



Annual Report

2020/2021

Executive Summary

Since its launch in late July 2020, the Hydrogen Accelerator has acted as an enabler of hydrogen technologies in Scotland's growing green economy. Hosted at the University of St Andrews, the Hydrogen Accelerator aligns closely with the University's own ambitions to lead the way in research that addresses climate change.

Through a partnership between the University of St Andrews and the University of Strathclyde, the Hydrogen Accelerator's focus is on the transport ecosystem and to catalyse capabilities across Scotland to ensure that the economic opportunities arising from the transition to net zero or ultralow emission mobility solutions can be fully exploited. The primary objective of the Hydrogen Accelerator is the facilitation of public bodies, industry, research organisations and higher and further education institutions to bring this ambition to fruition. The Hydrogen Accelerator plays a pivotal role providing technical and project management support to accelerate the deployment of projects at scale.

The Hydrogen Accelerator has already delivered several key achievements including the successful procurement of phase 2 of the Zero Emission Train project and delivering the business case to secure funding for the Low Carbon Applications Test Centre (LOCATE) power train test facility which will be established at the Michelin Scotland Innovation Parc (MSIP). These achievements sit alongside providing technical advice on projects across Scotland, ensuring their viability through thorough analysis. Further activities included providing evidence to the Scottish Parliament's Rural Economy and Connectivity Committee to support policy development, supply chain development to support the creation of high value jobs and skills required to grow the hydrogen economy in Scotland and providing support to SMEs already in the hydrogen sector or to those looking to transition.

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Delivering Hydrogen Initiatives Throughout Scotland

Since its launch, the Hydrogen Accelerator has been supporting several projects: Zero Emission Train Project, Low Carbon Transport Applications Centre (LOCATE), the Dundee Hydrogen Bus Deployment Project and the Glasgow Zero Emission Fleet Decarbonisation Strategy. Subsequently, engaging with the Highlands (Highland Council and the Powerhouse at Cromarty Firth) and Western Isles. These projects now form part of the wider portfolio of projects in the Hydrogen Accelerator's remit. An overview of individual projects is detailed in this section.

The Zero Emission Train Project – Phase 2

As part of its bold decarbonisation ambitions, the Scottish Government has set a target date to decarbonise passenger rail transport by 2035. A demonstration project led by Transport Scotland, Scottish Enterprise and the Hydrogen Accelerator (University of St Andrews) for the conversion of a class 314 train to a hydrogen fuel cell electric powertrain. This is an ambitious project, in its second phase, which will be carried out by an industrial consortium led by Arcola Energy in partnership with Arup, Abbott Risk Consulting and AEGIS. The project will involve full system design, installation and demonstration of the train and will be showcased on the heritage Bo'ness & Kinneil railway during the

prestigious COP26 event (26th UN Climate Change Conference of the Parties) hosted by Glasgow City from 1st - 12th November 2021.

The role of the Hydrogen Accelerator in this pioneering zero emission train project is not only to assist the development of zero emission technologies, but also to support the growth of the rail supply chain and innovation in this sector.



Scotrail 314 carriages being transported to Bo'ness travelling past The Kelpies.

Using a class 314 train, this project will demonstrate the capabilities of refurbishing rolling stock assets, thereby extending the longevity of the assets and building on the circular economy in Scotland. This project will enable integration of alternative traction power supply equipment to be utilised within the train which must operate to current and future railway regulations and safety standards. The innovative technology developed by this project will be transferable to other obsolete and inservice passenger trains, thereby assisting the decarbonisation of Scotland's rail sector and most importantly, providing commuters with greener, cleaner trains.

Low Carbon Transport Applications Centre, LOCATE

The Scottish Government announced in March 2021 the launch of a new heavy-duty vehicle platform testing and innovation facility, LOCATE, to be situated at Michelin Scotland Innovation Parc in Dundee.

The LOCATE initiative provides a 'first of a kind' platform level, route-to-market Power Train Test Bed (PTTB) for hydrogen fuel cell and battery electric drive trains. LOCATE will form part of a Low Carbon Transport Programme being jointly developed between Scottish Enterprise and Transport Scotland.

The LOCATE test facility will provide an 'emulated' representation of real-world duty



Michelin Scotland Innovation Parc site in Dundee.

cycles for a variety of heavy-duty road and niche vehicles. This replaces and brings forward what would traditionally have been on-road testing. LOCATE is unique in that it brings together PTTB capability with hydrogen and power network knowledge and skills gained from research and innovation through the University of St Andrews and the University of Strathclyde. The Power Network Demonstration Centre (part of the University of Strathclyde) also focuses on the decarbonisation of heavy duty vehicles through battery electrification and charging technology and will provide complementary facilities to LOCATE.

Dundee Hydrogen Bus Deployment Project

Dundee City Council is participating in an ambitious pan-European project for the commercialisation and deployment of hydrogen fuel cell electric buses and refuelling infrastructure across European cities - Joint Initiative for Hydrogen Vehicles across Europe (JIVE/JIVE2). Aberdeen and Dundee are two Scottish cities participating in this initiative along with a further fourteen European cities. Dundee anticipates the delivery of twelve hydrogen fuel cell electric buses in 2022. The glider double decker buses will be procured from Optare (a UK bus manufacturer) and then converted to hydrogen fuel cell electric powertrains by leading systems integration company, Arcola Energy at their new manufacturing facilities at the Michelin Scotland Innovation Parc (MSIP). The Hydrogen Accelerator is providing ongoing project support and has provided techno-economic assessment and technical specifications to support the procurement of the buses and the hydrogen refuelling infrastructure that will be based at Michelin



Schematic of a fuel cell electric bus.

Scotland Innovation Parc. Having the hydrogen refuelling infrastructure at MSIP will enable further roll-out of fuel cell electric vehicles and refuelling across the Tay Region.

Glasgow City Council – Fleet Decarbonisation Strategy

The Hydrogen Accelerator is providing ongoing project support to Glasgow City Council to realise its ambitions to decarbonise their entire captive fleet within the next ten years. An important initiative is the decarbonisation of their heavy fleet vehicles to hydrogen fuel cell electric. Having secured funding from Transport Scotland for the development of a prototype refuse collection vehicle which is being developed by Arcola Energy and Glasgowbased Farad Hillend, Glasgow City Council will be showcasing this prototype at COP26 in November 2021. The procurement process is currently underway for temporary and permanent refuelling infrastructure and for a fleet of an additional nineteen fuel cell electric refuse



Glasgow City Council Fleet Strategy.

collection vehicles. This will be the largest fleet in the UK and will enable further deployment of zero emission refuse collection vehicles across Scotland's city regions, supporting local authorities achieve their decarbonisation ambitions. The Hydrogen Accelerator is providing ongoing project and technical support and engaging across the Glasgow region with both public and private sector organisations who can collaborate on future zero emission transport initiatives.

Highland Council – Fleet Decarbonisation Strategy

The Highland Council has been developing their decarbonisation strategy in conjunction with regional ambitions to lead in the deployment of hydrogen refuelling infrastructure and zero emission mobility solutions for both public and private sector organisations.

The Hydrogen Accelerator continues to engage with Highland Council and has provided information

on the Scottish Government's hydrogen ambitions to their Climate Change Working Group who are developing their Climate Change Action Plan. Through this work, hydrogen ambitions and capabilities are being developed. The Hydrogen Accelerator has provided technical support during the development of a feasibility study for hydrogen production and refuelling infrastructure.



Port of Cromarty Firth.

The Hydrogen Accelerator has also provided a statement of capability, including course offering to the newly proposed Powerhouse at Cromarty Firth. This is a new centre of excellence for offshore wind and hydrogen production.

Western Isles – Building a Hydrogen Economy

The latest inclusion in the Hydrogen Accelerator's project portfolio is supporting the Western Isles to develop their hydrogen economy. Support is being provided to examine the whole energy system in terms of its supply and demand components including hydrogen for heat and transport in local industries such as distilleries and fisheries. The Western Isles have already



Ferry in Port Stornoway, Western Isles.

completed significant work and it is important that these lessons are captured for future development

of this unique energy system. The Hydrogen Accelerator is facilitating a collaborative approach amongst key stakeholders involved with the Western Isles.

Supporting Scottish SMEs

The Hydrogen Accelerator, through support from the Low carbon Challenge Fund, is supporting Scottish SMEs in the hydrogen sector. This project, *'Translating Hydrogen into Action'* complements the primary objectives of the Hydrogen Accelerator by supporting companies throughout the

hydrogen supply chain from fuel cell manufacturers to energy specialists to create a strong Scottish OEM-base. This is particularly pertinent as Scotland strives to achieve its net zero targets and create a strong hydrogen economy creating new jobs and skills within this emerging sector.



EUROPE & SCOTLAND European Social Fund Investing in a Smart, Sustainable and Inclusive Future *Translating 'Hydrogen into Action' is funded through ERDF funding.*

The University of St Andrews will provide access

to specialised manufacturing and testing equipment and provide a knowledge exchange programme informing companies of recent advances in energy storage technologies. Through '*Translating Hydrogen into Action*' the Hydrogen Accelerator will also identify innovation opportunities and provide advice around growth opportunities including relevant funding calls. Another important role is to serve as a platform for business to business collaboration to support sectoral growth.

This project was launched in February 2021 and has already initiated a series of collaborative events and is working closely with Scottish Enterprise to host an SME focussed workshop on the opportunities that will emerge from the Scottish Government's Hydrogen Action Plan which will be published later this year. A parallel activity strand has involved working very closely with the University's own Eden Campus to ensure industry appropriate facilities are available to companies within this sector. Facilities at the Power Network Demonstration Centre and DER Scotland are also available to SMEs through this project.

Communication, Outreach and Collaborative Initiatives

The Hydrogen Accelerator continues to collaborate with organisations within the hydrogen sector including Scottish Enterprise, Michelin Scotland Innovation Parc, the Scottish Hydrogen and Fuel Cell

Association (SHFCA), the Energy Technology Partnership, Energy Systems Catapult and many other stakeholders. Developing strong partnerships will enable the scaling up of projects across Scotland with a focus on supply chain development and the creation of high value jobs.



Rail Cluster Builder advert on social media.

An important strand of the Hydrogen Accelerator's activities is communications and ensuring that general awareness of hydrogen and the growth opportunities within the hydrogen sector. To-date we have hosted seven events and supported four sector specific events such as the SHFCA Annual Conference and the Scottish Engineering Rail Cluster Builder - Rail Innovation Day for Scotland and Rail Opportunities in Scotland's Zero-Emission Ecosystem.

Supporting Skills Development

To support the skills development required for the changing energy sector, the Hydrogen Accelerator has:

- developed and proposed CPD course and content for aerospace industry.
- developed and proposed CPD course and content for the Cromarty Firth.
- provided input to the development of the MSIP Skills Academy.
- provided content for the University of St Andrews undergraduate Sustainability course.

Supporting Policy

The Hydrogen Accelerator, in its wider role of providing academic support, has submitted written evidence to both the Scottish and UK Governments' Parliamentary committees. The advice includes guidance reports provided to:

- Scottish Parliament Rural Economy and Connectivity Committee relating to the use of hydrogen in agriculture. This evidence will inform the Committee's scrutiny on the forthcoming Scottish Government's Climate Change plan update.
- The Department of Transport (DfT) on Renewable Transport Fuel Obligations (RTFOs) providing advice to enable a refresh to the current Renewable Transport Fuels Obligations to further incentivise organisations transition to low or zero emission technologies.
- All-Party Parliamentary Group on Energy Studies advising energy policies which will drive an independent UK to achieve its net zero emission targets while fuelling the economy.
- All-Party Parliamentary Group on Hydrogen defining the role and potential for hydrogen technologies, including large scale production of green hydrogen and fuel cell electric transport, hydrogen for heat, the decarbonisation of industry and potential export potential during the transition to achieving net zero targets across the UK.

Looking Ahead

Scotland has an abundance of renewable energy resources which can be utilised to support the energy sector to decarbonise by the large-scale production of green hydrogen and hydrogen related compounds such as fuel for the transport sector. This resource coupled with Scotland's ambitious climate change targets is positioning Scotland to be at the forefront of this sector within the global market. In December 2020 the Scottish Government published its Hydrogen Assessment paper and will publish its Hydrogen Action Plan in the Autumn 2021 which will include a Hydrogen Policy Statement and funding to support the sector achieve its ambitions in building a strong hydrogen economy.

The Hydrogen Accelerator has a pivotal role in supporting Scottish stakeholders to benefit from the current opportunities within the sector. Aspects of this role have been developed within projects already in the Hydrogen Accelerator's portfolio. In the future programme of work, we will focus on:

- 1 Increasing collaborative activity within the sector between public bodies, industry and academia. This will result in technical challenges being addressed more effectively and innovatively.
- 2 Actively engage in the development of zero emission heavy fleet vehicles, supporting the public sector to achieve their decarbonisation ambitions and support collaboration across public and private sector organisations in the deployment of zero emission technologies.
- 3 Encourage public sector bodies, such as local authorities, to work on collaborative projects, particularly supporting joint procurement to achieve economies of scale.
- 4 Support the development of projects at scale, taking lessons learned from earlier demonstration projects and replicate proven technology uptake across Scottish regions.
- 5 Provide workshops for stakeholders to provide advice on the deployment of hydrogen technologies for the transition to net zero. This includes transport focused and supply chain specific events.
- 6 Ensure that skills development and training programmes for the changing workforce are developed and supported.

The hydrogen sector is fast evolving in Scotland, and it is recognised that hydrogen will play a key role in decarbonising the global energy system. We must ensure that a skilled workforce and robust supply chains exist as we transition to a hydrogen economy enabling Scotland to have a prominent role in the emerging global hydrogen market

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