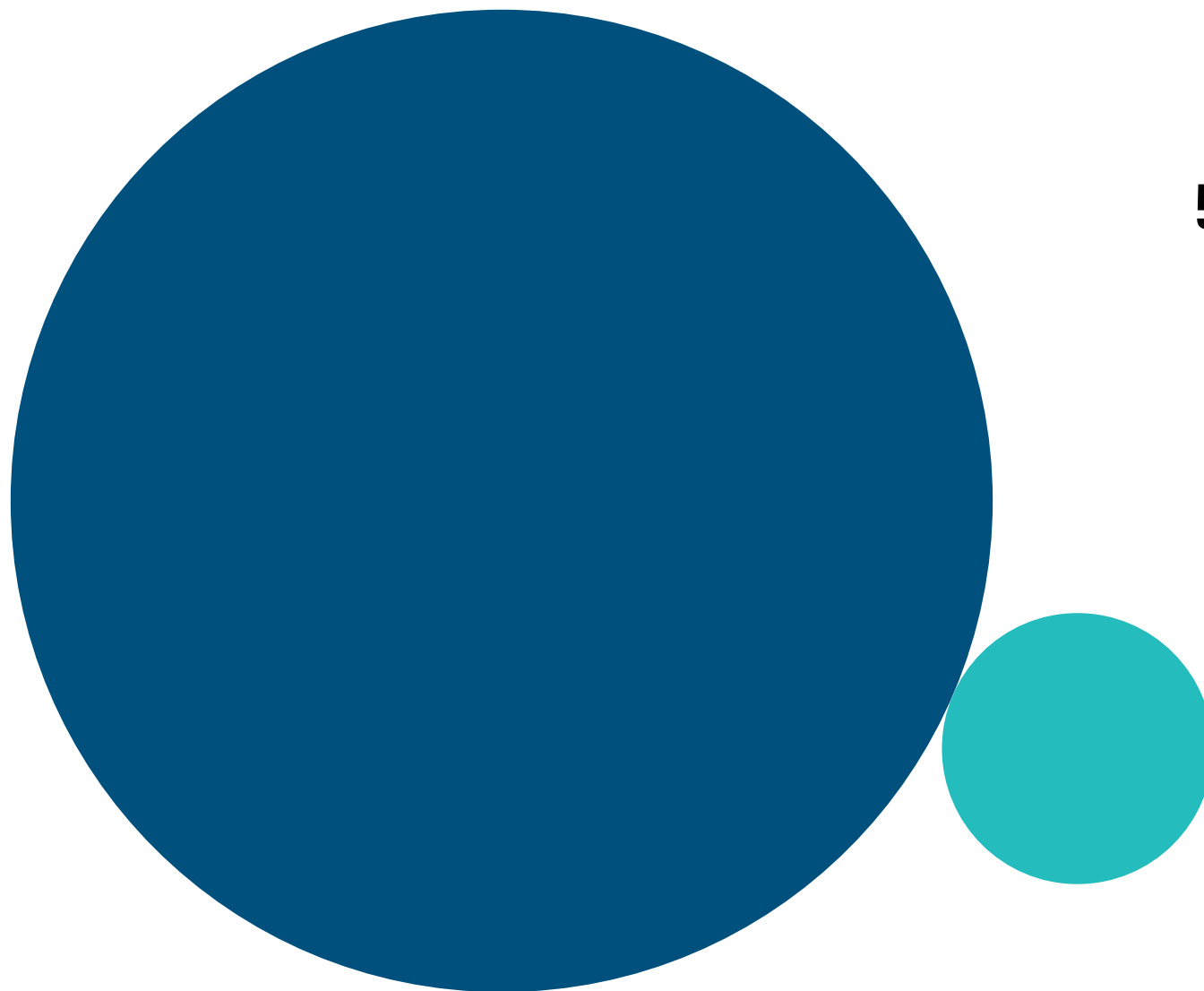The
Scotland
5G Centre

Follow us

www.scotland5gcentre.org

Realising Possibilities,
Transforming Futures

ABOUT

The Scotland 5G Centre is the national centre for accelerating the deployment and adoption of 5G.

Funded by the Scottish Government, the Centre is uniquely positioned with connections to industry, telecom providers and academia – allowing the team to work collaboratively and support the delivery of advanced communications solutions, future proofed to unlock Scotland's digital potential.

FOUNDING PARTNERS

- Scottish Futures Trust
- University of Glasgow
- University of Strathclyde
- Scottish Government

VISION

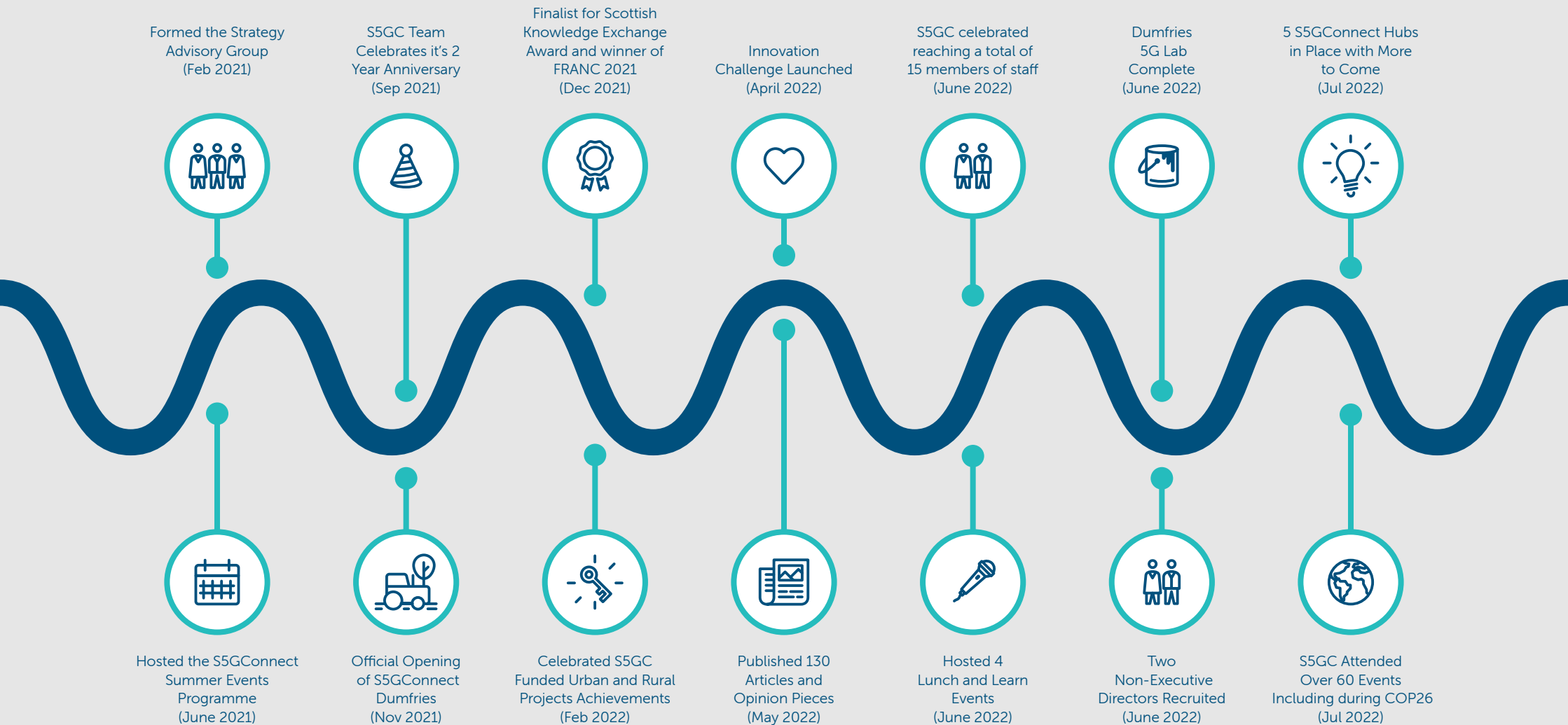The Scotland 5G Centre's vision is to realise the economic and societal potential of 5G for Scotland.

MISSION

The Centre's mission has five strands:

1 **Tailored for Scotland**: ensuring Scotland's priorities, global opportunities and challenges are addressed to maximum benefit.

2 **Presence**: providing a national focal point for all aspects of 5G.

3 **Knowledge exchange**: identifying, establishing and disseminating best practice in addressing 5G challenges.

4 **Capacity and capability**: facilitating collaboration to open pathways to markets, expertise and funding.

5 **Promotion**: supporting new 5G applications and services that are scalable and viable.
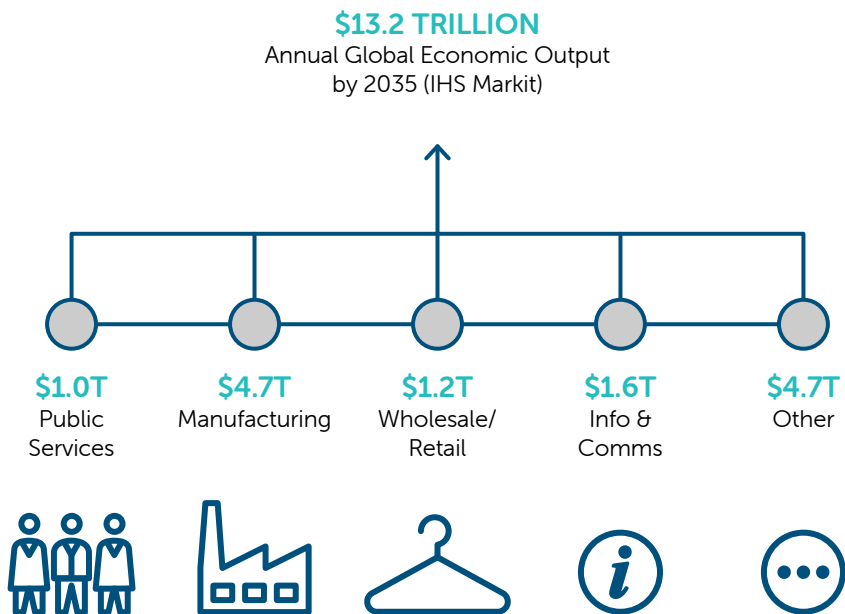
THE SCOTLAND 5G CENTRE
FEB 2021 – JUN 2022 MILESTONES

Formed the Strategy Advisory Group (Feb 2021)

S5GC Team Celebrates it's 2 Year Anniversary (Sep 2021)

Finalist for Scottish Knowledge Exchange Award and winner of FRANC 2021 (Dec 2021)

Innovation Challenge Launched (April 2022)

S5GC celebrated reaching a total of 15 members of staff (June 2022)

Dumfries 5G Lab Complete (June 2022)

5 S5GConnect Hubs in Place with More to Come (Jul 2022)

Hosted the S5GConnect Summer Events Programme (June 2021)

Official Opening of S5GConnect Dumfries (Nov 2021)

Celebrated S5GC Funded Urban and Rural Projects Achievements (Feb 2022)

Published 130 Articles and Opinion Pieces (May 2022)

Hosted 4 Lunch and Learn Events (June 2022)

Two Non-Executive Directors Recruited (June 2022)

S5GC Attended Over 60 Events Including during COP26 (Jul 2022)

ECONOMICAL BENEFITS OF 5G

5G is the key to Scotland's economic recovery, boosting enterprise and providing opportunities for innovation across key industries including healthcare, energy, utilities, tourism and manufacturing.

5G technologies are expected to contribute $13.2 trillion to the global economy by 2035, according to industry analysts IHS Markit. Innovative use cases such as Augmented Reality and Virtual Reality, 5G-enabled drones, factory automation and smart city ecosystems promise increased efficiency and productivity.

$13.2 TRILLION
Annual Global Economic Output
by 2035 (IHS Markit)

$1.0T	$4.7T	$1.2T	$1.6T	$4.7T
Public Services	Manufacturing	Wholesale/Retail	Info & Comms	Other

Source: IHS Markit, The 5G Economy: How 5G will contribute to the global economy, 2019

SOCIETAL BENEFITS OF 5G

Digital technologies are predicted to reduce global emissions by up to 15% by 2030, which will be critical in combatting climate change.

5G is by far the most energy efficient of all the generations. It will be an enormous contributor to breaking the energy curve. Reducing network energy use can also help to reduce what is often businesses' biggest operating cost.

The shift to 5G brings an opportunity for companies:

- To reduce energy costs through modernizing and replacing old equipment and maximising systems through the creation of digital twins.
- Enabling remote working and remote healthcare, reducing the need to travel and increasing the ability for communities to live independently.

S5GCONNECT PROGRAMME

Created in September 2020, the S5GConnect programme was put in place to increase awareness about 5G deployment and its resulting benefits to Scotland's Industry, through the rollout of S5GConnect hubs and test beds in urban and rural locations across Scotland.

The Connect programme offers access to cutting edge 5G mobile private networks, providing an opportunity for public and private sectors, start-ups, entrepreneurs and academic researchers to test new 5G enabled products, services and solutions.

Engage with the Centre and you'll receive free advice, access to a 5G testbed and expert support for developing new 5G applications or an understanding of how a 5G network could support your digital transformation journey.

5G connectivity solutions will transform how organisations will operate in the future, driving both cost and energy savings, increasing operational efficiencies, enabling new services and providing new opportunities for your business. Gain a competitive edge in the global marketplace now.
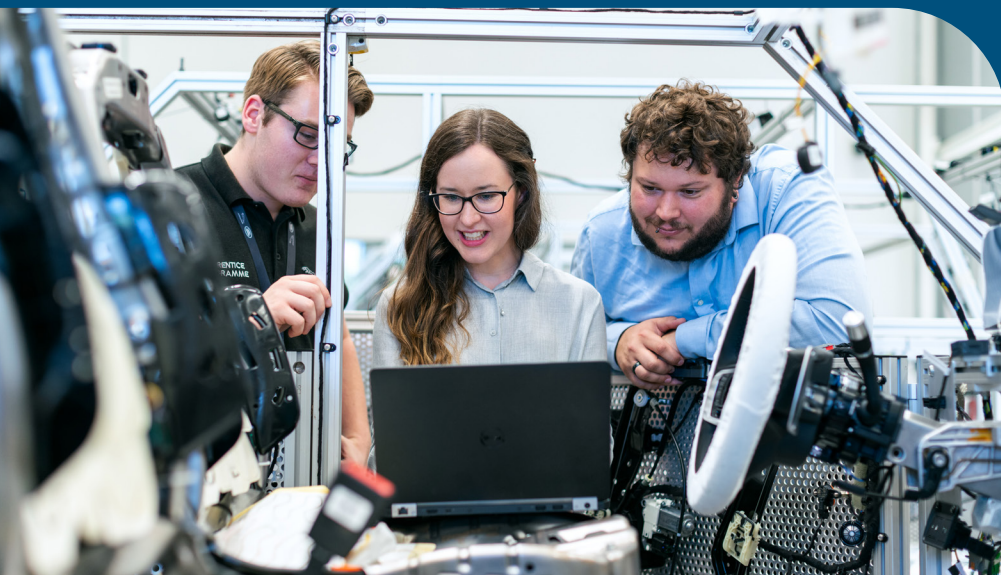
IMPACT

- Galvanise the 5G Ecosystem
- Drive Innovation and Growth
- Accelerate the demand for 5G
- Create more products, skills, services and jobs
- Attract Investment

HUB SERVICES

AWARENESS/BUSINESS SERVICES

- Partner Matchmaking & Introductions
- 5G Education & Knowledge Sharing
- 5G Funding Advice
- Private 5G Network Advice
- Project and Use Case Scoping

5G INNOVATION SERVICES

- Access to our 5G mobile private network
- Access to devices and equipment to enable 5G connectivity & testing
- 5G Development Workshops & Digital Infrastructure Insight
- 5G Integration & Procurement Advice
- Expert advice through your 5G journey

LOCATIONS

With 5 hubs in place and two further in delivery, each S5GConnect hub is tailored to its region, with a focus on supporting relevant local sectors and businesses to adopt 5G. Each hub has it's own private 5G testbed and offers a wide range of services.

- Aberdeen
- Dumfries
- Dundee
- Forth Valley
- HALO Kilmarnock

IN
2022
7 HUBS
WILL BE OPEN
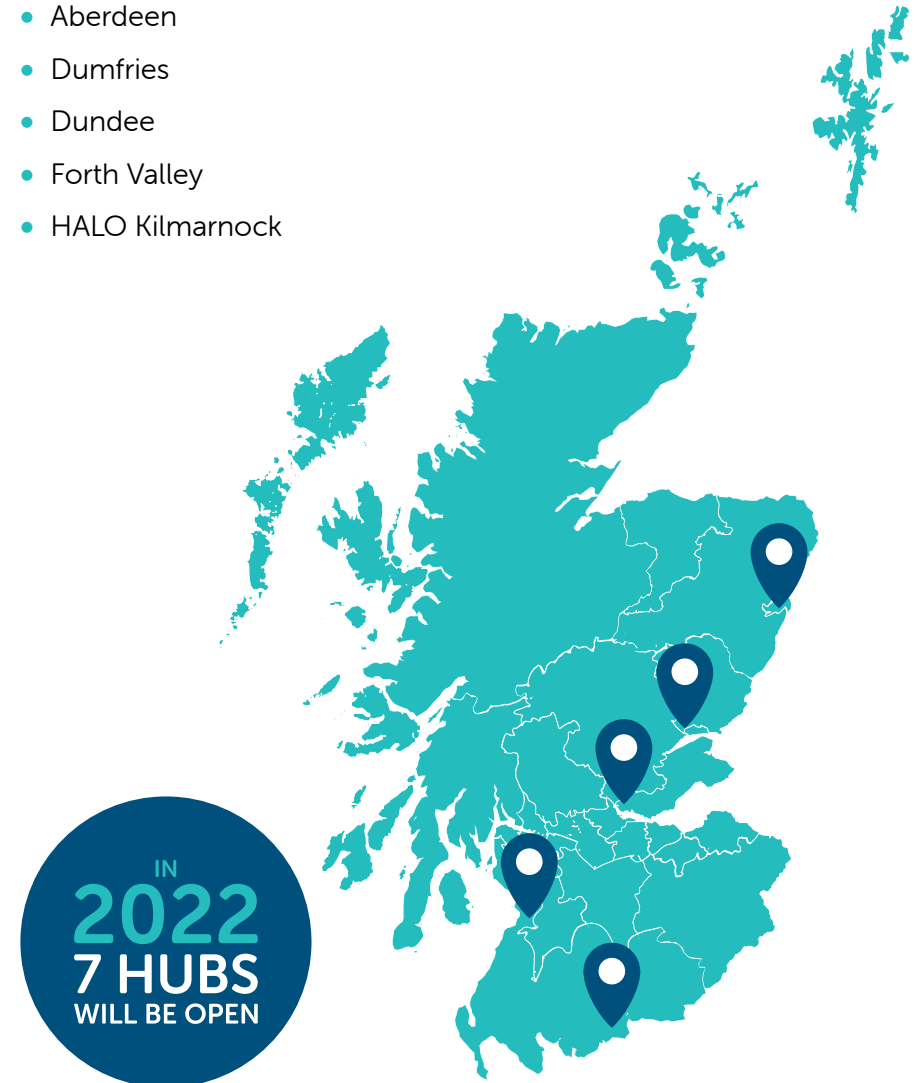
OVERVIEW

The Scotland 5G Centre's vision is to realise the economic and societal potential of 5G for Scotland.

HUB	PARTNERS	SECTORS*
S5GCONNECT ABERDEEN	Opportunity North East Vodafone Ericsson Aberdeen City Council	Renewables and Utilities Energy Ports and Logistics
S5GCONNECT DUMFRIES	The Crichton Trust AWTG South of Scotland Enterprise Nokia	Agriculture / Agritech Health and Social Care Rural Economy
S5GCONNECT DUNDEE	Abertay University Dundee City Council AWTG Nokia Scottish Futures Trust	Gaming – AR/ VR/ Simulation Interactive Entertainment Virtual Production Cyber Security
S5GCONNECT FORTH VALLEY	BT Plc Clackmannanshire Council University of Stirling Scotland's International Environment Centre	Net Zero Manufacturing Environmental Monitoring Transport and Logistics
S5GCONNECT HALO KILMARNOCK	HALO Urban Regeneration Scottish Power Ericsson Vodafone	Aerospace Satellite and Defence Built Environments Tourism

* Not limited to these set sectors

STATS

Population of approximately **230,000**

Approximate number of business units in 2019: **11,000**

Scotland met **90%** electric consumption in renewables

Port of Aberdeen increased turnover of **£33.5 million**

Around 100,000 people are employed within the energy sector, **accounting for 46% of jobs**

S5GCONNECT ABERDEEN

As the energy capital of Europe, Aberdeen is quickly developing as a leading player in researching and innovating every aspect of offshore renewables. The demand for renewable energy engineers is expected to grow as companies diversify from hydrocarbons and reduce emissions. Hywind, the world's first floating wind farm, is based in Aberdeenshire, while in Aberdeen bay, the European Offshore Wind Deployment Centre features the world's most powerful wind turbine.

KEY SECTORS*
- Renewables and Utilities
- Energy
- Ports and Logistics

PARTNERS
- Opportunity North East
- Vodafone
- Ericsson
- Aberdeen City Council

Address
The Scotland 5G Centre, ONE Hub,
Schoolhill, Aberdeen, AB10 1JQ

*Not limited to these set sectors

S5GConnect
Aberdeen

STATS

Population of approximately **150,000**

Agriculture accounts for **70%** of the area's economy

In Scotland, **17.5% of adults** who provide unpaid care

In Scotland, **36k** sleep in a care home and **67k** are supported at home

In 2020/21, **35% of the total Scottish** budget was spent on healthcare

S5GCONNECT DUMFRIES

Agriculture in Scotland contributes over £5,000 million to the economy with over 115,700 employees and 24,500 businesses. In Dumfries & Galloway, with a dispersed rural population, digitising healthcare and innovating the farming industry are key priorities. NHS Dumfries and Galloway are at the forefront of digital innovation, connecting 31 GP practices across the region, providing clinicians with real-time access to patient data, supporting faster and safer care.

KEY SECTORS*

- Agriculture/Agritech
- Health and Social Care
- Rural Economy

PARTNERS

- The Crichton Trust
- South of Scotland Enterprise
- AWTG
- Nokia

Address

The Scotland 5G Centre, Crichton Central, Bankend Rd, Dumfries DG1 4TA

*Not limited to these set sectors

S5G Connect
Dumfries

STATS

Population of approximately **150,000**

79% of UK firms favour AI cyber security products

Dundee has **over 40** gaming companies

11% of UK IT budgets are spent on cyber security

Approximate number of business units in 2019: **4,300**

S5GCONNECT DUNDEE

When you visit Dundee, you will see a city transformed. It is the birthplace of the Scottish games industry. Whether it's developing, programming or animation, Dundee is the place to be. With more than a dozen tech companies based in the city, Dundee continues to support a booming hi-tech economy and is fast becoming one of tomorrow's innovators.

KEY SECTORS*
- Gaming-VR/AR/Simulation
- Interactive Entertainment
- Virtual Production
- Cyber Security

PARTNERS
- Abertay University
- Dundee City Council
- AWTG
- Nokia

Address
The Scotland 5G Centre, Cyber Quarter,
Abertay University, Bell St, Dundee, DD1 1HG

*Not limited to these set sectors

S5G Connect
Dundee

STATS

Population of approximately **306,000**

UK is the **9th largest** manufacturing nation in the world

£183 billion of output from the UK manufacturing sector

Around **127 million** passenger journeys were made by bus in Scotland in 20-21

25% of traffic on roads is light and heavy goods vehicles

Data Source: statistics.gov.scot, makeuk.org, transport.gov.scot

S5GCONNECT FORTH VALLEY

Scotland has world-leading climate targets, and the Forth Valley region is committed to playing its role in addressing the global climate crisis. The Forth Valley for Net Zero campaign commits to supporting the region to achieve net-zero status by 2040 while Scotland's International Environment Centre (SIEC), based at the University of Stirling is driving the creation of a net zero regional economy and acting as a global exemplar of low-carbon growth.

KEY SECTORS*
- Net Zero
- Manufacturing
- Environmental Monitoring
- Transport and Logistics

PARTNERS
- BT Plc
- Clackmannanshire Council
- University of Stirling
- Scotland's International Environmental Centre

Address
The Scotland 5G Centre, Forth Valley College,
1 Devon Rd, Alloa, FK10 1PX

*Not limited to these set sectors

S5GConnect
Forth Valley

STATS

Population of approximately **47,000**

UK has **largest number** Aerospace SME's in Europe

In 2020, total UK turnover of **$34.8 billion** in the Aerospace sector

£65 million investment into the area via the HALO Project

UK will invest **£1.4 billion** into the Defence Space Strategy

Data Source: statistics.gov.scot, trade.gov, gov.uk, halo-projects.com

S5GCONNECT HALO KILMARNOCK

With a multi-million pound 21st century regeneration, Kilmarnock was awarded the title of 'most improved town' in Scotland. A first for Scotland, HALO Kilmarnock is at the heart of the town centre, supporting the growth and resilience of the Ayrshire economy and creating a dynamic commercial, educational, cultural, leisure and lifestyle quarter of the town, fuelled by renewable energy, where people can live, work, learn and play.

KEY SECTORS*
- Aerospace
- Satellite and Defence
- Built Environments
- Tourism

PARTNERS
- HALO Urban Regeneration
- Scottish Power
- Ericsson
- Vodafone

Address
The Scotland 5G Centre, HALO Urban Regeneration, Hill St, Kilmarnock, KA3 1HA

*Not limited to these set sectors

S5G Connect
HALO Kilmarnock

5G PROJECTS

The Scotland 5G Centre funds a wide range of 5G projects. We're working with various partners to research innovative 5G solutions, boost connectivity, develop skills, provide insights and offer access to a demonstration and development environment.
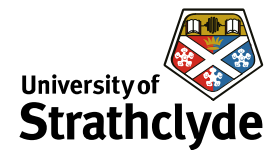
5G Rural Project: University of Strathclyde
sdr.eee.strath.ac.uk/

5G Urban Project: University of Glasgow
www.glasgowcsi.org

5G Infrastructure Project: Infralink
www.infralink.scottishfuturestrust.org.uk

PROJECT PARTNERS

University of Glasgow

infralink

University of Strathclyde

5G RURAL PROJECT:
UNIVERSITY OF STRATHCLYDE

- **S5GC has invested over £1.9 million of funding with an ROI of £2.5 million.**
- **The rural connectivity project is finding ways of using shared spectrum to deploy 5G to support energy management, fishing, tourism and next-generation communications to residents to sustain and support rural communities.**
- **Engineers from the University of Strathclyde built a custom private shared spectrum 5G standalone network to showcase the powerful benefits that 5G can bring to broadcasters.**

The key aim of this project is to bring new 5G technological solutions to rural communities and businesses throughout Scotland. They are currently working in locations including Loch Lomond and the Orkney Islands, developing a new operational model introducing neutral hosting and private 5G networks. This can lead to improved connectivity for remote communities and businesses, contributing to a new 5G ecosystem across Scotland and driving new business opportunities and inward investment.

RURAL CONNECTIVITY

Strathclyde University has created a rural environment to develop 5G radio access networks (RAN) and software defined radio (SDR) capability across all UK shared bands, suitable for the operation of shared spectrum private networks over various use cases.

As part of the 5G New Thinking project, Strathclyde has created a Rural shared spectrum 5G RAN on Orkney, connecting Westray and Flotta to Wave 1 5G Cisco Core.

They have also designed and built a rural testbed on Loch Lomond, with access to a variety of shared spectrum technologies, radio access networks, and 5G core connections to the University of Strathclyde's main 5G labs.

GLOBAL 5G-ENABLED PROJECTS

In September 2021 at the MotoGP and Grand Prix, Strathclyde worked in partnership with BTSport, Vislink and Dorna to present a world first in live 5G sports production, using Scottish engineering 5G solutions from their testbeds.

The team has also set up international industry partnerships, and collaborative 5G shared spectrum projects with partners in Ireland, New Zealand, Thailand, USA, Denmark, France, Kenya and the Faroe Islands.

5G URBAN PROJECT:
UNIVERSITY OF GLASGOW

- **S5GC has invested over £1.6 million of funding with an ROI of £29 million.**
- **5G real time technology creates new commercial opportunities and remote access to state-of-the-art facilities.**
- **5G test bed creates new immersive learning opportunities for students globally.**
- **One of the first demonstrations of remote robotics in higher education attracting worldwide attention.**

The key aim of this project is to bring new 5G technological solutions to urban communities and businesses throughout Scotland. They are currently developing a 5G-enabled Smart Campus offering sustainable, healthier and smart solutions to students, academics and the surrounding community. This is already attracting investment into the area, creating new jobs and will lead the way for future smart cities while contributing to Glasgow's carbon neutral commitment by 2030.
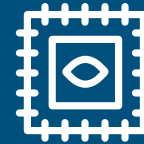
SENSORED MONITORED SEATING

By using RFID and LoRa technology on desks, data is gathered which can accurately present occupancy information enabling remote estate management, especially in a multi-occupancy open plan building.

REMOTE OPERATED ROBOTIC ARM

5G robotic arm uses a haptic feedback controller that allows you to feel senses of touch, motion and pressure all in real-time, allowing the user to operate remotely enabling remote healthcare and remote working.

3D HOLOGRAPHIC CALL

5G enabled 3D videoconferencing provides realistic virtual telepresence that moves away from conventional two-dimensional screens replacing it with holograms. Demonstrations show how this can be applied in a healthcare setting and in 3D Telemedicine.

CONNECTED MOBILE HEALTH CLINIC

The CMHC is a fully equipped state-of-the-art mobile clinic on wheels supported by a pop-up 5G mobile private network that enables remote testing, consultation, video diagnostics, monitoring and other care capabilities necessary for a team of trained professionals to carry out.

5G INFRASTRUCTURE PROJECT: INFRALINK

- **S5GC has invested over £390k of funding.**
- **Infralink is led by infrastructure experts, the Scottish Futures Trust, and is funded by the Scotland 5G Centre.**
- **Established to improve the engagement between potential public sector landlords and mobile industry tenants.**
- **Established several balanced, transparent tools that work across different areas of Scotland.**

The key aim of this project is to break down the complex processes and legislative barriers that have delayed the rollout of 4G and 5G infrastructure, by creating a new suite of balanced, transparent tools that work at a national level. They are impacting Scotland by eliminating barriers, enabling faster deployment, and more investment in mobile connectivity.

STANDARD DOCUMENTS

A balanced starting point removes the need to negotiate standard terms, allowing the parties to focus on the nuances of deploying new sites or upgrading or relocating existing ones.

PAYMENT GUIDANCE

A recommended methodology and price structure to occupy/use the assets that builds upon the principles of the Electronic Communications Code and recognises the impact of digital infrastructure as a tenant.

CONNECTIVITY MARKETPLACE

An online map-based shop window for public sector bodies interested in discussing connectivity in their area, allowing them to set out the assets and terms up-front and drive the discussions based on data.

INFRALINK-EXCHANGE

Infralink-Exchange is a pathfinder project awarded £500k of funding from the UK government's Department for Digital, Culture, Media and Sport (DCMS) to explore how street furniture can be used to enhance significantly mobile digital connectivity.

FRANC 5G DU-VOLUTION:
NEXT GEN 5G PROJECT

- **ADVA successfully bid with S5GC and other partners for the UK Government's Future Radio Access Network Competition (FRANC), awarded by the Department for Digital, Culture, Media and Sport (DCMS).**

- **The Centre provides the Programme Management Office (PMO) function to facilitate the delivery of the "FRANC 5G DU-Volution" consortium, which received £4.6m funding to create a new 5G Open RAN Distribution Unit (DU).**

- **The project team, in conjunction with the industry, will prototype, benchmark, commercialise and prepare this cutting-edge product for release in the UK by 2025.**

S5GC works closely with the Lead Partner: ADVA Optical Networking, and other stakeholders: AccelerComm, CommAgility, BT and the University of York. The team will work on this UK-sourced DU and evaluate and integrate state-of-the-art hardware and software components. This standards-compliant 5G Open RAN DU will accelerate processor-intensive functions and support exciting new use cases, as illustrated.

PRIVATE 5G   NEUTRAL HOST   MASSIVE MIMO   BEYOND 5G

PRIVATE 5G

A Private 5G wireless network can revolutionise Enterprise use-cases with low latency, ultra-reliability and high throughput for 5G network devices (UEs) and SIMs. The addition of edge-compute capability securely retains mission-critical sensitive data for on-site processing, e.g. smart manufacturing, warehouse logistics and mining/building excavations.

NEUTRAL HOST

Neutral host mobile networks resolve coverage and capacity issues inside hotels, enterprises and rural locations. Mobile users can expect equivalent service levels as on macro mobile networks. UK operators agree on the security, safety standards and configuration settings with wholesale providers who build and operate these high-quality networks.

MASSIVE MIMO

In today's 5G networks, Massive MIMO (multiple input, multiple outputs) helps align 5G coverage to the existing 4G footprint. Further advances in Massive MIMO include 'Cell-free Massive MIMO', under academic study since 2017.

The aim is to increase throughput and minimise interference and energy through the following steps:

- Deploy more antennas closer to users
- Reduce logical coverage cell boundary configurations
- Process signals system-wide, reducing interference.
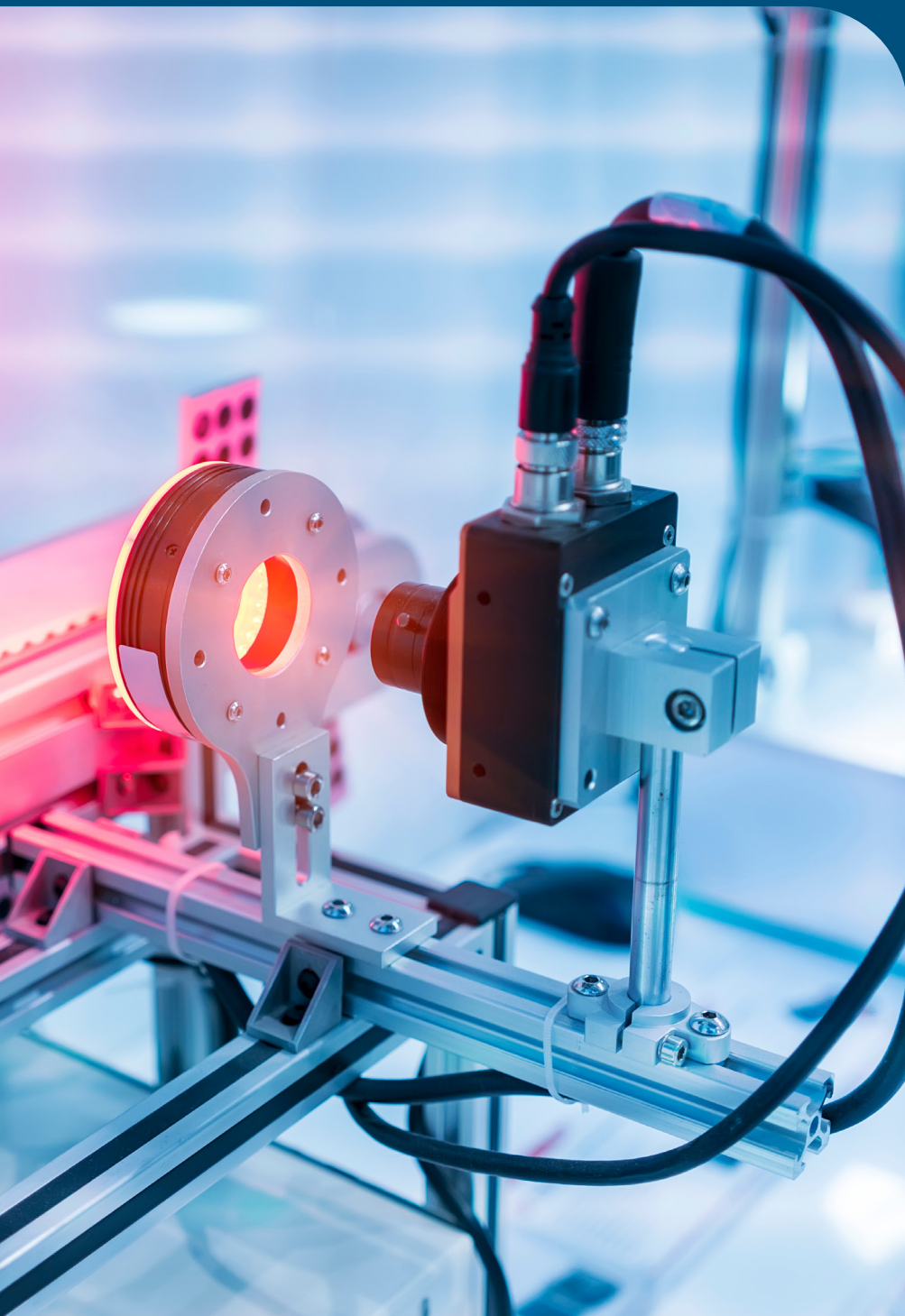
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