

Net Zero North

A submission to the 2021 Comprehensive Spending Review

Net Zero North (NzN) will connect the Northern Powerhouse's science assets, skills providers, and businesses to forge a green recovery from Covid-19. It will put the UK at the forefront of the global drive for net zero carbon.

A £168m investment by government will:

- increase Northern Powerhouse GVA by £1.5bn, by creating and securing jobs in a sector that is growing 4 times faster than the rest of the economy.
- lower annual Northern Powerhouse emissions by around 17MtCO₂e by 2030 - delivering around 20% of the overall reductions needed in the Northern Powerhouse to meet net zero by 2050;
- deliver the integrated NzN Skills Alliance, uniquely linking FE and HE institutions with industry to drive delivery of net-zero skills into all parts of the North, creating a highly skilled green economy workforce.

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Objectives

Net Zero North (NzN) will deliver innovation-led economic growth and reduced carbon emissions in the North of England by supporting the transition to a green economy. Creation of a regional innovation eco-system will deliver long-term value and productivity, securing employment, prosperity and wellbeing for the people of the region.

Net Zero North will:

- Build a thriving innovation eco-system supporting the creation and application of new knowledge, through a shared vision for a cleaner economy that builds on existing regional strengths. Support the creation of the next generation of innovative 'eco-preneurs' through collaborative programmes with industry.
- Initiate innovation and research programmes in areas of significant industrial need making capacity and capability available to meet current and future industrial challenges.
- Enable an innovative and effective skills system to overcome current and future skills gaps through collaboration between industry, HE, and FE, ensuring companies can recruit into roles that support growth and decarbonisation.

In delivering these objectives the programme will:

- increase Northern Powerhouse GVA by £1.5bn, by creating and securing jobs in a sector that is growing 4 times faster than the rest of the economy.
- lower annual Northern Powerhouse emissions by around 17MtCO_{2e} by 2030 – delivering around 20% of the overall reductions needed in the Northern Powerhouse to meet net zero by 2050;
- deliver the integrated *NzN Skills Alliance*, uniquely linking FE and HE institutions with industry to drive delivery of net-zero skills into all parts of the North, creating a highly skilled green economy workforce.

Current Arrangements

The North of England has a strong array of scientific, research and innovation assets, anchored by large companies such as Siemens, Sellafield, and Unilever, public entities and Research and Technology Organisations such as Advanced Manufacturing Research Centre and Centre for Process Innovation, both part of the High-Value Manufacturing Catapult, the 30+ universities of the North of England, including the N8 Universities; 8 world-leading research-intensive universities, all ranked in the top 25 in the UK.

Despite these assets, the North of England has not delivered as strongly as other regions to the UK economy for a number of years, resulting in a national economy that is unbalanced, with London and the greater South East surging ahead. There is, however, a clear understanding in the North of where regional strengths exist;

- The Northern Powerhouse Independent Economic Review (NPIER) identified energy as a prime capability, due to expertise in low-carbon energy generation, and storage.
- IPPR North identified the region's natural assets as a leading resource to address the challenges of carbon emissions, climate mitigation, biodiversity and wellbeing.

Globally, investment in green businesses that can drive both carbon emissions reductions and economic growth is growing rapidly – in 2020 global FDI totalling \$85bn was invested in the renewable energy sector alone.¹ In the UK, the government has laid out a route to net zero and economic growth, focussed on innovation, infrastructure and skills across a range of critical initiatives. These strategies represent both an opportunity and a risk for the North. The region already has around one-third of the jobs in the low-carbon goods and services sector, but it also has a greater carbon footprint per head of population than for England as a whole. It also has more carbon-intensive industry, with some Local Authorities having over a quarter of jobs in high-emitting businesses.

Government has already invested significant amounts of money into ultra-low-emissions vehicles, carbon capture for power stations and industry, the Nature Climate Fund, the Woodlands for Water scheme and Direct Air Capture – discrete investments into specific technologies.

The Need for Change

For the North to meet its full potential some challenges need to be addressed through systemic change.

The North faces a particularly challenging starting point. Higher levels of carbon-intensive businesses than the English averageⁱⁱ mean it needs to decarbonise faster than the rest of the country to keep pace with national targets. A particular challenge is developing alternative low-carbon fuels, for example hydrogen. Its poorly connected business base limits the ability of firms to introduce innovative and efficient low carbon technologies and processes at the scale and pace needed. A disconnected skills system will not be able to supply enough skilled workers to fill the predicted 422,000 vacancies in the low-carbon sector alone,ⁱⁱⁱ as well as the 150,000 skilled workers needed nationally to meet the 2.4% GDP target for research and development spending.

Covid-19 has also disproportionately affected the North of England with over £11bn of economic activity lost due to mortality (57.7 more people per 100,000 dying in the Northern Powerhouse) and issues relating to mental health.^{iv} Austerity exacerbated the effects of Covid by leaving the North in a more vulnerable position prior to the pandemic; the Northern Powerhouse punched below its economic potential, with levels of productivity, private sector investment, R&D activity, skills, and business start-ups all lower than the national average. Despite pockets of high performance, too many of the North's cities, towns, rural communities and coastal locations have been left behind, trapped in a low-skills, low-innovation, low-productivity cycle.^v

Existing capital and research and innovation investment into 'net-zero technologies' has been predominantly isolated or sectorally focussed. The absence of wider collaboration means that there are missed opportunities for sharing knowledge and expertise. NzN will provide the means for faster, wider diffusion of technologies across the region through collaboration and skills.

The majority of government investment has been focussed on 'technological' solutions; the question of land-use, particularly rural land, is one that has yet to be fully addressed. Much of the North is rural, and changes to land-management practices through the Environment Bill will need to be addressed. Dasgupta, and Dimbleby in their reviews of biodiversity and the food system both recognise that systemic change is needed.

- The food system is responsible for *one-third* of all greenhouse gas emissions (20% in the UK), contributes to biodiversity loss (20 species of plant account for 90% of worlds food), and is decarbonising more slowly than other sectors.
- Dasgupta recommends, in broad terms, that we increase 'Nature's supply', challenge our models of economic success, and transform our institutions and systems.

The changes needed to deliver on the Dimbleby and Dasgupta reviews are deep-seated and wide-ranging, but the benefits are extremely broad. For example, health is impacted by poor diet (and has a knock-on effect on economic performance), and our ability to access the genetic and chemical diversity of nature (40% of today's medicines are extracted from plants) is limited due to species loss.

Recent analysis of the performance and adoption of innovation in the North has highlighted that businesses in the region often struggle to capture value from knowledge creation due to weaknesses in, and engagement with, local and regional networks.^{vi} SMEs in particular find it difficult to access and participate in these networks. Innovation does not take place in a vacuum, rather it is an ecosystem of parts. The North of England already has many of the parts needed to create a thriving innovation ecosystem in place; specialised areas of expertise, existing public and private institutions, cultural assets to attract workers, and proximity to major international hubs. However, the ecosystem does not

function as effectively as in other parts of the UK. Businesses struggle to engage with local and regional networks, collaboration between parts of the North is challenging and the outputs of innovation are not being effectively disseminated. Together, these factors result in the situation that successes in a particular place remain disconnected from clusters elsewhere in the region.

Net Zero North will provide the catalyst to transform and level-up the economy of the North by amplifying the value of public and private investment, supporting knowledge exchange and dissemination between private and public actors and empowering the North of England to be world-leading in net zero technologies.

The Opportunity – Net Zero North

Net Zero North will lead the Northern Powerhouse in its transition to a net-zero economy by harnessing our unique mixture of industry, science and research capabilities, and natural assets. It will help to create a green Northern Powerhouse, driven by innovation, supporting business growth, attractive for inward investment and exporting know-how, products and services internationally.

Investment in NzN will provide business-facing innovation programmes driving collaboration between the different actors in the R&D ecosystem, building on proven methodologies and expertise in the region. Net Zero North would build on the success of these programmes and develop novel approaches to innovation, providing, for example:

- Simplified access to the research and innovation base in the North of England.
- Industry-led collaborative research and innovation programmes.
- Secondment and mobility opportunities to support knowledge exchange and skills development.
- Innovation support to empower and enable SMEs to reach the market.
- Improved access to facilities to expedite industry research, particularly for SMEs.
- Community-building, cross-disciplinary, networking events, conferences, and hack-a-thons to allow business-to-business and business-to-researcher interactions.

Proven schemes have demonstrated significant return-on-investment and it is these schemes that NzN would seek to model interventions upon. For example:

- The N8 Industry Innovation Forum delivered over £10m of collaborative investment between industry and university for a £1.6m investment.
- Medical Technologies IKC (University of Leeds) has generated and leveraged £170 million in research and innovation funding from £10m funding.
- Since 2012 Centre for Global Eco-innovation (Lancaster University) has secured £25M+ and supported more than 700 SMEs. An independent review of the first phase of the Centre forecast that by 2026 it will have created £65M of gross GVA and £50M in net additional GVA.

Net Zero North will deliver through three parallel, pan-Northern projects, aligned to the Government's Ten Point Plan for a Green Industrial Revolution, and addressing the needs of businesses, developed through consultation with business:

Sustainable hydrogen economy - *positioning the UK as global leader in hydrogen for net zero*

The Northern Powerhouse is at the leading edge of innovative hydrogen development in the UK; it hosts demonstrators for hydrogen production, distribution, and utilisation and is at the leading edge of developing novel technologies to produce green hydrogen and explore uses for hydrogen beyond industrial decarbonisation. Research and innovation challenges remain for large-scale adoption of hydrogen; for example, novel materials for use with hydrogen, and electrolysers that can use 'dirty water' for export to areas that have limited supply of clean water. NzN will link existing and proposed capital assets for hydrogen generation and utilisation, small modular and next generation nuclear and

other renewable energy sources. Supporting these three elements of the Ten Point Plan will reduce emissions and support the transition of carbon-intensive industries in the region.

Grow smarter - *managing land for net zero by reducing emissions and increasing carbon capture*

The Northern Powerhouse contains 88% of England’s peatland, 70% of its wetlands, and 28% of its forests. Improving land management for carbon sequestration, adapting for climate change mitigation and improving agricultural practices for food, biofuels, or other bio-derived materials can support reductions in emissions, as well as increases in biodiversity and wellbeing. New models of agriculture and land management will support the visitor economy as well as create jobs and expertise in rural communities.

NzN Skills Alliance - *creating the workforce for a northern green economy*

The *NzN Skills Alliance* will support the delivery of the Government’s Skills for Jobs programmes in the region to ensure we can fill the estimated 422,000 jobs in the low-carbon economy that will be created in the Northern Powerhouse by 2050.vii Industry, FE, and HE will collaborate to ensure that the skills needed in the region can be delivered at all levels. Hubs for industry-linked doctoral training in Teesside (hydrogen) and at Eden North/Morecambe (Grow Smarter), with outreach to FE colleges and the public in towns, cities, and communities across the North will also be developed.

Financial Summary

NzN will require a £168m Government investment in Years 1-3, broken down as follows:

NzN Programme Element	Nature of the investment ^{viii}	Amount
Sustainable Hydrogen Economy	Research and Innovation – large-scale innovation and research activity to support and leverage existing, and planned, capacity and capability in demonstrators and other assets in the region. Industrial Doctorate Hub for the NzN Skills Alliance.	£99m
Grow Smarter	Research and Innovation – large-scale innovation and research for innovation activity and scaled-up adoption of near-to-market technologies Industrial Doctorate Hub for the NzN Skills Alliance.	£69m
Total Investment		£168m

Sustainable Hydrogen Economy

The North of England is already leading the way in developing hydrogen as a viable low-carbon alternative fuel. Energy is recognised as a prime capability for the north and its developing capability in hydrogen coupled with existing expertise around renewable energy, nuclear power and energy systems and utilisation makes the North the ideal place to further support low-carbon energy innovations.

Three of the UK's large industrial clusters are in the Northern Powerhouse and developing hydrogen as an alternative fuel, in the place that it is needed, makes economic sense. Furthermore, there are other potential beneficiaries, for example the glass industry in the north-west and the steel industry in Yorkshire, part of which has just been taken back into government ownership (Sheffield Forgemasters, MoD).

NzN will work with industry partners to drive innovation through the supply chain and remove barriers to adoption of hydrogen. Significant levels of capital investment have already gone into the region with HyNet, Net Zero Teesside, Northern Endurance Partnership, Zero Carbon Humber, and Humber Zero benefitting from nearly £120m investment in the recent Industrial Decarbonisation Cluster funding round. NzN will complement these investments by providing a resource for research, development and innovation support, ensuring that these capital investments deliver the full range of benefits promised. It will also create collaborative opportunities for breakthrough technologies to be developed and deployed at scale and pace.

Sustainable Hydrogen Economy would address many of the challenges identified as part of the UK Hydrogen Strategy and impacts 6 of the 10 Points for a Green Industrial Revolution. *Sustainable Hydrogen Economy* will focus on:

1. **Optimising CCUS-enabled hydrogen** for rapid market growth. Supporting CCUS-enabled hydrogen will allow us to focus immediately on supporting the removal of industry barriers such as hydrogen 'compatible' materials, data on degradation and operating procedures, and the design, development, and testing of an intelligent and safe hydrogen transmission system. Supporting CCUS-enabled hydrogen in this way will help to reduce the relative costs of manufacture, as well as overcome some of the technological uncertainties that exist.
2. **Establishing electrolytic hydrogen** for a longer-term scaled up solution. Net Zero North has specific expertise in new nuclear and renewables technology, including Small Modular Reactors, that through collaboration with industry will support testing of the feasibility of an electrolytically-produced hydrogen supply. Electrolytic hydrogen is currently higher cost than CCUS-enabled hydrogen but Net Zero North can help to develop and scale-up the technologies needed to reach industrial scale.
3. **Addressing methods for storing and utilising hydrogen.** Through existing research capacity in the region Net Zero North will work with partners to explore, demonstrate and validate how hydrogen can be utilised for decarbonising transport, heating and cooling, as well as stored and integrated into the wider energy mix. Identifying and demonstrating new use cases is vital as part of coordinating 'supply and demand' and creating a viable market.
4. **Addressing current and future skills gaps.** Through the Net Zero North Skills Alliance and the Hydrogen Industrial Doctorate Hub in Tees Valley, Net Zero North will connect employers, business-representative organisations, and Further Education to collaboratively address the skills needs and gaps that may hold back the development of hydrogen. According to the Green Jobs Taskforce Report, the most pressing needs in hydrogen and CCUS are for technical skills, retraining of workers in the oil and gas sectors, and continue to attract graduates who can develop project management and regulatory skills, with flexibility maintained as the skills mix may change as new technologies for CCUS or hydrogen generation are developed.

Low-carbon hydrogen represents a pan-Northern opportunity to connect research expertise, industrial capacity, and existing and planned investment, supported by a programme of innovation. The North of

England can become a global leader in the generation, storage, and usage of green hydrogen, an industry which is expected to create 221,000 jobs and contribute £18bn to GVA in the UK per year^{ix}. Large markets for hydrogen technologies outside of the UK, particularly in the United States, will provide opportunities for export and inward investment.

Leading industry partners and RTOs, such as Sellafield Ltd (Cumbria), The Welding Institute (TWI, Middlesbrough), and Centre for Process Innovation (CPI, Redcar), have committed to work with Net Zero North to capitalise on this opportunity. Together, we will deliver solutions more quickly to sectors where adoption of hydrogen technologies has not previously been prioritised.

Intended outcomes

- Driving the levelling up agenda by creating a globally competitive innovation-led hydrogen economy in left behind parts of the North.
- Supporting the creation of a market for hydrogen through research and innovation support for the development of CCUS-enabled hydrogen generation capacity through existing demonstrators and capital investment.
- Accelerating the development of low-carbon hydrogen through research, development and innovation investment into nuclear, renewables, and electrolyser technologies.
- Supporting efforts to make the UK a scientific superpower, by leading the development of hydrogen technologies in support of government's efforts to reach net zero carbon emissions by 2050.

Grow Smarter

Managing land for net zero by reducing emissions and increasing carbon capture

The North of England covers a quarter of the total land area of England, is highly diverse in its landscape, and encompasses over 70% of all England's wetlands, moors and heathlands, and natural grasslands, as well as 31% of all water bodies and 49% of all watercourses.

This large and diverse expanse of natural assets, close to 5 of England's 8 core cities and their associated industrial hubs, provides the North a unique opportunity to reimagine the way we use land at scale to promote economic growth, environmental sustainability, and human wellbeing.

Management of the landscape needs to change and is changing, through the Environment Bill and the need to manage competing needs for land; for building, for food, for biodiversity, for carbon sequestration, or for tourism and leisure.

Land-use changes are a zero-sum proposition – there is only so much land and making changes in one area will have knock-on effects in all the others – changes that we need to be able to measure effectively. Developing systems and models for understanding land-use changes are vital if we are to reduce the carbon footprint of the rural economy. Dasgupta, in the Economic of Biodiversity review identified a number of options for change, all of which the Northern Powerhouse is well placed to explore:

- Specific challenges include improving conservation and restoration of natural assets, improving efficiency of 'extraction' from Nature and producing less waste, and developing fair and sustainable supply chains.
- Systems needs, such as developing measures of productivity that account for Nature and decision-making whilst account for natural capital, require a holistic approach land-use.
- People need to be empowered to make informed choices, with education at all levels to support these choices.

Net Zero North and the Northern Powerhouse are well-placed to address these challenges through the *Grow Smarter* programme, addressing 4 of the 10 priorities in 10 Point Plan for a Green Industrial Revolution. *Grow Smarter* would:

- **Address specific technical challenges**, for example, through the nationally leading expertise in engineering biology to develop and test novel, sustainable feedstocks for bio-derived bulk materials and high-value chemicals; build on the existing N8 AgriFood Resilience Programme to explore how technical innovation e.g. peri-urban vertical farming, could contribute to shortening supply chains, or develop new mechanisms for circularising the economy, through waste reduction and recovery.
- **Support the use of natural assets in the North of England to**
 - **sequester carbon at scale** and enhance biodiversity to reduce carbon and increase the resilience of the natural environment. Manage trade-offs involved in repurposing land that is used for sequestration.
 - **enhance wellbeing and the visitor economy** by protecting the natural landscape in our rural and coastal places
 - **improve urban and peri-urban environments** to deliver quality green spaces, new business opportunities and increased resilience to climate change for the region's 15 million citizens. Air quality, shade and urban wellbeing will all be among some of the issues we need to address as we approach 2050.
- **Develop integrated land-use models.** Utilise the experience of the business schools to develop, in collaboration with industry, models for carbon-accounting, as well as measures to demonstrate the long-term effectiveness of sequestration programmes.

- **Address Skills Gaps and raise awareness of Nature through education.** Through the NzN Skills Alliance and the Industrial Doctorate Hub at Eden North, Grow Smarter will address future skills gaps, but also to ensure that an awareness of the contribution of Nature to the world we live in is embedded in teaching at all levels. Skills relating to enterprise and business diversification, modern primary production techniques e.g. regenerative agriculture, digital technologies, circular economy principles, as well as ecological engineering, planning, finance, and marine skills will be vital.

This collaborative endeavour will be supported by key material assets such as the newly funded National Innovation Centre for Rural Enterprise (NICRE) at Newcastle University, and the Global Eco-Innovation Centre at Lancaster University. Commercial partners including Unilever (Wirral), PZ Cuzzons (Salford), BASF (Cheshire), and Procter & Gamble (Newcastle upon Tyne) are interested in working with us to *manage land use for net zero by reducing emissions and increasing carbon capture.*

Intended Outcomes

- Supporting Northern businesses to move more quickly to new, more sustainable business models and market sectors. Ensuring that SMEs benefit from research and innovation support to accelerate their journey to market, to increase regional growth and prosperity.
- Supporting the Northern household products and high-value chemicals industries in creating sustainable land-use models to underpin their future growth
- Driving the levelling up agenda and supporting the governments 2.4% target, by supporting innovation-led growth in rural and peri-urban parts of the North which currently have weak links to the North's research and innovation infrastructure.
- Making the UK a scientific superpower in sustainable land use for net zero carbon emissions by 2050, by supporting practically focused science in the production of bio-derived materials and carbon sequestration, which have potential for significant global growth.

NzN Skills Alliance

Creating the workforce for a northern green economy

Young people and minority ethnic people have been the worst-affected groups by Covid-19 for employment prospects; 70% of job losses between March 2020 and May 2021 were in people under 25.^x As the country recovers from Covid the jobs market looks very different; the Green Jobs Taskforce Report highlights the existing and future skills gaps – many of which are in technologies and sectors that are decarbonising rapidly. If the UK is to meet its climate obligations, these roles need to be filled with employees trained in the latest technologies, for roles that meet the needs of businesses, and they need to be filled urgently.

With the publication of the Skills for Jobs White Paper the Government sets out its vision for business-need leading the development of skills provision through collaboration with Further and Higher Education. The Net Zero North Skills Alliance is a trailblazing collaboration of Universities, Colleges and employers exploring how to up-skill people in and into good quality jobs in vibrant clean industries. In particular, there is a clear need to:

- Support young people in Further Education to gain the relevant skills they need for an evolving job market.
- Support mid-career workers who are looking to or are forced to change career or sector.
- Ensure that existing employees with businesses are able to update their skills to adapt to changing need.

Delivering on the promise of the White Paper will require collaboration across the whole skills system, recognising that each actor has a role to play in delivering a coherent offer.

Industry and industry-representative bodies need to lead in determining sectoral skills needs and where the gaps exist, at a local level.

Further Education needs to adapt courses and teaching to meet the local, emerging skills gaps. However, a rapidly changing curriculum would require staff to adjust and adapt their teaching materials rapidly in collaboration with industry and with Higher Education.

Higher Education needs to increase flexibility of access to degree courses or modules through ‘non-traditional’ routes to ensure that there is a seamless transition to level 6 qualifications, as well as ensure that there is access to existing and bespoke CPD training to maintain the skills of the existing workforce. Access to facilities for Further Education and industry may be beneficial, particularly in rapidly changing technical areas, as well as supporting development of teaching materials to ensure the latest research and innovations are incorporated.

Developing a regional NzN Skills Alliance will support the roll-out of Governments Skills for Life agenda by supporting the actors within the system. It will:

- create a collaboration of experts from HE, FE, RTOs and industry, to map existing training provision, including apprenticeships; identify future green economy needs; and design and pilot new and innovative ways of offering training through FE and HE.
- create an integrated training provision with incentives for upskilling and progression through Apprenticeship, FE or HE pathways, CPD and higher-level training.
- establish Industrial Doctorate Hubs in Teesside and at Eden North in Morecambe linked to *Sustainable Hydrogen Economy* and *Grow Smarter*; to be home to cohorts of doctoral (Level 8) students and to develop outreach programmes, opening up a range of opportunities to potential employees and the public in left-behind towns such as Blackpool and Blyth.

One example of the vital need for connected thinking is the electric vehicle industry in the North East. Investment in the immediate future will see up to 20,000 jobs created directly and in

materials supply chains related to EVs; with around 5 graduates needed for every 25 non-degree apprentices. Ensuring that the skills ecosystem in the region can provide trained workers with the required skills will require collaboration between all actors in the skills eco-system; relationships that the NzN Skills Alliance will create and enhance.

Intended Outcomes

- Delivery of an integrated NzN training environment uniquely linking FE and HE institutions with industry and with reach into all parts of the North.
- Ensure that FE and HE are fully enabled to deliver the skills training needed by ensuring that teachers are up to date with the latest technologies, have access to leading-edge facilities, and by supporting bespoke training opportunities.
- Create a cohort of workers trained to level 8 through the Industrial Doctorate Hubs with both the technical and business skills to kick-start new business growth in the region.
- Ensure that the North is recognised as a great place for people to live and work, creating opportunities that support retention of graduate talent and encourages talent from outside the region and country to relocate.

ⁱ <https://blogs.worldbank.org/psd/global-investors-shift-focus-sustainability-amid-push-green-recovery>

ⁱⁱ IPPR North (2017), Net Zero North

ⁱⁱⁱ Ecuity Consulting for Local Government Association (2020), Local Green Jobs – Accelerating a Sustainable Economic Recovery

^{iv} COVID-19 and the Northern Powerhouse: Tackling Health Inequalities for UK Health and Productivity, NHS

^v Transport for the North (2016), Northern Powerhouse Independent Economic Review

^{vi} Cambridge Econometrics for Transport for the North (2020), Research and Innovation in the Northern Powerhouse. Private Communication.

^{vii} Ecuity Consulting for Local Government Association, Local Green Jobs – Accelerating a Sustainable Economic Recovery

^{viii} HM Treasury, Consolidated Budgeting Guidance: 2020-21

^{ix} All party parliamentary group on hydrogen (2020), Report dated July 2020

^x Office for National Statistics, Earnings and employment from Pay As You Earn Real Time Information, seasonally adjusted, 15 June 2021

Appendix 1: Project partners as of September 2021.

