provided through UK Research and Innovation's flagship Strength in Places Fund (SIPF). The 55-month CScnnected SIPF project has a total value of £43million, supported by £25million of UKRI funds. It builds on Wales's regional strengths and integrates research excellence with a unique regional supply chain in compound semiconductor manufacturing.

For latest news, visit CScnnected.com and follow us on [LinkedIn: CScnnected](#)

CScnnected is supported by UKRI

