

Scotland: A green industrial powerhouse

The nation of innovators forges ahead with a new economic transformation strategy for sustainable and inclusive growth

Every country faces a choice about how to transition to net zero and the post-pandemic world: lead the way or lag behind. Scotland has chosen to lead, says Cabinet Secretary for Finance and the Economy Kate Forbes.

“We choose to lead, because we believe we can. We believe Scotland has all the necessary resources, talents, ingenuity and natural assets,” she asserts. The nation is already a frontrunner in the fight against climate change, having decarbonized faster than any G20 nation as it races to meet the ambitious goal of being net zero by 2045. It also appears to be rebounding rapidly from both COVID-19 and the U.K.’s exit from the European Union, with its gross domestic product rising by 6.9 percent in 2021. “The economy has proven to be exceptionally resilient, and it’s coming back stronger and faster than expected. Scotland’s tourism and hospitality sectors have had a difficult time, but the financial services sector was stable throughout and most other industries—including engineering, manufacturing, information and wider technologies—have all recovered surprisingly quickly,” says Philip Grant, chair of the Scottish executive committee at Lloyds Banking Group, the U.K.’s largest banking and insurance business.

From the steam engine to the television, telephone, MRI scanner and bank ATMs, Scottish inventions have been changing the world for centuries. “We might have a population of just 5 million, but we have a long tradition of being pioneers and innovators,” Forbes notes. Last month, she launched a new 10-year strategy for economic transformation that sets out how the government intends to capitalize on this tradition in order to realize opportunities in decarbonization, disruptive technologies and transforming industries. “To deliver a just transition to a net zero economy, we need to invest in our people, invest in innovation and invest in the areas that are going to deliver the most sustainable inclusive growth. These include renewables, as Scotland is home to over 40 percent of the U.K.’s wind and water generation capacity; food and drink; and technology generally. We have a thriving tech ecosystem, increasing numbers of global corporates are choosing to establish tech hubs here and we have the U.K.’s second-largest fintech cluster,” Forbes states.

The new strategy is supported by substantial public funds. For example, in 2020 the Scottish government established the U.K.’s first national development bank, which will have access to £2 billion in funding over the next



Kate Forbes
Cabinet Secretary
for Finance
and the Economy



Glasgow successfully hosted 120 world leaders at COP26

decade, she reveals. “At the same time, we’re endeavoring to leverage private capital that complements our investment in key growth sectors, particularly in terms of green investments. We’ve established a global capital investment plan, for instance, to make it easier for investors to find propositions in Scotland. It sets out what we are trying to do and how opportunities can be secured. If I were to capture our vision in a nutshell, it’s to create a pro-prosperity, pro-business and pro-jobs environment that allows entrepreneurship to flourish and makes Scotland an even more attractive place for investors and innovation.”

Despite the pandemic and Brexit, investments into Scotland rose in 2020, Forbes reports. “We’ve been the U.K.’s top destination for foreign direct investment (FDI) outside London for the past six years, with three of our cities—Edinburgh, Glasgow and Aberdeen—being among the top 10 U.K. cities for FDI. Inward investors constitute about 3 percent of our businesses, but they’re responsible for 34 percent of employment and 77 percent of our exports. They are vital to our economy.” Grant is not surprised that investor numbers are growing: “It’s an excellent place to do business from and a productive place to develop businesses, with its size as its best asset. The connectivity between skills, companies, government and professional services is such that one can get things done quickly. There’s also symmetry in ambition between industry, academia and the government, which ensures an environment that aligns innovative ideas with the goal of achieving significant impact.”

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Kate Forbes, Cabinet Secretary for Finance and the Economy

Adrian Gillespie, CEO at the economic development agency Scottish Enterprise, is another who believes the nation’s focus on innovation is drawing in investors: “We’ve been very successful in attracting research and development projects, which is hugely connected to our world-class universities and highly educated, skilled population.” Forbes offers a final message for those considering a move into the stunningly beautiful country with its misty glens, heather-covered mountains and endless coastlines: “Come. If you invest, establish a business or decide to work or study here, you will be met with a warm welcome and significant opportunities that synchronize with your business and green agendas.”

Shifting to a next-generation economy

Scotland has created a dynamic, energizing environment for innovative businesses in diverse future-focused sectors

“There are things Scotland is well known for, like our preeminence in whisky, our fabulous natural environment and tourism, plus our role in the oil and gas sector. But there’s so much more going on in our economy,” states Adrian Gillespie, CEO at economic development agency Scottish Enterprise.

All of the nation’s growth sectors have two factors in common, he asserts. “Our ability to innovate quickly in a thoroughly collaborative way and our determination to be at the forefront of the net zero transition are certainly proving to be of interest to investors.” Those factors can be seen in an energy industry that is rapidly diversifying from the production of oil and gas, which has sustained the country’s economy for decades. “Scotland has differentiated itself through a focus on offshore renewable energy generation. The North Sea has vast potential in this area and a tremendous amount of innovation is taking place, often based on our expertise in subsea and wider offshore engineering. The world’s first offshore floating wind farm is here, for example, and we’re developing technologies such as hydrogen and carbon capture and storage. This makes Scotland an outstanding location for investments in green energy and sectors that depend on it, such as next-generation mobility,” notes Gillespie.

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Adrian Gillespie, CEO, Scottish Enterprise

Sandy Begbie, CEO of the trade body Scottish Financial Enterprise, points out that the nation’s world-class energy industry is buttressed by an equally world-class financial services sector. “Scotland has the industries, assets, skills and natural resources to be a net exporter of renewable energy technologies. Its financial services providers will play an absolutely central role in supporting that transition and the country’s wider journey to net zero, hopefully showing the rest of the world what’s possible in the process.”

With over 2,000 operators in the sector, Scotland is one of Europe’s most important centers for financial services, which contribute around 9 percent of its gross domestic product. “It’s a very strong ecosystem that includes everything from fintech, venture capital and private equity to some of the world’s biggest investment managers, banks, accountancy and legal firms. That’s what makes us the U.K.’s second-largest financial services sector and we continue to be attractive for inward investment,” Begbie says. He is convinced the country is set to become a leading global center for sustainable finance: “Most financial centers across the world aspire to be that, but Scotland already has



Scotland has carved a niche around vertical farming technologies

real strengths in green and ethical finance, and we’re doing a substantial amount of innovative work in sustainable products and services. Plus we have the advantage of having a full ecosystem, including an envy-inducing fintech cluster that’s expanding by about one company a week.”

Other growth sectors are life sciences and technology, Gillespie notes. “We have the highest number of research-intensive universities and tertiary-educated people per capita in Europe, which translates into robust science and engineering sectors. We’re at the leading edge in pharmaceutical innovation, precision medicine, digital health technologies, quantum technologies and photonics, for instance. There’s also a big focus on advanced manufacturing in the country right now.” According to Alastair McInroy, CEO of the industry association Technology Scotland, “Scotland has always been a nation of innovators and we’re now punching way above our weight in various technologies. We’ve seen very healthy foreign direct investment into our specialties, driven significantly by the quest for talent, which Scotland has a lot of, as well as the ability to directly engage with our devolved government here and our development of sector-specific clusters.”

“Innovation ecosystems are popping up all over the country,” confirms Gillespie. “Universities have gone beyond their walls and opened up to the wider economy by partnering on the establishment of Innovation Districts. These capitalize on the fact that we have fantastic companies, great technology, an excellent relationship with investors and world-leading academic research. The connectivity between them all is what defines Scotland’s Innovation District model and it allows us to innovate effectively at pace.”

Scottish Enterprise is an active partner in a number of these hubs, he adds. “To give a few illustrations, the BioQuarter just outside our capital benefits from the University of Edinburgh’s expertise in life sciences, while Glasgow City Innovation District has created an open culture of collaboration between the University of Strathclyde and industry in areas like digital health, space applications, quantum technologies and renewable energy. The Energy Transition Zone in Aberdeen is utilizing that region’s offshore-energy capabilities and we’re currently investing in the new National Manufacturing Institute Scotland. It’s the centerpiece of our manufacturing innovation district in Glasgow, which involves technologies across sectors such as aerospace, medical sciences, food and drink. It’s a really exciting time to be in Scotland: it’s a dynamic, energizing environment, where a multitude of astoundingly interesting things are happening.”



Adrian Gillespie
CEO
Scottish Enterprise

The U.K.’s most attractive location outside London

Scotland’s appeal as an investment destination has tripled since 2019. A contributor to this is its support of emerging growth sectors like fintech

According to the EY Attractiveness Survey 2021, Scotland has never been a more attractive destination for international investors.

“Our survey found Scotland is the most attractive place in the U.K. outside London and outperforms other locations. Scottish foreign direct investment increased by 6 percent in 2020, which is exceptionally encouraging, especially in the context of a 12 percent fall at the U.K. level and a 13 percent fall across Europe that year. It’s a phenomenal result,” says Sue Dawe, managing partner and head of financial services at EY Scotland, which provides the country’s business community with expert assurance, tax, strategy and transaction, and consulting services. Dawe highlights financial services as being among the sectors drawing in investment: “Two-thirds of people working in the U.K.’s financial services sector are outside London. There’s a lot of competition from other regions and our research shows Scotland’s success comes down to a unique combination of factors. These include access to skills and talent, much coming from our excellent, innovation-focused universities, the recognition that it’s a great place to live and work, with relatively low living costs, and the considerably lower set-up costs compared to other prestigious financial hubs.”

Scotland has long been recognized as a powerful force in financial services, she states. “We have hundreds of years of banking, insurance, wealth and asset management experience. However, the sector hasn’t stood still and has gained international acclaim in a number of emerging areas, such as technology and sustainability.” One reason it is becoming a frontrunner in the digitalization of financial services is the collaborative attitude of stakeholders in the sector, asserts Dawe. “There is considerable collaboration between FinTech Scotland and organizations like Scottish Financial Enterprise, as well as between fintechs themselves and between larger financial services businesses—especially those that may not have in-house capabilities to deal with this ever-changing land-

A sizeable financial cluster

- Centuries of financial services expertise
- 161,000 people working in financial and related professional services
- Voted the best place in Europe to start a tech business
- 175+ fintech startups and success stories
- 16 technology incubators and accelerators

SOURCE: FINTECH SCOTLAND

scape.” This approach is helping the country take a lead in areas that have gained increasing importance in recent years, including online payments systems and open banking. “The world needs organizations that facilitate online payments, while making sure consumers are protected from fraud. Similarly, open banking is crucial for understanding consumer trends and to meet their needs. That means creating data which must be protected. The fact that the Smart Data Foundry, previously known as the Global Open Finance Centre of Excellence, is based in Scotland is an indicator of the fantastic ecosystem we have for the support of emerging growth sectors,” she says.



Sue Dawe
Managing Partner
and Head of
Financial Services
EY Scotland

The country is also ideally positioned to assist in the global shift toward sustainability, adds Dawe. “Scotland has a great opportunity to lead the green transition from the front because, as well as our world-class financial services sector, we have a world-class energy sector. By bringing those sectors together, Scotland can set itself apart.” EY has its own ambitious sustainability goals, she reveals. “Globally, EY is carbon negative and has further committed to being at net zero by 2025. We were also one of the first to appoint a global head of sustainability, tasked with bringing together our global network’s capabilities with the overall aim of helping clients transition. EY Scotland is playing its part and is currently working with companies of all sizes to map out their journeys to net zero. By leveraging the combined knowledge and expertise of our local and global networks in sustainability, digitalization and many other areas, we deliver the best solutions to solve our clients’ problems.”



40% of the U.K.'s wind and water power capacity

Vast natural resources, oil and gas capabilities, plus innovative strengths in renewables have accelerated Scotland's decarbonization agenda

Last November, Glasgow hosted an event that First Minister Nicola Sturgeon called "one of the most important gatherings of this century": the United Nations Climate Change Conference.

In a speech that launched Scotland's COP26 program, Sturgeon gave two reasons why it was the right location for a summit where world leaders kept our chances of limiting global warming to 1.5 degrees alive. Firstly, Scotland is at the vanguard of technologies that could enable this target to be met and, secondly, it is leading by example. "We've decarbonized more quickly than any G20 nation. We've already halved our emissions since 1990, we're committed to halving them again over the course of this decade and we aim to reach net zero by 2045," she asserted. The U.K. as a whole has targeted 2050 for net zero, but Scotland's decarbonization agenda is ahead of the other nations. In 2021, 99 percent of the electricity and 25 percent of the energy it used came from renewables, particularly wind, but also hydro, solar and biofuels. To help it attain its ambitions, Scotland is ramping up renewables and addressing challenges presented by its huge North Sea oil and gas sector, which has a workforce of 71,500. "Those jobs and the people in them matter," said Sturgeon. "Our focus will be on achieving the fastest possible just transition for the oil and gas sector."

The North Sea's hydrocarbons deliver 12 percent of Scotland's gross domestic product at the moment, says Deirdre Michie, CEO of the trade body Offshore Energies UK (OEUK). "We're a center of excellence for the global industry. We're absolutely committed to playing our part in the energy transition and have set the target of reducing production emissions 50 percent by 2030. However, it's crucial that we support our sector for as long as the U.K. needs oil and gas. The gas price crisis the world is currently facing is a stark example of why you need a secure local energy supply as you go through this transition." In 2021, the industry and the U.K. government signed a groundbreaking North Sea Transition Deal that should accelerate the transition, she reveals. "Its elements include reducing emissions of offshore assets, stimulating new sectors like hydrogen, carbon capture and storage (CCS), plus supporting our supply chain to transition. The deal is also focused on people and skills. Our employees today need to be confident there's a future for them and there definitely is, 90 percent of our oil and gas jobs have high or medium transferability as the skills and expertise Scotland has are the ones that are going to underpin the energy mix of the future."



Deirdre Michie
CEO, Offshore Energies UK



Wind generated 72% of Scotland's renewable electricity in 2020

Co-chair of the Scottish Energy Advisory Board Sir Jim McDonald also stresses the role oil and gas companies have to help bring about the energy transition: "They have good balance sheets, understand major project management, have great technical capabilities and they've shifted their innovation to support energy's move to a different future. By working with them, we will accelerate the investment and reality of decarbonized infrastructure. Another thing that's impressed me is the consistency of the Scottish government's focus on low-carbon energy infrastructure and the decarbonized economy." One of its focus areas is floating offshore wind, he states. "It has the potential to add around £1.5-£4 billion in gross value to the Scottish economy within six years. The next two to three years are critical for Scotland to build offshore capability to first serve our own requirements and then to address a global market."

In 2021, the nation had almost 9.6 GW of installed wind capacity, most of it onshore, and projects for a further 8.8 GW had received consent. This January, its first offshore auction for a decade was won by 17 fixed, floating and mixed wind projects that could boost capacity by a further 25 GW. Shell was one of the winners. "As a result of the ScotWind auction, Shell and our partner ScottishPower will be creating two at-scale offshore floating wind de-

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Deirdre Michie, CEO, Offshore Energies UK

velopments. That builds on our strengths: hydrocarbons are absent, but the engineering challenge is much the same," says Simon Roddy, Shell's senior vice president of U.K. upstream. One of the signatories of the North Sea Transition Deal, Shell has pledged to be net zero by 2050. "We're improving the way we produce oil and gas, while using our skills to develop new technology. A further important undertaking is a large-scale offshore CCS project we're partnering on that utilizes existing oil and gas infrastructure. The North Sea is the U.K. biggest energy asset. It has served the country for decades in terms of oil and gas, and we believe it will be at the center of low-carbon energy," Roddy says.

In addition to being a pioneer in offshore wind, Scotland is advancing other novel energy sources. For example, it developed the first offshore tidal energy array in 2016, and last year the government launched a £100-million funding plan to turn the nation into a world leader in hydrogen and Europe's lowest-cost producer for the gas that could be supplying 15 percent of the nation's energy needs by 2030.



Keith Anderson
CEO
ScottishPower

Working closely with electricity generators, transmission companies, governments and other stakeholders to realize Scotland's and the U.K.'s energy transition goals is National Grid ESO. The company is responsible for ensuring Scotland's rapidly changing electricity generation mix is delivered to customers securely, dependably and efficiently. "Just one system operates across England, Scotland and Wales, and it's one of the world's fastest decarbonizing electricity systems. It's also among the most reliable systems, with 99.999 percent reliability," says National Grid ESO's chair, Fintan Slye.

The ambition is to operate at zero carbon by 2025, which is something no other country is shooting for. "The increasingly vast amount of offshore wind generation in Scotland needs to get to where our population centers and large industrial demands are," explains Slye. "The transmission and distribution networks have to move power in very different ways now and we must constantly adjust to that. We also have to monitor what's happening in areas like electric vehicles, heating and hydrogen, which all interrelate as we go into the future."

Further up the value chain and central to the U.K.'s just transition to net zero is ScottishPower. The company is part of the Iberdrola Group, one of the world's largest integrated utility companies and a leader in wind power. "We're the only big energy company in the U.K. that's involved in generation, transmission, distribution and retail. We're involved in every part of the process of getting green electricity into houses, businesses, cars and heating systems," stresses CEO Keith Anderson. "The group is helping to drive the decarbonization of energy and ScottishPower leads that activity within the U.K. 25 years ago we were predominantly a coal generating business, but we recognized that had to change and started investing in renewables. Everything we do now is seen through the prism of net zero 2050 and in December we blew up the last chimney on Scotland's last coal plant, an incredibly symbolic act for us and the nation," notes Anderson.

Today, ScottishPower only generates 100-percent green electricity. It currently operates more than 40 wind farms that have a combined capacity of 2,500 MW, most of which are in Scotland. That electricity is sold to over 5 million customers in Scotland, England and Wales, he says. "We'll never step back from our 100-percent renewable status, which is why we have no interest in CCS, gray or blue hydrogen. Our view is the future is all green and that pushes us to invest in wind, solar, green hydrogen and battery technology." The company plans to invest almost £4 billion by 2025 to double its generation, with one of its newest developments being the acquisition of 800 MW of photovoltaic projects across Britain.

There is widespread political agreement throughout the U.K. with regard to the decarbonization of energy, which makes it easier to plan for investments in infrastructure, research and development, job creation and supply chains explains Anderson. "ScotWind is the latest phenomenal step forward. ScottishPower's 7 GW across two floating and one fixed project more than trebles our existing offshore pipeline and could power 8.5 million homes, over three times the number of houses in Scotland. That shows the scale of our ambition. We're partnering with Shell on the floating projects because we think it's important to work with the oil and gas sector to help move the energy transition, create new jobs and transfer skills." Processes like ScotWind have created a big enough market to encourage innovation

and drive down the costs of renewables. "Five years ago, a U.K. offshore wind farm would have cost about £150 per MW/hour. Today, that cost is below £40. The change in turbines is colossal; their size, blade design, materials, gearboxes, cabling technology and the systems that run the carlines have advanced exponentially through innovation and digitalization. Every turbine we operate feeds information to our control center near Glasgow now. We can analyze each one's performance, which allows us to use and balance the system effectively and efficiently," he stresses.

In 2021, ScottishPower announced a £3.3 billion plan to upgrade its transmission and distribution networks that cover over 100,000 kilometers of the U.K. This will support the grid connection of more than 6 GW of new renewable capacity, plus 670,000 electric vehicles and 370,000 heat pumps, according to Anderson. "This investment is all about helping to decarbonize the country. It's about getting the system ready for the electrification of transport as well as the move from gas to electric and ground-source heat pumps."

It is also supporting decarbonization through its retail business, he adds. "We want to bring our customers on this journey with us. Things like transport and heat have a big impact on people's lives and we need to make it easy to change. For us, it's about innovation and investment, creating new products and making them the obvious choice. When people look to change their cars, let's make it simple to choose an electric one because of an extensive charging network and because charging with green electricity is cheaper than gasoline. When they are looking to replace a boiler, we need to have invested in innovation and manufacturing to lower the cost of electric heat pumps. ScottishPower is in a good place to do that: we understand the whole process and are totally focused on delivering net zero."

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The North East of Scotland is fast becoming a globally integrated hub for driving energy toward net zero and the most attractive place in Europe for businesses working with low-carbon energy technologies.

The focal point for this dynamic cluster is the Energy Transition Zone (ETZ), a 40-hectare site in Aberdeen that lies alongside the city's new £400-million deep-water South Harbour. Established in April 2021, ETZ Ltd is a private-sector-led not-for-profit company that has already secured £60 million in mainly public funding, says CEO Maggie McGinlay. "Our mission is to ensure ongoing sustainable economic growth for the region. ETZ Ltd is an enabler, using our funding to make things happen quickly. We're investing in the land and onshore infrastructure to attract new companies focused on high-value manufacturing, as well as supporting our world-class oil and gas supply chain to transition to new opportunities. We're repositioning the North East of Scotland from the oil and gas capital of Europe to the net zero energy capital of Europe, and we have the tools at our disposal to achieve that."

"We're repositioning the North East of Scotland from the oil and gas capital of Europe to the net zero energy capital of Europe, and we have the tools at our disposal to achieve that."

Maggie McGinlay, CEO, ETZ Ltd

The most prominent of those tools is the strength and expertise of the region's hydrocarbon industry, its workforce and suppliers, she states. "Aberdeen has a 50-year history in offshore oil and gas, and has demonstrated an inherent pioneering attitude in terms of technology, innovative processes and talent development. We aim to build on the significant capital investment of the energy giants and tier-one companies with a large footprint here, many of which are now focusing on low-carbon opportunities. We're also bringing on-board the hundreds of entrepreneurial and innovative small to medium-sized supply chain companies in the region. All the valuable skills and know-how that have been invested in North Sea oil and gas mustn't be lost, rather they should be applied to accelerating the energy transition."

January's ScotWind auction for 25 GW of offshore wind developments in the North Sea has heightened investor interest in the zone. "About 70 percent of the projects are within 100 nautical miles of Aberdeen and can be easily serviced from here. The projects are a mixture of fixed, which we have substantial capabilities in, and floating, which is a genuinely exciting opportunity. Around 75 percent of global subsea engineering capability is based in our region, while the world's first and largest floating offshore wind farms are cur-



Aberdeen's new deep-water South Harbour

rently operating in our seas," reveals McGinlay. To capitalize on this potential, a dedicated Off-shore Floating Wind Campus is being developed within the ETZ that will include the £9-million National Floating Wind Innovation Centre, she says. "Other new energies Aberdeen has strong capabilities for that are attracting investments include blue and green hydrogen, plus carbon capture and storage (CCS). The region has all the right ingredients for these technologies. We have the knowledge and expertise, the financial capital, the offshore infrastructure and assets are in place, and we have a stellar record in delivering offshore solutions."



Maggie McGinlay
CEO
ETZ Ltd

Aberdeen also offers innovative companies excellent research partners and startup accelerators. As well as two local universities with a focus on energy, the city is home to the Net Zero Technology Centre that was created in 2017 with £180 million in public funding. "Our initial aim was to maximize the potential of the North Sea, but that very quickly evolved to championing and driving an affordable energy transition. The technologies we develop and deploy now are concentrated on emissions reduction in oil and gas, energy system integration and a digital, automated future," says CEO Colette Cohen. The center wants to create the first smart basin in the North Sea, she states. "We've made great progress with the oil and gas industry in digitalization; building digital twins, enabling production optimization and the smart management of asset systems using predictive analytics. Some of the other interesting projects we're working on include the reuse of hydrocarbon facilities for carbon sequestration and totally disruptive technologies for offshore green hydrogen."

According to John Morea, CEO of SGN, the U.K.'s second-largest gas distribution company with about 5.9 million customers, "Hydrogen presents one of the opportunities for our business to play a real part in the energy transition, specifically for industry, transport and domestic heating. One project we're involved in is piping hydrogen from Aberdeenshire's St Fergus gas terminal, which will enable us to start blending it with our natural gas to lower its carbon intensity. We're also lucky to have highly talented engineers in Aberdeen who are working with us on a world-first scheme to create, store and supply 1,000 homes with 100-percent green hydrogen."

SGN has invested in biomethane plants as well, including 12 in Scotland that utilize whisky and beer production waste, says Morea. "We won't rest until we've helped the U.K. meet its ambitions to get to net zero. For example, we're doing a lot of work with the Scottish engineering company Wood on what it would take to make the country's gas system carbon free."

Headquartered in Aberdeen, Wood is one of the world's leading end-to-end consulting and engineering companies, with a workforce of over 40,000 professionals spread across 60 countries. The firm recorded revenues of around \$6.4 billion in 2021 and has a global reputation for providing innovative solutions to highly complex challenges related to transitioning energy and decarbonizing industries such as energy, power, transportation, water, pharmaceuticals and public infrastructure.



Robin Watson
CEO
Wood

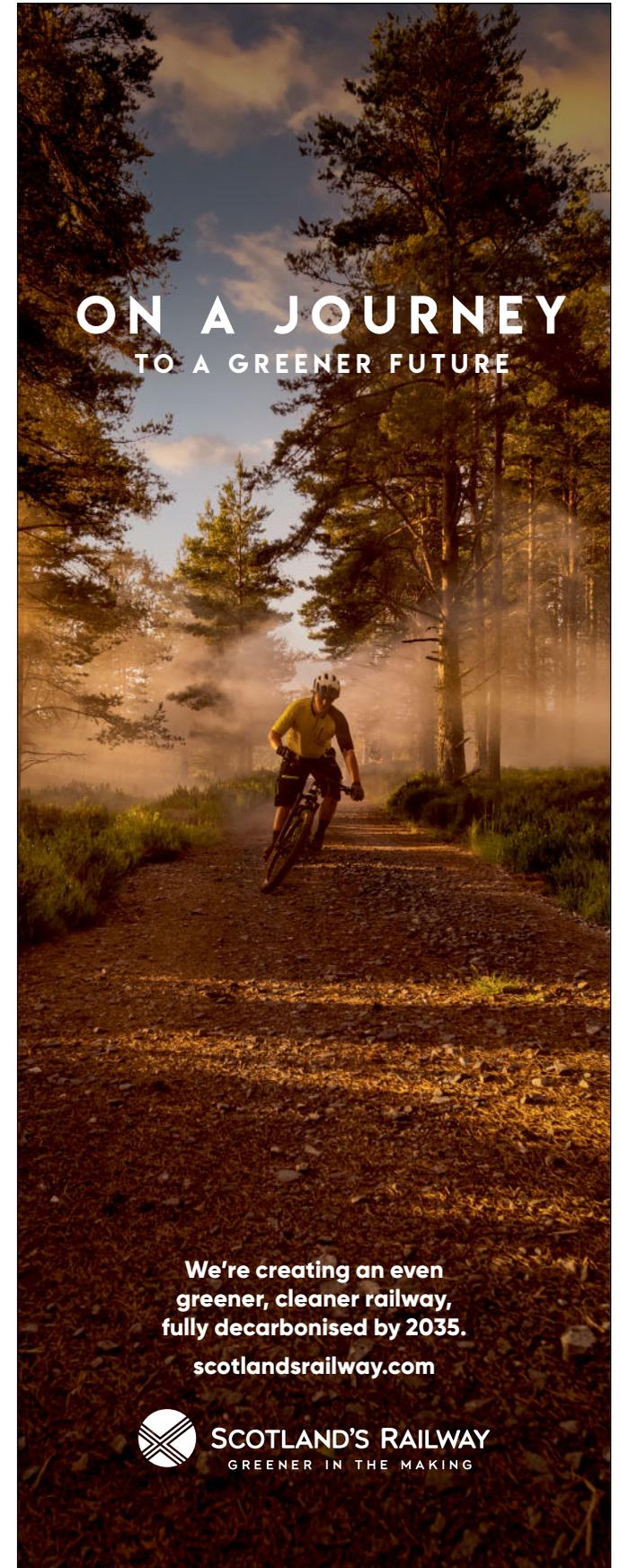
"We have a rich heritage in North Sea hydrocarbons and have grown organically and through acquisitions over the decades. A pivotal moment came in 2017 when we acquired Amec Foster Wheeler, which served additional geographies and sectors. That doubled our size and we've since reduced our reliance on upstream oil and gas by about two-thirds, while remaining one of the region's biggest employers," explains CEO Robin Watson. During those years, Wood has repositioned itself to address the main issues the world faces, which Watson believes are energy transition, the drive for sustainable infrastructure, the modernization of industry, plus digitalization and future skills. "We now have the right skill mix and capabilities to meet these challenges. For example, in the U.S., where about 35 percent of our workforce is based, a substantial proportion of our projects now concern sustainable energy. We've also recently announced the sale of our built environment business, which will enable us to invest even more on our energy transformation and industrial decarbonization priorities."

"We have over 60 years of experience in hydrogen, 20 years in carbon capture and storage, plus about 15 years in solar, onshore and offshore wind."

Robin Watson, CEO, Wood

Wood is extremely qualified in technologies that could bring net zero. "Obviously we have over 100 years of engineering experience in conventional energy, chemicals, polymers and new materials. However, we have over 60 years of experience in hydrogen, 20 years in CCS, plus about 15 years in solar, onshore and offshore wind as well," asserts Watson. Examples of its latest initiatives include the expansion of a U.S. renewable bio-refinery, project management of a major U.K. industrial decarbonization carbon capture scheme, engineering for the U.K.'s first hydrogen storage and distribution pipeline, adding wind power to a North Sea platform so it no longer burns gas and installing solar panels on European refineries to reduce their carbon intensity.

Watson is convinced that the company's cutting-edge strengths in innovation and digital technologies can expedite the world's net zero ambitions. "Much of what we've already achieved in hostile offshore environments is hugely impressive, and that can be used in wave energy, green hydrogen, wind farms or CCS." In addition to generating its own in-house innovations, Wood collaborates with partners like Honeywell on man-machine interfaces and Microsoft on digital workers and twins, he notes. "There's also a very broad, energetic research and development bed in Scotland, with a lot of interesting things going on in universities. In fact, Wood's consultancy wind business was a spinout from the University of Strathclyde. With some of the best engineers in the world here as well, we can solve many of the challenges connected with energy transition."



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A lighthouse for worldwide decarbonization

Scottish businesses with unique technology solutions are having a big impact on global environments. Here, we describe a few of them

As a global leader in technology that enables decarbonization of the built environment, IES has helped improve the energy performance of over 1 million buildings around the world. We asked CEO and founder Don McLean to introduce the company.



Don McLean
CEO and Founder
IES

Our core Virtual Environment building performance simulation software has supported the energy efficient design and retrofit of individual buildings for 27 years, helping identify ways to maximize occupant comfort, energy efficiency, compliance with building regulations and energy standards. But climate change is having a profound impact on our planet and it's only going to get worse unless we start taking serious action now to decarbonize our built environment, which accounts for almost 40 percent of carbon emissions globally. We recognized that tackling one building at a time was too slow, so we expanded our capabilities. This culminated in the 2019 release of our digital twin technology, the Intelligent Communities Lifecycle (ICL), which produces highly accurate virtual replicas that give people the ability to analyze multiple buildings, communities, cities and the energy networks supporting them. The point is to make the built environment operate as energy efficiently as possible, but it can also address issues like supporting net zero investment decisions; environmental, social and governance reporting; enhancing health, comfort and wellbeing; reducing energy costs; and fuel poverty.

What makes the ICL different to other digital twin technologies?

Whereas most just digitize the geometry of buildings, we also digitize their physics. That makes our technology unique and I don't see anyone being able to match what we are doing for at least a decade. The key distinction with our digital twin is that it not only looks like the buildings, it behaves like the real buildings, responding to different conditions to produce an invaluable digital asset. It's a very powerful and accurate way of modeling buildings that applies physics and precise analysis using real data in combination with other techniques, including machine learning and artificial intelligence. We can model any building or community with such a degree of accuracy that we can answer the questions people need answering to ensure that their building, community or city is performing the best it possibly can. Too often, the building profession uses simplified, quick-fix measures, such as spreadsheets, to make decisions—we're not going to solve climate change with spreadsheets. Methods that involve a lot of assumptions about how buildings will be used lead to embedded problems, which makes them more expensive to decarbonize later on.



Digital twin models that look and behave like real buildings

IES started as a University of Strathclyde spinout and is still headquartered in Glasgow. What role has the nation played in its development?

We've worked with a whole host of public and private sector organizations, cities and even remote island communities across Scotland to help them progress their carbon-reduction strategies. For example, we do a lot with universities, the University of Glasgow in particular. All of their new and refurbished buildings were modeled in our software and, as those come online, the university is using our software to constantly analyze and optimize building performance, detect operational faults and identify where further energy, carbon and cost savings can be made.

We believe the more we can do here, the more Scotland can be a lighthouse for our technology internationally. Indeed, we're seeing significant growth and rapid global expansion, with the company now having offices in Ireland, the U.S., Australia, Singapore, India and we're just about to open one in Canada. We're also starting to make traction among Fortune 500 companies. They're starting to understand the extent of what we can do and how they can use us in decarbonization. Our partnerships with larger companies are helping to accelerate the uptake of our technology. We're no longer just pushing into the market, we're seeing a pull toward our technology too.

“Climate change is having a profound impact on our planet and it's only going to get worse unless we start to take serious action now to decarbonize our built environment.”

Don McLean, CEO and Founder, IES

What are the main challenges you face?

The use of our technology requires a reasonable amount of expertise. We estimate that there are only about 20 thousand people worldwide that use our software regularly and there's a lot of headhunting that goes on to pick up those people. To address this, we've forged relationships with universities around the world to help implement training so that students graduate with the ability to immediately start making a real impact within the built environment. It's key for universities to train people that can then take those skills to train more people, so the technology proliferates faster. Because it's so unique, and the climate-change timeframe is so limited, it needs to reach as many people in as short a period as possible. The world needs to act now and accept that we all need to take responsibility for decarbonization. Hopefully, by working together and with the support of the right technology, we can turn the tide before it is too late. IES's mission is to get the right technology into people's hands.

Engineering a sustainable future

Ever since James Watt's pioneering development of powerful, affordable steam engines that kick-started the first industrial revolution, Scottish engineers have been catalysts for change. An organization that illustrates the nation's remarkable history in the sector better than most is The Weir Group, as CEO Jon Stanton reveals: “It was formed by two brothers, who invented a revolutionary pump for steamships, an innovation that had a key role in Glasgow becoming the world's largest shipbuilding city. 150 years later, we're still based in Glasgow.” Throughout the decades, Weir has proved adept at redirecting its activities to address new global challenges, says Stanton. “We invented the first desalination plant in the 1880s, for example, and when oil was discovered in the North Sea, we provided innovative solutions that helped develop that industry. Over time, we became diversified, but we've recently focused on mining, which was where we saw the greatest growth potential.”

“As the world looks to decarbonize and electrify, it needs much more copper, nickel, cobalt, lithium and other metals that go into renewable energy infrastructure and batteries.”

Jon Stanton, CEO, The Weir Group

Today, Weir's 11,000 employees support 5,000 mines around the world. “Essentially, our products help dig rock out of the ground, make big rocks into small ones, get concentrates or end products out of those rocks and manage the waste byproducts,” he explains. The group generated revenues of £1.9 billion last year, with the global push for sustainability being a major contributor to increasing demand for its engineering expertise, the CEO discloses. “As the world looks to decarbonize and electrify, it needs much more copper, nickel, cobalt, lithium and other metals that go into renewable energy infrastructure and batteries—for instance, an electric vehicle requires four times as much copper as a traditional car. The world is mining roughly 20 million tons of copper a year at the moment, which will probably have to rise to over 30 million tons to satisfy demand over the next decade.”

At the same time, mining companies are aiming to boost their own sustainability credentials, he adds. “The industry uses a lot of energy and water, produces a lot of waste and impacts local communities. As an innovative engineering group, it's a tremendous opportunity for us to help customers maximize production volumes, while also reducing their carbon footprint and environmental impact. We have a pipeline of sustainable solutions in development that will reduce their energy and water consumption, which include a novel way of grinding rock into a fine powder. It's 40 percent more energy efficient than existing technologies and uses no water.” The group collaborates on research and development with academic institutions worldwide, particularly the University of Strathclyde, where the Weir Advanced Research Centre is based. “That's where we do our blue-sky thinking, in terms of material science and other technology advancements that could make mining smarter, more efficient and sustainable. For instance, we're working on things like self-healing rubber and robotics, as well as deep sea and asteroid mining,” states Stanton.

Another area that Scotland excels in is photonics, an industry that currently contributes £1.2 billion to its annual economy. “It's not a sector many are aware of, but it's vitally important for modern-day living. Photonics refers to technologies connected to the generation, manipulation and storage of light that are incorporated into a vast number of everyday products and devices, such as mobile phones, cameras, lasers, imaging and scanning systems. Pho-

tonics is also going to be an essential element in the delivery of net zero, due to its use in things like lidar, which maps the effects of severe climate events with light, photovoltaics, optical systems that inspect wind turbines and energy efficient LED lights,” says Alastair McInroy, CEO of trade body Technology Scotland. The nation's photonics cluster contains globally renowned home-grown companies. One is M Squared Lasers, a developer of award-winning laser platforms that utilize photonics and quantum technology, which have led to breakthroughs in areas as diverse as dementia, cancer diagnosis, whisky maturation and next-generation space propulsion. M Squared's technologies are also used by organizations such as the European Space Agency to provide critical climate and greenhouse gas emission data.

A second example is Intelligent Growth Solutions (IGS), a prominent photonics player in the country's expanding agritech scene. IGS raised £42 million in a 20-times oversubscribed Series B funding round last year. “We're the world's biggest vertical farm technology company. A major advantage of our farms is our unique method of powering LED lights that is energy efficient, prevents flickering and can mimic sunlight,” says CEO David Farquhar. “We also have an automated robotic handling system to manage the crops, so no workers need to go into the growing area. That reduces farming costs, plus it means pests and diseases aren't brought in, hence we don't need to use chemicals. In addition, ventilation and irrigation systems mimic wind and rain, while our software manages everything in the cloud. It's extremely sophisticated technology, but easy to operate,” notes Farquhar. He would like to see an extensive network of vertical farms around Scotland in both urban and remote rural settings. “That would remove the need for many imports and, if they were powered with Scottish renewables, we would have a very reliable, high-quality supply of locally grown, completely green food.”



Transforming infrastructure for the 21st century

Backed by strong investment in local innovation and development, a green revolution is taking place in Scotland's transport and water systems

Scotland is on a mission to decarbonize transportation, currently the largest contributor to its greenhouse gas emissions.

Its targets—which include reducing the sector's emissions 75 percent by 2030 and reaching net zero by 2045—are more ambitious than many other countries, while its strategy may be unique, says Stuart Greig, director of low carbon economy at government agency Transport Scotland. "It's a pivotal sector in the transition because it touches on everyone's life, every day. What we're doing that's different is focusing on how to redesign the system to remove negative climate and social impacts. We're massively upping our investment in active travel options, such as walking, cycling and public transport, Over the next few years, active travel will have 10 percent of our budget, which is in excess of £300 million per annum. We're also rethinking the purpose and design of city and town centers, thinking not just about the journeys made, but why they are being made."

Transport Scotland is investing heavily to embed innovative zero-emission technologies in the transport system as well, he says. "The transition to electric vehicles (EVs) is not something that's on the horizon, it's right here. We have one of the best EV charging networks around and there are hundreds of electric buses coming onto the road, as well as hydrogen buses. We're also working hard on vehicles that really need technology breakthroughs—for example, we've supported the rollout of some of world's first hydrogen-fueled garbage trucks and emissions-free fire engines."

The nation is now recognized as a leading destination for innovation and investment in zero-emission mobility, states Greig Coull, CEO at the world-class Michelin Scotland Innovation Parc (MSIP) in Dundee on the east coast. "Scotland is the ideal breeding ground for innovation and moving things forward. We're just the right size, have a collective ambition, and public and private sectors work in harmony. It's important that companies, entrepreneurs and academics have the opportunity to meet, ideate, prototype, test, develop and scale. MSIP is this hub for sustainable mobility and decarbonization, it's a melting pot that can spark the fire of innovation and advance initiatives rapidly." Covering 32 acres of land, MSIP was established in 2020 by three equal partners: Michelin, the economic development agency Scottish Enterprise and Dundee City Council. It offers flexible space for all sizes of innovative manufacturing businesses, excellent infrastructure, testing facilities and on-site green energy in the form of wind turbines, provision for solar power, plus a hydrogen production and refueling station that is being installed. "There's a lot



Stuart Greig
Director of Low Carbon Economy
Transport Scotland



MSIP is investing £20 million on its 32-acre site in Dundee



Greig Coull
CEO
Michelin Scotland
Innovation Parc

of interest in the available space, but we're sticking closely to our mission and being selective about who we work with," Coull reveals.

MSIP is proving to be attractive to companies operating in a number of sectors. These include hydrogen vehicles and the gas's supply chain, the decarbonization of heavy duty vehicles and rail. Indeed, among tenants that have moved in or reserved space is Ballard Motive Solutions, which has created one of the world's first hydrogen-powered demonstration trains, he says. "There's also some extremely innovative battery technology being scaled here, as well as projects for reusing and recycling batteries." Later this year, MSIP is opening a Skills Academy to deliver training in some of these new technologies and an Innovation Hub, which will include design labs, hot desks, meeting spaces and a digital suite.

The parc is already providing extensive support to entrepreneurs and start-ups through, for instance, an accelerator program and innovation challenges that are focused on decarbonization. According to Coull: "There's significant

"There's significant funding available in Scotland for businesses of all sizes with the right ideas, technologies and concepts."

Greig Coull, CEO, Michelin Scotland Innovation Parc

funding available in Scotland for businesses of all sizes that can demonstrate the right ideas, technologies and concepts to go forward. MSIP doesn't fund directly, but we advise companies on what's available and how to access it. Having Scottish Enterprise as one of our partners and very close links with Transport Scotland helps us break down barriers quickly." As well as collaborating closely with government bodies, universities and the local community, MSIP is allied to Michelin-associated innovation centers in France and Germany, plus the Net Zero Industrial Cluster Exchange, a joint initiative between the Scottish government and Société Michelin that connects organizations and cities around Europe.

Coull is keen to point out that the main purpose of the parc is to turn ideas into commercial reality. "This has always been a nation of inventors. The difference this time is that, instead of its knowledge being dissipated around the world, Scotland is committed to developing and growing its innovation here. That makes investing in Scotland a very attractive proposition."

The nation's extensive air transport sector has a crucial role in facilitating that investment, says Derek Provan, CEO of AGS Airports, the operator of Glasgow Airport, Aberdeen Airport and Southampton Airport in England. "Our key aim is to create connectivity that drives inward investment, tourism and trade." Glasgow Airport is the country's principal long-haul hub, as well as its second-largest export facility after Grangemouth seaport. It was also the main landing point for international attendees of 2021's United Nations Climate Change Conference, he comments. "Our operation went extremely well, even though the number of world leaders we expected to welcome went up from around 50 to over 90 at the last minute. Interestingly, many attendees were visiting Glasgow for the first time and some had assumed it was a very industrial city. By the time they flew out, they'd realized it's actually a city of academia, tech and finance now."

In 2019, Glasgow Airport carried over 9 million passengers and Aberdeen Airport nearly 3 million. Those figures collapsed in 2020 due to COVID. "This year, we could see around 60 percent of 2019's numbers and we forecast getting back to that year's level around 2025. But the aviation industry is resilient. Every time we come through a crisis, we come back better, and I'm confident the industry will deliver what the country needs moving forward," Provan asserts. One thing AGS is setting out to deliver is sustainability, he notes. "People want to travel by air, but that can't be at the expense of the planet. Our airports are carbon neutral and we have a roadmap for all carbon emissions directly resulting from our business to reach net zero by the mid-2030s. As part of that, we're developing one of Scotland's largest solar farms on Glasgow Airport's doorstep and we've created a consortium to place small wind turbines by the side of runways, for example. Scottish airports could also be pioneers of sustainable fuel

technologies. We have short flights from the mainland to islands that would suit electric planes and a hydrogen-powered plane will soon be trialed here."

With almost 14.7 million passengers in an average year, Edinburgh Airport is Scotland's busiest air transport hub. It is currently constructing a solar farm on its site that will provide 26 percent of its energy needs, according to CEO Gordon Dewar. "Our operations are already carbon neutral and, while we are proud of that, we know there's more to do for the greater good of Scotland. Our sustainability strategy is about more than just carbon; it's about making our business sustainable and a social and economic asset that serves future generations."

Scottish Water, the publically owned company responsible for supplying water and wastewater to the nation's households, is focused on the future-fitness of its business and infrastructure as well, says CEO Douglas Millican. "We're investing well over £700 million a year in our infrastructure and systems. Scotland has an abundance of water resources, with approximately 30,000 lochs and many rivers. Despite that, we face challenges, the biggest of which is adapting to climate change. We're experiencing more intense storms, for instance, where the volume of water hitting the ground is higher than it was historically, and when that drains away, it puts pressure on our sewer system. We need to make sure that, irrespective of what the climate throws at us, we keep delivering the services our customers depend upon." Scottish Water is also working with new technologies to reduce the carbon intensity of its construction projects by 75 percent and aims to be net positive for carbon emissions, he states. "Already, wind turbines on our estate are producing more than twice the electricity we consume ourselves. Scotland is becoming a real exemplar in environmental performance and we want to be at the forefront of the nation's ongoing green revolution."



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Rail leads the economy away from fossil fuels

Over the past decade, Scotland's Railway has been transforming the service it offers customers throughout the nation

From investing in new trains and reopening long-closed railway lines, the rail industry in Scotland has been growing capacity, introducing new services and cutting journey times across the country.

Rail is a key contributor to Scotland's economic and social development, supporting over 13,000 direct jobs and creating opportunities for Scottish companies and suppliers of all sizes. Scotland's Railway—a partnership between Network Rail Scotland and ScotRail—encompasses some of the most remote parts of the U.K. network and some of its best-known landmarks, such as the Forth Rail Bridge and Glenfinnan Viaduct, which plays a starring role in the Harry Potter film series. The railway links Scotland's seven cities as well as servicing the needs of hundreds of towns and rural communities. Each year, over £1 billion is spent operating, maintaining, renewing and enhancing Scotland's rail network.

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The redeveloped Glasgow Queen Street station

For over a decade, Scotland's Railway and the Scottish government have placed a strong focus on expanding rail travel into new communities and reconnecting parts of the country cut off from rail by the Beeching closures of the 1960s, which saw tracks ripped up across Britain. In the central belt between Edinburgh and Glasgow, the line from Airdrie to Bathgate was reopened in 2010, creating a new direct rail route between the country's two biggest cities. A new 35-mile line into the Scottish Borders, between Edinburgh and Tweedbank, followed in 2015, helping to fuel economic growth by opening new commuting, social and educational opportunities and making it easier for tourists to reach historic sites in the south east.

Investment in new lines is ongoing, with work underway on the Levenmouth Rail Link, which will reconnect the Fife coast to the network and create two stations, while a new station for Inverness Airport will boost growth in the Highlands. New stations at East Linton and Reston will be completed by 2023 as well, improving travel links for communities to the east of Edinburgh.

As the greenest form of mass public transport, the rail industry in Scotland has also long been focused on electrifying urban centers and key commuter routes. Since 2007, government investment of over £8 billion has been committed to electrification projects and new, greener train fleets. Between 2014 and 2019, 325 kilometers of Scotland's central network were electrified and 75 percent of Scotland's Railway's customers now travel on zero-emission trains. Electrification has been extended up to Stirling and between Glasgow and Edinburgh, via routes to the north and south of the cities. In the future, more electrification work will see even greater decarbonization of the network.

Scotland's Railway has been going green for six decades since the electrification of the west coast main line from Glasgow to London in the 1960s. "Today, Scotland's Railway has one of the U.K.'s largest electrified networks outside London, but we've not just decarbonized rail transport, we've made it vastly better. It's now modern, clean and dependable," says Alex Hynes, managing director of Scotland's Railway. Over the next three years, the Barrhead and East Kilbride lines, to the south of Glasgow, will be the latest to see electric trains introduced, and planning is also underway to decarbonize the Borders railway and services in Fife.

Beyond the central belt, the industry is examining a range of options for removing diesel trains from the network and, while some form of electrification is the most likely solution for the main lines to Inverness and Aberdeen, elsewhere more innovative options may be employed. For the Far North line



Alex Hynes
Managing Director
Scotland's Railway



75 percent of passenger services have been electrified

to Wick and Thurso, the Kyle-of-Lochalsh line and the scenic West Highland lines to Oban and Mallaig, hydrogen- or battery-powered trains are likely to be the most viable options due to availability of power supplies and the impact on the landscape of overhead power cables.

The U.K. government has challenged the U.K.-wide rail industry to remove all diesel trains from the network by 2040, but the Scottish government has set an even more ambitious target for Scotland: to decarbonize domestic passenger services by 2035. Scotland's Railway's decarbonization team is in the midst of developing and delivering a program of infrastructure projects to support this ambition. During the development phase, we are looking to design out problems and unnecessary scope, and believe we can deliver this program over its lifetime with significant efficiencies.

The switch to greener forms of power is not just limited to passenger train operators, freight companies too are finding ways to go green, with more electric freight locomotives and moves into trialing hydrogen, battery-powered and hydro-treated vegetable-oil fueled engines. More than 45 percent of freight journeys already run electric in Scotland, and even a diesel freight train is far less polluting than moving goods by road, emitting just a quarter of the carbon dioxide (CO₂) of the equivalent road journey.

"We've not just decarbonized rail transport, we've made it vastly better. It's now modern, clean and dependable."
Alex Hynes, Managing Director, Scotland's Railway

While rail contributes just 1 percent to the U.K.'s total annual greenhouse gas emissions, the industry is well placed to help lead the wider economy away from its reliance on fossil fuels. Rail is in the unique position of currently being the only mode of transport capable of moving both people and heavy goods using a zero-carbon solution. As a result, the railway has huge potential to play a vital role in decarbonizing the economy by providing reliable, green transport for individuals and industries alike. In 2020, Scotland's Railway moved more than 4 million metric tons of goods—the equivalent of 170,000 lorries—and has ambitious plans to grow the freight sector. "Each freight train takes 76 trucks off the road and, if just 10 percent of Scotland's heavy goods vehicle movements were switched to rail, it would reduce almost as much annual CO₂ emissions as the entire rail industry emits," states Hynes.

Off the tracks, Scotland's Railway is looking at how to reduce the carbon footprint of its offices, depots, stations and other infrastructure. It is focused on taking a whole-business approach to identifying ways to reduce its impact on

the environment. The railway is embedding circular economy principles in the early design of projects and conducting material and waste management plans for all major investment works. At the recently redeveloped £120-million Glasgow Queen Street station, for example, more than 95 percent of the demolition material produced during the rebuild has been recycled into a range of sectors including house and road building projects and the bio-mass industry. Some of it even returned to Scotland's third-busiest station for reuse as part of the aggregate base layer for the new building. The carbon footprint of the demolition work was also significantly reduced by carrying out the recycling within Glasgow.

The railway is refining its approach to interacting with Scotland's nature as well, with a dedicated team of ecologists working to help limit its impact on wildlife. With a network covering over 2,800 miles of track, much of it running through countryside and farmland, the railway plays host to a diverse range of wildlife. From replanting native trees and shrubs to offset the effects of necessary tree felling near the tracks to installing bat and bird boxes in areas where trees have been removed, the railway is working more closely than ever to promote biodiversity and the sustainable management of its infrastructure.

Additionally, the wider challenge that Scotland's changing climate presents to railway infrastructure is being addressed and, between 2014 and 2024, over £250 million will be invested in earthworks, drainage and bridge strengthening projects around Scotland. The industry is also using new technologies and monitoring techniques to make the network more robust. For instance, Scotland's Railway is the first part of the U.K. network to establish a full-time, 24-hour weather monitoring team within its route control room. As the country continues to recover from the impact of the COVID-19 pandemic and works to meet the climate challenge, Scotland's Railway is ready to play its part.

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Scottish degrees: A badge of excellence

Scotland is home to an outstanding network of 19 first-class universities, each of which has a highly distinctive positioning

“University excellence is one of Scotland’s key distinguishing factors and critical competitive advantages,” says Alastair Sim, director of Universities Scotland, which represents the sector.

“The success of our universities is important for the success of Scotland as a nation that attracts international talent and investment. Crucially, the sector includes diverse institutions with diverse strengths, from great research-intensive universities that are among the world’s top 100, to modern universities with brilliant applied courses, which are developing people with genuine talent for all types of exciting new disciplines.” Brexit has presented challenges, he comments. “We don’t yet know if we will be able to take part in the European Union (EU) Horizon research program and regret this hasn’t been finalized. In addition, EU students now pay fees, whereas previously they attended for free, as Scottish students do. However, EU students are still coming, because our universities remain brilliant, extraordinarily stimulating places to be.”

According to Sally Mapstone, principal and vice-chancellor at the University of St Andrews, one reason Scottish degrees are internationally attractive is that they are usually completed in four years rather than the standard three in England and other countries. “Students have a distinctive opportunity to avail themselves of two years where they can take a variety of subjects and then they can build on their majors in the two final years. That’s really beneficial to the learning experience.” Located in Fife on the east coast, the world-renowned University of St Andrews is Scotland’s oldest university and nearly half of its current 10,425-strong student body hails from abroad, she says. “They come from over 130 countries, with 16 percent coming from the U.S. Our high-quality degrees are incredibly appealing to a wide range of students.”

Last September, the University of St Andrews was ranked first in the U.K. for student satisfaction and academic success in The Times and The Sunday Times Good University Guide. “It’s the first time in 30 years that any university has displaced Oxford and Cambridge, which has a lot to do with us offering a research-informed, education-intense student experience,” explains Mapstone. With strengths in liberal arts and sciences, it is increasingly entrepreneurial, she says. “Our new Eden Campus has space and facilities to bring together synergies between education, research, invention, small and medium-sized enterprises (SMEs), plus local, national and global businesses. Among the technologies we’re going to be developing are next-generation batteries for electric transport and we’ve begun a hydrogen accelerator program.”



Sally Mapstone
Principal and Vice-Chancellor
University of St Andrews



Students in the King James VI Library, University of St Andrews

She is delighted that the University of St Andrews is now being recognized for not only its world-leading status, but also its commitment to sustainability and social responsibility. “The university system in Scotland is small enough for us to act together effectively. In the past five years, our universities have dramatically widened access for students from disadvantaged backgrounds in a way that hasn’t been achieved in England. The sector offers hope for future generations of students, society, the world in terms of the fruits of our research, and it also offers a model for how global institutions can function in a manner that is collegial, ambitious and inventive. In the post-pandemic world, we need institutions that transcend nationalism to focus on the greater good. Scotland’s universities do that better than any others, in my opinion.”

Richard A Williams, principal and vice-chancellor of Heriot-Watt University, agrees. “Scottish universities are at the forefront of shaping the future and training people for that future.” With five campuses in Scotland, Dubai and Malaysia, as well as 40 percent of its students studying remotely, 200-year-old Heriot-Watt stands out as a highly international educator. “We’re wholly integrated and students can spend time in any of our locations, while our degrees don’t specify where they studied,” he says. Heriot-Watt is possibly best known for its fostering of future business leaders and as a boutique engineering

“We need institutions that transcend nationalism to focus on the greater good. Scotland’s universities do that better than any others.”

Sally Mapstone, Principal and Vice-Chancellor
University of St Andrews

university. “We’re globally prominent in oil, gas and new energy technologies, such as floating renewables, for example. Another strength is marine sciences, particularly sustainable fishing and the development of marine communities,” notes Williams.

“Right now, Scotland is a country with universities that are all set to help deliver a transition to a sustainable and fair future,” adds Iain Gillespie, principal and vice-chancellor at the University of Dundee. He describes that institution as: “A campus university in the heart of the city, which is triple intensive in research, teaching, enterprise and engagement. We’re extremely well rated for life sciences, for instance, with a recent Clarivate pharmaceutical industry survey suggesting we’re the most influential university worldwide for delivery of that business. Scotland has seven or eight strong research-intensive universities, from relatively young ones like Dundee, through to big Russell Group universities. For a nation of our size, that’s phenomenal.”

The elite Russell Group of universities are the U.K. equivalent of Ivy League schools. Two members of the group are Scottish, one of which is the University of Glasgow. “We’ve always been a world-changing university and numerous Nobel laureates have come out of our university, including last year’s prizewinner in chemistry, David MacMillan. We’re currently 73 in the QS and 86 in the Times Higher Education World University Rankings and we’re consistently in the top 100. We were also named Scottish University of the Year by The Times and Sunday Times Good University Guide 2022,” reveals its principal and vice-chancellor, Sir Anton Muscatelli.



Sir Anton Muscatelli
Principal and Vice-Chancellor
University of Glasgow

The 571-year-old institution offers undergraduate, postgraduate, professional development and a range of other study options that cover an extremely wide variety of disciplines. Every year, around 35,000 students from over 140 countries benefit from education at its city-center campus, the facilities of which are currently being expanded as part of a £1-billion investment program. It currently boasts a global community of over 219,000 alumni, says Muscatelli. “We’re one of the most international universities in the U.K. Roughly 35 percent of our students come from outside the U.K., with our international student population more than doubling in the past decade.”

The University of Glasgow is renowned for both academic expertise and its cross-disciplinary, high-impact research activities that attract over £168 million in grants and contracts a year. “We’re among the top U.K. universities for research intensity and are in the top five for the number of patents granted. Our areas of excellence include precision medicine and chronic diseases, making us one of the strongest universities for life sciences and biomedicine in the U.K. We’re also exceptional in quantum technologies, including sensors and imaging that contribute to innovative manufacturing, biomedical technologies and the green transition,” he states.

Another strength is connecting technologies with life sciences. “For example, we host the MRC Centre for Virus Research in conjunction with the U.K.’s Medical Research Council. During the pandemic, it played a major role in sequencing the virus and it will continue to prepare the world for what might come next, as it is at the leading edge of work around COVID in terms of therapies and vaccines,” adds Muscatelli. Across both education and research, the University of Glasgow is also a powerful force in engineering, law, arts and humanities, social sciences, veterinary science, creative industries and it is home to the Adam Smith Business School, which the Financial Times ranks as being among the top 100 management educators in Europe.

Like other leading universities, the University of Glasgow has focused on extending its international connections over the last decade, he comments. “This is possibly the area in which the university has transformed the most. We’re now part of several important global networks, such as Universitas 21, and we’re a member of the CIVIS initiative for European universities. We also have many strategic alliances with universities around the world and have set up transnational education hubs in Singapore and China, where we teach degrees jointly with partner institutions. In total, we have 420 study-abroad and exchange partners.”

The university also nurtures international and domestic partnerships with the private sector. One notable illustration of how Scottish universities are driving the country’s businesses and economy forward is the proactive, catalyzing role it has taken as anchor partner in the Glasgow Riverside Innovation



The University of Glasgow is investing £1 billion in its campus

District (GRID), a new innovation hub in the city, which runs alongside the River Clyde in an area that was previously synonymous with shipbuilding. “GRID’s geographical area extends from our campus to the Queen Elizabeth University Hospital, one of Europe’s largest hospitals, where some of our clinical innovation is based. Within the innovation district, particularly around life sciences and biomedicine, we’ve been developing spaces to allow industry to collocate with us, as well as spaces for our very active spinout companies. We’re about to open a £116-million Advanced Research Centre next to an innovation cluster we’re creating, for instance. This will act as an incubator for spinouts and local small and medium-sized enterprises, as well as housing interdisciplinary themes that interact with industry,” he explains.

The University of Glasgow’s socioeconomic influence on Scotland is already impressive. It directly employs more than 9,000 people, including over 4,800 research and teaching staff, while it also plays a role in widening access to education, Muscatelli comments. “Around 27 percent of our Scottish undergraduate students are from the most deprived areas of the country as we believe education can be a route to social mobility. Additionally, our focus on research has a massive economic impact: a recent study, based on 2018-19 data, showed that our contribution to the Scottish economy amounted to £4.4

“The University of Glasgow embodies a powerful combination of skills, research and innovation that positively impacts our economy.”

Sir Anton Muscatelli, Principal and Vice-Chancellor
University of Glasgow

billion. We’ve grown since then, so that figure will be similar or even higher now. Essentially, the University of Glasgow embodies a powerful combination of skills, research and innovation that positively impacts our economy and society.” It also aims to have a positive impact on the environment. The city is heavily committed to decarbonization, its universities are on the frontline of that commitment and the University of Glasgow itself has a highly ambitious, achievable plan to reach net zero by 2030.

Muscatelli’s goals for the university are for it to continue to be a world-changing institution that tackles global challenges, to help Scotland and the U.K. with their post-COVID economic recoveries and to become even more internationally connected. “We want to work with the very best. Whether you’re a leading company looking to collaborate with our scientific experts or a student thinking about studying in one of the world’s best cities, have a look at what Glasgow has to offer.”

Internationally competitive research programs

As well as being innovative, Scotland's research-intensive universities are people-centric, ambitious, bold and collaborative

"The Scottish higher education system ranks exceptionally highly in terms of global competitors. You can see that in research rankings, publications and student satisfaction," asserts Sir Jim McDonald, principal and vice-chancellor of the University of Strathclyde.

The institution he helms epitomizes that competitiveness. Established in Glasgow city center in 1796, today it has a student body of over 24,000, he says. "We see ourselves as a European technological university based in Scotland with a 225-year history, that's an important part of our identity. However, we seek to drive the place like a startup. We try to be innovative, relevant and we focus on high-quality academic endeavor—but we remain a connected institution, with private and public sector organizations and internationally." The University of Strathclyde is the only institution to be named U.K. university of the year twice in the last eight years by Times Higher Education



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University of Strathclyde has a €300-million research portfolio

(THE), which currently places it fourth in the U.K. for student satisfaction. "We have very high employment statistics, because the graduates we produce are smart, highly motivated and ready for professions," states McDonald.

THE also ranks it in the top 20 for research intensity, he adds. "This year, our research funding portfolio will be around €300 million across our faculties of science, engineering, business, humanities and social sciences," McDonald, who also co-chairs the Scottish Energy Advisory Board, takes the example of low-carbon energy to explain the university's approach to research: "We do world-class work in renewable energy technologies, including offshore wind, smart grids, hydrogen and storage. Alongside, we need to understand the economic, policy and regulatory requirements of a net zero future. We also need behavioral psychology, as the transition won't be achievable unless society engages. We set up clusters of multidisciplinary teams, we do it at scale and we engage with government, agencies and industry."

A few of its other recognized strengths are industrial informatics, artificial intelligence, machine learning, fintech and advanced manufacturing. Throughout its research programs, academics collaborate closely with industry. In this area, as well, the university is an innovator, having pioneered the district model that is an exemplar for extracting economic and social benefit from research. "We have two major hubs: Glasgow City Innovation District and the Advanced Manufacturing Innovation District, which are populated by the academic community, large companies, supply chain partners, entrepreneurs and innovators. Between the two, we will be generating between £2-3 billion gross value added. That's an enormous contribution to the economy and a terrific way for us to attract students and staff," enthuses McDonald.

The University of Stirling is another research-intensive institution, says its principal and vice-chancellor, Sir Gerry McCormac. "We're strong in aquaculture, dementia and better ageing, and we're the regional center for driving a net zero economy. Additionally, we're Scotland's university for sporting excellence and have a presence at an elite level in virtually all sports. For example, our students won medals at the Tokyo Olympic Games, we brought home golds from the Winter Games, plus we produce champions in golf, soccer and tennis." Stirling also offers a unique student experience, he adds. "It's a center for health and wellbeing as well as for athletes. Our 360-acre campus is one of the most beautiful in the world, although I'd be remiss if I didn't mention that our research and education rankings are great as well."



Sir Jim McDonald
Principal and Vice-Chancellor
University of Strathclyde



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Widening access to higher education

Universities are ensuring that students who live in remote parts of Scotland have the opportunity to fulfil their potential

At the forefront of the Scottish university sector's successful efforts to promote inclusivity in education is The Open University, which was founded with the mission of widening access to tertiary-level study 50 years ago.

The university has more than 200,000 students in total, making it the U.K.'s biggest academic institution and the only one with a footprint in all four of its nations, says Susan Stewart, director of The Open University in Scotland. "We offer transformational opportunities for everyone, regardless of their prior educational qualifications, which is quite unique." The university has a worldwide reputation as a pioneering global provider of high-quality, supported online distance learning. Its degrees, qualifications, short courses and skills-based training options can be studied in modules, which are developed by teams of academics, educational technologists and media specialists, she states. "The beauty of our model is that people don't need to move to study with us. We're the fourth-largest university in Scotland with over 20,000 students, 24 percent of them have disabilities and 23 percent live in remote, rural parts of the country."

The model's flexibility also means people can learn when and where they want. "There's no need to take time out of work or other commitments. Employability is another attractive feature: three-quarters of our students study with us to advance or change their career. Whatever their aspiration, with a huge curriculum of over 200 qualifications, there's something here for everyone," notes Stewart. The Open University's expertise in distance learning bolstered Scotland during the pandemic, she reveals. "We've seen a 30-percent growth in student numbers and experienced unprecedented accessing of our free learning platform, Open Learn, through which we rapidly launched targeted short courses to upskill and reskill individuals facing challenges. We also quickly developed micro-credential courses for many industries; curated free online resources for audiences such as the healthcare sector, school pupils and homeschooling parents; and supported other educators to pivot to online teaching."

In addition to helping individuals, society and businesses to navigate the pandemic, the university's continued focus on targeting Scotland's skills gaps in areas like digitalization, coding, business management and the green economy has a substantial economic impact on the country. As do its expansive research activities. The Open University ranks in the top third of U.K. universities for research, which it collaborates on with partners that include the BBC, the National Health Service, the United Nations and NASA. "We're world leaders in space research, while international development and inclusion is another of our many strengths. At a U.K. level, our research addresses government research priorities in each of the four nations and adds more than £72 million to the economy annually," states Stewart.

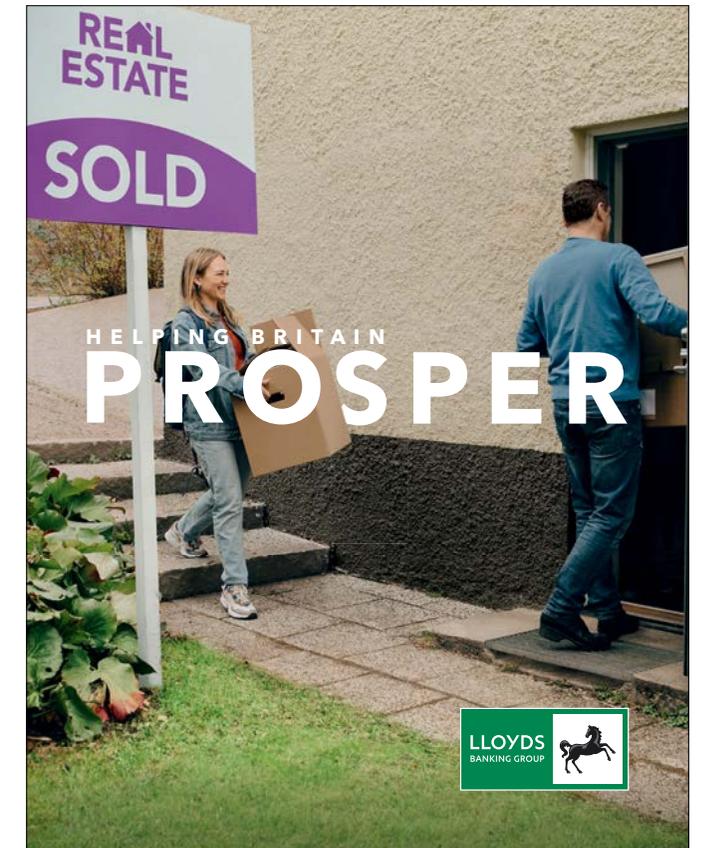


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The Open University makes learning accessible to everyone

Ten years ago, another university opened that also widened access significantly: the University of the Highlands and Islands, which operates 13 colleges and research centers across its region, teaches at many remote learning centers and provides online courses. "Our footprint is probably the size of Belgium and we have about 33,000 students. We design our curriculum to meet needs of communities around our campuses and to transform the lives of our students. We offer further education, apprenticeships, traineeships, undergraduate and postgraduate programs," details its principal and vice-chancellor, Todd Walker.



Susan Stewart
Director
The Open University
in Scotland



Engines for economic and social change

Knowledge transfer and the development of entrepreneurs generate national and global benefits

Universities make a vital contribution to the Scottish economy, while a number of them are also responsible for more localized economic impacts that are equally substantial.

Based at a stunning campus just outside Aberdeen, which QS ranks among the U.K.'s top 10 cities for students, Robert Gordon University is one of those institutions. "We're a major player in economic regeneration both nationally and in the north east of Scotland. Aberdeen is seen as the energy capital of Europe and we have a big role in transitioning some of its industries into the green economy," says its principal and vice-chancellor, Steve Olivier. With 17,000 students on campus and online, the university's 11 academic schools offer an extremely broad portfolio of study options. However, one common thread runs through all its programs: enterprise. "We stand out for our professional focus, business interface and industry connections. In addition, we put tremendous emphasis on creating not just the entrepreneurs of the future, but also an entrepreneurial mindset in all our students. Overall, we punch above our weight in two areas: graduate employability and student satisfaction," asserts Olivier. The sector's main ranking bodies back this statement up. For instance, Robert Gordon University is first in Scotland and second in the U.K. in the graduate employment rate measure, according to QS, while The Times and Sunday Times Good University Guide named it the best modern Scottish university for student experience in 2022 and the U.K.'s top business school in 2020.

The university engages in world-class research that delivers effective solutions for business and industry, comments Olivier. "We're the largest knowledge-transfer partnership provider in the north of Scotland. Our research encompasses four interdisciplinary themes: environment, energy and sustainability; health and wellbeing; living in a digital world; plus inclusive and creative societies." In reality, he adds, "Sustainability in its broadest sense is a focus of all our activities. We collaborate with partners nationally and across the world to solve problems in a wide range of areas. For instance, we've recently looked at the quality of drinking water in Sri Lanka, we've been transforming the logistics supply chain in the North Sea, we have projects on sustainable cities and long COVID, and our school of engineering is working with the governments of Mexico and Algeria on issues related to their energy sectors." The real-world applicability of its research was illustrated in 2021, when the university and its industry partner Scotmas won Innovation of the Year at the Scottish Knowledge Exchange Awards for their collaborative development of a novel technique for producing disinfectants without harmful by-products.

Two of Robert Gordon University's research facilities in particular are regarded as global centers of excellence. One, the RGU Energy Transition Institute, is helping offshore energy industries in the North Sea and around



RGU campus offers a wonderful study and leisure environment

the world to address challenges and opportunities they face. The National Subsea Center, on the other hand, works with partners in all sectors to develop game-changing digital and smart solutions that can sustainably realize the economic potential of oceans.

Its university-wide Entrepreneurship and Innovation Group has an increasing focus on sustainability as well. Among its many activities is an in-house startup accelerator program that is open to both internal and external entrepreneurs, states Olivier. "Each edition of the program is themed and the most recent one was for projects that solve global challenges—specifically, reducing inequalities, responding to COVID-19 and innovations around mental wellbeing. We give entrepreneurs that get onto the program guidance and mentoring, while the best ideas get seed funding, workspace and other benefits. In 2020, we were shortlisted as the U.K.'s outstanding entrepreneurial university of the year by Times Higher Education." Innovative projects the university is currently accelerating include an e-energy app that helps customers calculate the



Steve Olivier
Principal and Vice-Chancellor
Robert Gordon University

"Aberdeen is seen as the energy capital of Europe and we have a big role in transitioning some of its industries into the green economy."

Steve Olivier, Principal and Vice-Chancellor
Robert Gordon University

price of locally installed renewable technologies, a vertical farming concept for former industrial spaces, a zero-carbon smart plugin energy storage boiler and a real-time emission monitoring solution that uses drone technology.

Despite its location on the nation's northern coast, Robert Gordon University attracts many international staff and students. "Aberdeen is a terrific, cosmopolitan city that has always had an international outlook, while the university is a great, collegiate place to work. We currently have students from 153 countries and our international recruitment has shot up in the last two years. That's partly because of our reputation for employability and student satisfaction, but also some of our very specific programs and courses. Scotland and Robert Gordon University are excellent places to study. Here, you are imbued with the spirit of curiosity, you will learn and you can be successful in whatever field you choose," he concludes.

According to Sir Paul Grice, principal and vice-chancellor of Edinburgh's Queen Margaret University, "The relative weight of Scotland's university sector puts it right up there with some of the nation's major industries like whisky, oil and finance as absolute engines of economic growth, as well as engines of social change. As such an engine, we at Queen Margaret University strive to make Scotland, the U.K. and the world better, happier, more successful places."

The university has been working toward that goal ever since it was founded in 1875 to help working-class women expand their career options. Today, Queen Margaret University's teaching and research programs are focused on business, creative industries, social sciences and tackling two of Scotland's biggest challenges: education and health. "Educating the teachers and health workers of the future are two of our strengths. Another area where we're making a real difference is food and wellbeing," he says.

With around 4,500 students on its campus, Grice describes the university as being "big enough to make an impact, but small enough to treat each student, member of staff and partner as an individual." 97 percent of its undergraduate students are in graduate-level positions within 15 months of leaving the institution. In addition, he says, "A large percentage of students study for our degrees through our transnational educational partners in, for instance, Greece, India, Nepal and Egypt. That gives us an international perspective, as does the fact that our on-campus student body is truly international."



Sir Paul Grice
Principal and Vice-Chancellor
Queen Margaret University



QMU's campus is 6 minutes by train from Edinburgh city centre

Queen Margaret University's research focuses on projects that bring both economic and societal benefits. "Our Institute for Global Health and Development is recognized worldwide for its work. Additionally, we're a leader in researching person-centered practice and biomechanics in healthcare. We're also doing interesting research around food, such as looking at substitutes for palm oil," notes Grice. Next year, the university is expected to start constructing a new Food and Drink Innovation Hub and a wider innovation park, he adds. "This will provide us with additional potential to partner with industry and to help more small and medium-sized enterprises. We've had a lot of success in that area already through our on-campus business innovation zone that gives entrepreneurs practical support." Most of the startups the university works with are female-led, as it believes entrepreneurial women are under-supported elsewhere, he comments. "That's a huge missed opportunity for the U.K. and we can make an important contribution to redressing the balance."

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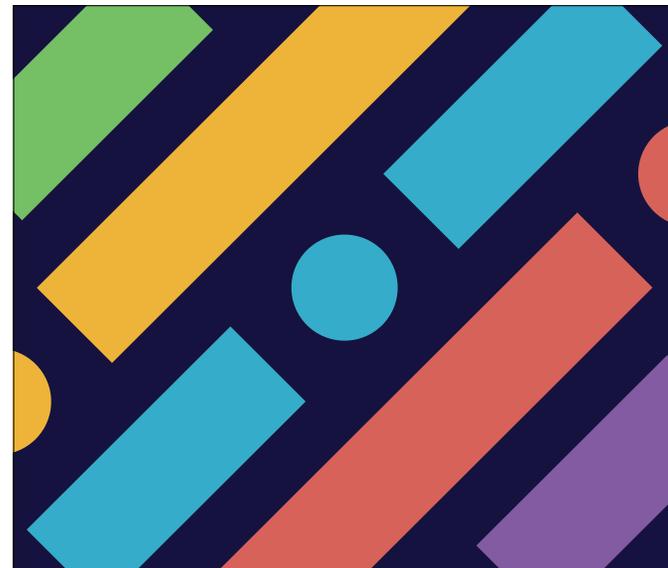
IES

The common good is where it starts and ends

Social innovators in education and research are helping the world to tackle some of the biggest challenges it has ever faced

An excellent illustration of the out-sized global influence of Scottish educators is Glasgow Caledonian University, one of the top 70 universities worldwide in terms of impact toward achieving the United Nations' Sustainable Development Goals (SDGs), according to Times Higher Education.

"We have a strong sense of purpose as a university for the common good. We were aligned to the goals before they had been articulated and were already delivering on climate change, poverty, inequalities and socially responsible business models," explains Pamela Gillies, principal and vice-chancellor. The university's education and research specialties include health, social and life sciences, renewables, engineering, construction, management, business and law, she notes. "What distinguishes our approach is interconnectedness, as every SDG is related to others. With that and a clear eye on the need for impact, you can become fifth in the world for your work on gender equality, as we are."



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GCU is a vibrant, values-led, multicultural university

There are many other examples of how Scotland's leading modern university for research power is impacting SDGs, says Gillies. "We look at engineering and the built environment through a sustainability lens, with an emphasis on how we can promote clean water, energy efficiency and low-emission practices. Our contribution to health is also significant: we produce the largest number of health professionals for the nation, host Health Protection Scotland and we're at the forefront of infectious disease control." Glasgow Caledonian University's innovation generates an annual £1.4 billion for the U.K. economy. "Over 300 businesses work with us in our areas of excellence and we're the leading provider of graduate apprenticeships in Scotland, as businesses know that upskilling workforces is the most cost-effective way of meeting environmental, social and governance challenges. We've also been providing low-cost upskilling with high social impact in Africa for many years."



Pamela Gillies
Principal and Vice-Chancellor
Glasgow Caledonian University

It has nearly 22,000 students, who study at its campuses in the heart of Glasgow, London and New York. Gillies gives one reason why internationalization is important. "COVID made it clear the world has to rebuild community resilience from the bottom up. That's as true in Glasgow as it is in Delhi or New York. We have to reach out and work together to tackle complex problems like health inequalities and climate change. Universities with a commitment to the common good make a huge contribution to communities, not just economically, but in terms of innovation and the development of resilience in the face of some of the biggest challenges the world has ever taken on."

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Scotch whisky: An all-time bestseller

First distilled in the country over 500 years ago, Scotland exports more whisky than Ireland, Japan and America combined

“The preeminent world whisky is Scotch,” says **Graeme Littlejohn**, the Scotch Whisky Association’s director of strategy and communication.



Graeme Littlejohn
Director of Strategy and Communication
Scotch Whisky Association

Global interest in the spirit has grown in recent years, he comments. “People try others, but they always come back to ours. That’s due to heritage, provenance, quality and our unique landscapes producing spirits with so many different characteristics.” In 2021, the country’s 138 whisky distilleries generated 21 percent of all U.K. food and drink exports. Those exports were worth £4.5 billion, 19 percent more than the sector earned in 2020, he reveals. “We export to around 180 markets, with 44 bottles being shipped every second. We’re not back to our 2019 levels of £4.9 billion, but we’re optimistic about future growth.” As well as COVID and Brexit, in 2020 Scotland’s single-malt distillers were impacted by a 25-percent tariff imposed by President Trump as part of a wider trade dispute. Its suspension in 2021 was welcome, he states. “We’re now building back in the U.S., our largest global market by value.”

“We’ve built a diversified portfolio of distinctive, premium quality, great tasting, authentic brands that are rooted in strong traditions.”

Peter Gordon, Director, William Grant & Sons

One reason for expanding interest in Scotch whisky is consumers’ increasing concern about the sustainability of goods they buy. It is crafted from just three ingredients—water, yeast and cereals—and the sector has made significant progress in boosting its sustainability. “39 percent of energy used in production is now from renewables and we’ve reduced greenhouse gas emissions by 53 percent since 2009. In 2021, we launched a new sustainability strategy with targets for, among other things, production to be net zero by 2040 and all packaging to be recyclable, reusable or compostable by 2025,” he notes.

“Scotch whisky distillers often say, ‘We’re friends at the well and foes at the pump,’ strong competitors who collaborate closely on priorities like environmental protection,” asserts Peter Gordon, director of William Grant & Sons, the family-owned distiller that crafts a number of globally iconic spirits. Gordon is a fifth-generation descendent of William Grant and his wife Elizabeth, who, after planning and saving for 20 years, fulfilled their dream of building a distillery in the Highlands in 1886: Glenfiddich. Today, it is the world’s



The first drops of Glenfiddich flowed on Christmas Day 1887



Peter Gordon
Director
William Grant & Sons

leading and most-awarded single malt distillery. “The example they set taught us the benefit of long-term planning and investing through upturns and downturns. They also handed down a belief in education, endeavor and patience—vital virtues for a business based on being innovative, getting the fundamentals of your products right and sticking with something if you believe in it,” he explains. These values have helped the firm to become one of the most respected and successful distillers worldwide, he adds. “Slowly, but surely, we’ve built a diversified portfolio of distinctive, premium quality, great tasting, authentic brands that are rooted in strong traditions.”

In the U.S., William Grant’s single malts are the whiskies of choice for bartenders, mixologists and consumers all over the country. These include the original Glenfiddich, rare and limited-edition expressions of the signature whisky that have been aged for between 12 and 50 years, plus The Balvenie range of handcrafted, luxuriously smooth single malts, which was first distilled in 1892. Their popularity has increased as more consumers appreciate whisky in the same way they have always appreciated wine, explains Gordon. “People now understand what fine whisky is about, the advantages of it coming from a specific place, the way age assists in developing whisky and how it interacts with wood in the cask.” Other highlights in the distiller’s portfolio are award-winning blended whiskies like Grant’s, Monkey Shoulder and the Irish Tullamore D.E.W., Sailor Jerry rum and Drambuie liqueur. However, Gordon states, “Beyond our whiskies, our most important brand in the U.S. is the cucumber-and-rose-infused Hendrick’s Gin, which is distilled and bottled in Scotland. We’re also seeing strong growth with our Milagro tequila range made from Jaliscan blue agave, and our 2020 acquisition of a Mexican tequila distillery shows our long-term commitment to that brand.”

All of its spirits are created by master craftsmen who retain many of the industry’s traditional practices, but who never stop experimenting. Since 2018, for instance, the company has launched eight products, including Fistful of Bourbon, its first American whisky. Gordon feels a strong sense of responsibility as part of the fifth generation of the family to steer the company. “What’s unique about the business is that we are selling many ages of whisky and benefiting from decisions people made decades ago. That makes me conscious of making choices that are right for the long term. We talk within our family about it being a relay race—my purpose is to be able to pass the baton on in better shape than when I received it.”



Littlemill Distillery’s remaining casks are highly prized

With a rich heritage that dates back to at least 1772, Loch Lomond Group is among Scotland’s most historic and lauded independent whisky distillers and blenders. “We have three distilleries, including our iconic Glen Scotia Distillery. In 2021, it was recognized as the Scottish Whisky Distillery of the Year at the annual Scotch Whisky Awards, while the 25-year-old expression of our Glen Scotia single malt was named Best Whisky in the World at the San Francisco Whisky awards last year,” says Colin Matthews, Loch Lomond Group’s CEO. The distillery was founded in 1832 in Campbeltown on the Mull of Kintyre peninsula, an area that was considered to be the whisky capital in the 19th century. Glen Scotia is one of only three distilleries still operating in the region and the range of fine whiskies crafted there have a distinctive taste that offers fruit, caramel and a salty tang of the sea. Another of the group’s distilleries is also unique, notes Matthews. “Our Loch Lomond Distillery houses grain and malt stills. We use the grain in blended whisky and the malt in both single malts and for blending. The key flavor profile for our Loch Lomond whiskies is fruit and honey, with a tiny bit of soft smoke.” In addition, the group has secured the last remaining casks from the nearby Littlemill Distillery, Scotland’s oldest licensed distillery that is sadly no longer standing. Every year, expressions of this stock are released in highly prized limited editions.

“Because of the different types of stills we have overall, we can actively manage our flavor profiles, which makes us the most flexible whisky business in Scotland,” the CEO explains. That has helped to support a diverse portfolio

“The 25-year-old expression of our Glen Scotia single malt was named Best Whisky in the World at the San Francisco Whisky awards last year.”

Colin Matthews, CEO, Loch Lomond Group

of successful brands beyond Glen Scotia, Loch Lomond and Littlemill, such as Spearhead, High Commissioner and Inchmurrin. Loch Lomond Group has also developed award-winning brands with other spirits, he adds. “Glen’s Vodka is the second-biggest vodka brand across the U.K. Our Ben Lomond Scottish Premium Gin has experienced strong growth as well and now comes in a number of flavors, with some of the botanical ingredients being hand picked from the beautiful, wild Ben Lomond mountain that overlooks our distillery. Currently, we’re developing new rums and tequilas, and we’re about to finalize the acquisition of a high-quality champagne winery in France.”

As well as expanding its portfolio, the group has invested heavily in its distilleries and vast bottling plant since it was acquired from the original family owners in a 2013 management buyout led by Matthews. “We still

use traditional methods, but we’re not against modern practices that allow us to make the very best whisky. I’m committed to further investing to constantly improve our quality and our carbon footprint,” he says. Loch Lomond Group has also substantially extended its international footprint over the last decade. “In 2013, our brands were only available in three countries outside the U.K. Today, they are well distributed in 128 countries around the world. In key markets like the U.S., we’ve established our own structures and management, which adds dynamism to our business, and we’ve built a fantastic relationship with Blue Ridge Spirits & Wine Marketing there, which has a strong national distributor network.” One of the group’s strategies for increasing brand awareness is investing in sports sponsorship, Matthews comments. “In golf, for instance, we’ve been a key sponsor of The Open Golf Championship and Women’s British Open for five years. As a result of all our efforts, our brands are stronger and much more visible. Now it’s our job to capitalize on that by driving on with the exciting new projects we have in our pipeline,” Matthews asserts.

Despite having 80-years experience as a respected whisky broker and bottler, Ian Macleod Distillers only acquired its first distillery, Glengoyne, in 2003. “Traditionally, single malt represented a small fraction of the Scotch whisky industry, managing director Leonard Russell reveals. “It now accounts for over 10 percent of sales volumes. There’s remarkable enjoyment to be had from sipping single malt and a good one to start with would be our Tamdhu, as it’s matured in sherry casks and easy to drink—then just follow your nose!”



Colin Matthews
CEO
Loch Lomond Group



A driver for fintech and green financing

One of Europe's leading financial centers, Scotland has a global reputation for expertise and innovation in financial services

Scotland is the U.K.'s second-biggest financial hub and home to over 2,000 local and multinational businesses offering diverse financial services.

"The sector accounts for about 9 percent of Scotland's gross domestic product, with 160,000 direct and indirect employees concentrated in Edinburgh and Glasgow," states Philip Grant, chair of the Scottish executive committee of Lloyds Banking Group, the U.K.'s largest retail and commercial bank and its only integrated provider of banking, insurance and wealth propositions. Under its umbrella are many household names, including Lloyds Bank, Halifax, Bank of Scotland, the nation's oldest bank, and Scottish Widows, the insurance, pensions, savings and investment services specialist. According to Grant, "Scotland is important to us and vice versa. We have around 25 million customers across the U.K. and support about 2.5 million in Scotland. Approximately 150,000 Scottish businesses bank with Bank of Scotland alone; we're



Scotland offers an unparalleled green and healthy quality of life

very aware of the responsibility and importance of the group to Scotland's businesses and economy."

The group is also the U.K.'s biggest digital bank and the pandemic accelerated its development strategy for digital services, he reveals. "It's been a forcing mechanism for simpler and cleaner ways of working and thinking. One opportunity we've taken to speed up simplification and broaden our proposition was our recent acquisition of Embark Group, a fast-growing fintech business with a large site in Dundee." The rationale behind the purchase of Embark and its leading investment platform is straightforward. "The application of its technology will mean we can transform many of our propositions, such as retirement, to give customers more flexibility and choice. It allows us to create a direct-to-consumer investment proposition using the strength of our group brands as well," asserts Grant. Embark is just one of over 175 fintech firms that currently have a base in the country and the sector is growing exponentially, he says. "We're establishing an ecosystem that allows for mutual benefits arising from innovative fintech firms developing alongside established brands and financial services businesses."



Philip Grant
Chair
Scottish Executive
Committee, Lloyds
Banking Group

"We're establishing an ecosystem that allows for mutual benefits arising from innovative fintech firms developing alongside established brands."

Philip Grant, Chair,
Scottish Executive Committee, Lloyds Banking Group

Scotland is also emerging as a center for green financing, he notes. "As a small country with a close business community that's aligned with academia, it's possible to drive these types of initiatives." Lloyds Banking Group itself is helping to make net zero a reality in numerous ways. "For instance, we've tilted pension funds toward sustainable investments and our banking business is targeting companies transitioning to a low-carbon economy with another £5 billion of funding across the U.K., outside of the £8.6 billion we've already distributed in green finance since 2016. We're also the U.K.'s largest funder of electric vehicles, a major lender for renewables projects and we've provided about £1.4 billion to housing associations that is directly linked to environmental, social and governance outcomes. We aim to ensure that all communities have access to financial support to participate in the transition," Grant says.

Financial services with a clear local purpose

From the world's oldest surviving building society to a new national development bank, financial firms are invested in Scottish communities

Scotland boasts a range of financial services organizations that are dedicated to sustaining the nation in highly distinct ways.

One example is the Scottish Building Society that was founded in 1848 and is mutually owned by its 33,000 members, the vast majority of whom are Scottish. "We're the world's oldest remaining building society and we've stuck true to our original business model and purpose," says CEO Paul Denton. That purpose is acting as a safe haven for savings and using the funds raised from those to provide residential mortgages. Everyone who opens a savings account or takes out a mortgage becomes a member of the society, he states. "Because of our mutual model, we don't pay dividends to corporate investors. Instead, our profits are kept for future investment or paid out to our savers."

Awarded Building Society of the Year for the third year in a row at the Scottish Mortgage Awards in 2021, the society's concern for supporting its community was evident throughout the worst of the pandemic, when it banned repossessions and gave extended mortgage breaks to hard-hit members. "COVID was disruptive, however despite record-low interest rates, 2021 was our most successful year ever for profits. Stamp duty relief created a surge in demand for new mortgages, while most households actually increased savings during the crisis and that helped our funding. In 2020 alone, we grew our mortgage book by 22 percent. We're not the U.K.'s biggest building society, but we saw higher growth than any other that year," asserts Denton.

"We may be a traditional, values-led building society but, at the back end, we're a remarkably modern financial services provider."

Paul Denton, CEO, Scottish Building Society

Scottish Building Society, which is already carbon neutral, prides itself on being a personal, flexible and sustainable lender. "We don't look at mortgages on an algorithmic basis. Each case is personally reviewed and underwritten," notes the CEO. This helps explain why, at a time when many in its industry are closing branches, the society is opening new ones in key Scottish cities. "In-person banking used to be transactional. That's changed and it's not just about younger people wanting digital banking and older people wanting face-to-face. We find our younger members want to transact digitally but welcome advice in person as they're less experienced in financial matters, so we will continue to foster physical relationships with members and to offer robust online capability. We may be a traditional, values-led building society but, at the back end, we're a remarkably modern financial services provider," he says.



About 8 percent of Glaswegian employees work in finance

A much younger organization is Scottish National Investment Bank, the U.K.'s first mission-led development bank that will be capitalized with £2 billion in public funds over 10 years. "Our missions are scaling up innovative businesses, reducing geographical inequality and financing the transition to a just net zero," says its chair, Willie Watt. "Projects have to meet one of our missions and be commercially viable—although we don't compete with the private sector, we think our job is to crowd in private capital. We launched in 2020 and have already committed nearly £200 million on 13 investments."



Paul Denton
CEO
Scottish Building
Society

Legends to festivals: The feast of Scotland

Host of the world’s biggest arts festival, Scotland offers a uniquely magical mix of natural, historical and cultural treasures

From its majestic mountains, glorious glens, legendary lochs and rugged coastline to prehistoric remains, crumbling castles, picture-perfect fishing villages and vibrant cities, Scotland is an extraordinary place to visit.

“There are so many unmissable things to see and experience here, but it’s the way everything comes together that makes Scotland utterly unique. There’s romance, mystique and great richness in our heritage and culture, with each part of the nation having its own, very special stories to tell,” says Malcolm Roughead, CEO of VisitScotland, the national tourism organization. Almost 220,000 people work in Scotland’s tourism sector, which accounts for around 5 percent of its gross domestic product and brings approximately £12 billion into its economy every year, he notes. “Between 2011 and 2019, the number of international tourists we welcomed increased by 17 percent, with the U.S. being our largest market at almost 500,000 visitors. As Scotland is very accessible, both internationally and internally, the growth in tourism has sustained many of our fragile rural and island communities, and allowed them to flourish. That’s important, because those communities are one of the things that makes Scotland so exceptional. It also makes it easy for people to tour round our whisky distilleries or 13 UNESCO-listed sites, for example.”

The country is rising in popularity as a destination for agritourism, plus outdoor activities such as kayaking and mountain biking. “We also have a global reputation now for holding business and sporting events. As the home of golf, we’ve hosted the Ryder and Solheim Cups, while the first UCI Cycling World Championships will take place here in 2023, followed by the World Athletics Indoor Championships in 2024,” states Roughead.

Cabinet Secretary for the Constitution, External Affairs and Culture Angus Robertson points out that: “Scotland is a beautiful country with a tremendous history that people around the world know about and want to explore. At the same time, this is an exceedingly contemporary nation in terms of the skills, technology and creativity that are being developed here.” The creative arts have been a central part of Scotland’s identity for centuries and that tradition continues today, he says. “We’ve got a new generation coming to the fore now who are incredibly talented. Despite being a country of just over 5 million people, we’re producing a vast amount of amazing talent in music, the performing arts and across the entire cultural space. As in all countries, our arts community had a very challenging time during the pandemic, but this is the year that we can start enjoying Scotland’s wonderful cultural offering again. And what’s programmed to happen in art, music, theater, cinema and television this year looks absolutely fantastic.”

Diverse creative industries generate nearly £5 billion a year for Scotland’s economy. “One significant recent development is the burgeoning success of our television and film sector, with our production studios currently working



Edinburgh Festival celebrates its 75th anniversary this summer

at full pace on top-level content,” Robertson reveals. Isabel Davis, executive director of the agency that promotes this sector, Screen Scotland, backs up his statement. “We’re busier than ever with enquiries from national and international companies looking to base productions here. Scotland has grown from a destination for location-based filming into a very competitive option for entire productions, including shoots, visual effects, post-production and animation.”

Reasons for this include a doubling in public funding for the sector since 2018 and new large-scale production facilities. The launch production at Edinburgh’s FirstStage Studios was Amazon’s thriller *The Rig* in 2021, and the streaming giant is working there again on an adaptation of Neil Gaiman’s *Anansi Boys* at the moment. A further substantial production space, Kelvin Hall, will open in Glasgow shortly, providing an additional complement to the existing smaller studios around the country. Scotland also offers an extremely varied range of urban and rural locations. Recent productions to take advantage of this include DC Films’ *The Batman* and *Batgirl*, Lucasfilm’s upcoming *Indiana Jones* movie, the BBC’s *Peaky Blinders* and Starz’s long-running series *Outlander*.



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CEO
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Above all, says public body Creative Scotland’s CEO Iain Munro, “Scotland is a festival nation.” Throughout the year events are held to celebrate arts, foods, sports and many other aspects of Scottish life, with a few unique highlights being the Highland Games, Hogmanay and Burns Night. “The emblem of the nation, however, is the Edinburgh summer festivals, including the International Festival, which is 75 years old this year, as well as the Fringe, Art, Jazz and Blues, and Film Festivals,” Munro insists. Over the years, Edinburgh’s summer festivals have enabled the country to form strong creative ties across the globe, he adds. “They’ve become a powerful cultural brand for Scotland and helped the world to recognize that—built on dynamism, creativity and the warmth of our people—we’re an ambitious, forward-looking and progressive country that has culture very firmly at its heart.”