Tay Cities Clean Growth Skills for Scottish Enterprise

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ekosgen

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Executive summary

Overview

We are in a climate of unprecedented change and disruption. Rapid decarbonisation and the pursuit of a Net Zero economy represents a fundamental socio-economic shift. Scotland's *National Strategy for Economic Transition* (NSET) has the explicit aim of transitioning to an economy that is focused on wellbeing and Net Zero. A key focus for the NSET is to strengthen Scotland's position in new markets and industries to support a just transition to Net Zero. There is massive market opportunity in positioning Scotland at the vanguard of this though modes of economic operation such as Clean Growth.

Clean Growth, in the Scottish context, can be defined as growth that increases our prosperity, while reducing our carbon emissions, and one that strikes a balance between the conservation, restoration, and utilisation of Scotland's natural resources. Clean Growth is a key pillar of the ambitions of the Tay Cities Region, which the Clean Growth Initiative aims to deliver against. A key component of the region's ambition is ensuring that sufficient skills are available to support growth plans and ambitions of those businesses who provide Clean Growth products and services, or who operate in Clean Growth sectors in the region. Within the Tay Cities Region, Clean Growth sectors are defined as: Circular Economy, Clean Energy, Green AgriTech, Sustainable Mobility, Data and Digital Solutions.

Clean Growth skills in the Tay Cities Region

The current education and training system provides a range of skills of relevance to Clean Growth. Apprenticeship framework provision in particular has increased in the Tay Cities Region in recent years. Whilst there is a mixed picture in terms of college and university enrolments, providers including the Michelin Scotland Innovation Parc (MSIP) Skills Academy, Dundee & Angus College and Abertay University are increasingly delivering short courses and micro credentials of relevance to Clean Growth skills.

However, the demand for skills amongst employers operating in Clean Growth sectors is not being met. The current volume of skills demanded is considerable and is anticipated to scale up in future, and this volume of skills required across all Tay Cities Clean Growth sectors is a critical challenge. Also, the nature of skills demanded means that workers are required at all levels, and at all points of each sectoral value chain.

Some specific skills requirements have been identified across Clean Growth sectors:

- Plant science and biology, and mechanical and engineering skills are identified as important for **Green AgriTech**;
- Understanding of Circular Economy principles, systems thinking and problem solving are critical for **Circular Economy** businesses;
- Across **Clean Energy**, renewable generation, grid management and local energy systems are key – along with skillsets in heating decarbonisation;
- Electric vehicle charging, maintenance and repair are skills in demand for **Sustainable Mobility** (as well as in Clean Energy), as are skills in sustainable transport planning and intelligent transport systems; and
- The application of technology, digital and data systems is driving demand across all Clean Growth sectors, not just in **Digital and Data Solutions** as a cross-cutting sector.

However, demand is typically less about specific Clean Growth roles or skills, and more about skilled individuals able to apply their knowledge, capabilities and expertise in Clean Growth areas. Education qualifications are becoming less relevant. Employers value base knowledge, meta skills, adaptability and resilience more – durable skills supplemented by Clean Growth or sustainability know-how, and an

ability to engage in systems thinking. These wrap-around skills are considered to be critical be employers, and must not be ignored.

Despite the evident supply pipeline, more skilled workers are required to support the development of Clean Growth sectors in the Tay Cities Region. There is a need for growing capacity in the region's education and training system. This is not just for volume, but for effectiveness, responsiveness and connectivity between education and training providers and the Clean Growth business base, though recent changes in the education and training funding landscape may impact on the ability to realise this. Transitioning skillsets from other sectors also has a role to play in meeting Clean Growth skills demand.

There remains a significant challenge in fully understanding skills demand across the region, by sector and for Clean Growth as a whole. Business engagement is a critical factor here. There is limited intelligence, poor channels of communication on need where there is engagement, and no smooth engagement with businesses. Further, businesses do not communicate their skills needs effectively – and smaller businesses are not engaged in conversations about future skills demand and need.

Employers do not have confidence in the 'stickiness' of solutions: the position that the Tay Cities Region is at on the Net Zero transition/Clean Growth journey means that there is a lot of uncertainty for businesses around solution permanence in terms of industry and societal response to the Climate Emergency. As such there is a degree of risk aversion in following particular solutions, modes of operation, and so on.

Understanding of what Clean Growth is, and of the terminology surrounding Clean Growth, is also problematic. Whilst strategic stakeholders have no problem with understanding or at least seeing it as interchangeable with other similar terminology (e.g. sustainable growth), businesses typically have limited understanding. This issue is tied up with the lack of engagement from and communication with businesses in the region that operate in Clean Growth sectors.

Recommendations

Based on the findings of the report, the following recommendations are made:

Recommendation 1: Establish a regional strategic approach to funding a Clean Growth skills response, to make sure that skills need and demand within Clean Growth sectors is addressed.

Recommendation 2: Develop a segmented skills approach for Clean Growth, to augment Clean Growth skills provision and allow better targeting of skills interventions.

Recommendation 3: Aggregate demand from employers, to maximise their engagement in Clean Growth skills discussions, and help to build critical mass of demand for education and training providers.

Recommendation 4: Embed Clean Growth skills in education and training, to build climate literacy and Clean Growth competency amongst education leavers and sector entrants.

Recommendation 5: Use micro-credentials and short courses to respond to changing need, as an agile means to provide upskilling and targeted short-term skills interventions.

Recommendation 6: Ensure flexibility and resilience is a key component of the Clean Growth skills response, to provide the meta skills and wrap-around competences and capabilities that are in demand from businesses.

Recommendation 7: Maximise the Tay Cities Region's ambition to be a test-bed, to increase the scope for securing and maximising the opportunity for learning and training through live, on-the-job experience.

Recommendation 8: Ensure co-ordination to deliver a coherent, streamlined education and training system for Clean Growth skills, to offer streamlined Clean Growth skills pathways in the Tay Cities Region.

Recommendation 9: Targeted promotion of Clean Growth employment opportunities, to maximise the visibility of Clean Growth jobs and careers.

These recommendations underpin a potential roadmap of activity for Scottish Enterprise and strategic partners in the Tay Cities Region to consider and implement. The proposed activities and timescales reflect the study findings and conclusions, and build on the recommendations set out above.

It will be for partners to agree and determine responsibility for delivering against these activities and action areas. It will also be important to ensure that these actions are not seen in isolation from other identified skills needs in the region: they must be considered within the work of the Tay Cities Region Skills Advisory Board and wider Tay Cities Deal Skills Programme.

1 Introduction

Overview

1.1 We are in a climate of unprecedented change and disruption. Rapid decarbonisation and the pursuit of a Net Zero economy represents a fundamental socio-economic shift. At the same time, the continued recovery from the COVID-19 pandemic will be unconventional – such a recovery has not previously been experienced, and it is anticipated that we will experience an extended period of extremely high demand for skills, uneven economic performance and continued disruption to global supply chains.

1.2 There is also a changing strategic landscape, through *Delivering Economic Prosperity, Scotland's National Strategy for Economic Transition* (NSET)[1], with the explicit aim of transitioning to an economy that is focused on wellbeing and Net Zero. A key focus for the NSET is to strengthen Scotland's position in new markets and industries, generating new, well-paid jobs from a just transition to Net Zero. There is massive market opportunity in meeting an environmental imperative, and positioning Scotland at the vanguard of this though modes of economic operation such as Clean Growth.

Clean Growth and the Tay Cities Region

1.3 Clean Growth, in the Scottish context, can be defined as growth that increases our prosperity, while reducing our carbon emissions, and one that strikes a balance between the conservation, restoration, and utilisation of Scotland's natural resources.[2] It is sustainable growth which works for people, strengthens our economy and saves our planet.

1.4 Clean Growth is a key pillar of the ambitions of the Tay Cities Region. As set out by the Tay Cities Deal document and its supporting Regional Economic Strategy:

> *"The Tay Cities Region will be an inclusive, vibrant and net-zero carbon economy by 2045. On our journey the region will become the location of choice for companies to test, demonstrate and roll out innovations in clean growth that will combat climate change and generate economic prosperity. We will align our passion, skills, innovation assets and places behind this overarching goal."*

1.5 This also forms a central part of the Clean Growth Initiative's vision statement. To realise this Clean Growth ambition, the Tay Cities region aims to:

- Leverage the Regions' assets to help drive Clean Growth demand;
- Attract high value green jobs[3] and investment to the region, and in doing so attract new talent; and
- Support the transition to Net Zero within the region and for Scotland, embracing new concepts and securing community participation along with way.

1.6 However, to maximise the potential of Clean Growth in Scotland and in the Tay Cities Region, and to realise ambitions for Scotland to be a global leader in climate innovation and

[1] https://www.gov.scot/publications/scotlands-national-strategy-economic-transition/

[2] https://www.scdi.org.uk/cleangrowth/

[3] Green jobs are jobs that, through an ongoing process of 'greening', can be classified as either 1) new and emerging, 2) subject to significant changes in work and worker requirements, or 3) increasing in demand. See: Warwick Institute for Employment Research for Skills Development Scotland (2022) Green Jobs in Scotland: An inclusive approach to definition, measurement and analysis ; at: https://www.skillsdevelopmentscotland.co.uk/media/49856/green-jobs-in-scotland-report_final-4.pdf

sustainability, new and different skills – Green or Clean Growth skills[4] – will be required. A key component of the region's ambition is therefore ensuring that sufficient skills are available to support growth plans and ambitions of those businesses who provide Clean Growth products and services, or who operate in Clean Growth sectors in the region. Within the Tay Cities Region, Clean Growth sectors are defined as: Circular Economy, Clean Energy, Green AgriTech, Sustainable Mobility, Data and Digital Solutions.

This report

1.7 ekosgen was commissioned by Scottish Enterprise in December 2022 to undertake research into the emerging Clean Growth skills landscape in the Tay Cities Region. The commission recognises the importance of a workforce and region focused on a greener economy, and in turn supporting a Just Transition and the ambition of transformational change set out in the new National Strategy for Economic Transformation (NSET). To achieve Scotland's commitment to Net Zero by 2045 and for a 75% reduction in Greenhouse Gas (GHG) emissions by 2030 requires fundamental and transformational change, and this must be supported by a corresponding shift in the skills base of the existing workforce.

1.8 This report is based on: desk research around the Clean Growth sectors in the Tay Cities Region, and analysis of skills supply data regarding courses and subjects of relevance to Clean Growth; and a programme of consultation and engagement with businesses, business representatives, education and training providers and strategic stakeholders. Based on the findings of our research, we have prepared a report that:

- Identifies the skills required within the Tay Cities Region to provide the workforce with the necessary ability to support the Tay Cities Clean Growth Initiative, and wider Just Transition objectives, to become a climate resilient and Net Zero economy;
- Identifies challenges, intersections and gaps between current education and training availability, skills availability and skills requirements amongst employers; and
- Draws conclusions and makes a series of recommendations for the required skills response to meet employer demand for Clean Growth skills and workers, setting out a proposed roadmap to achieve these recommendations.

Report structure

- **Chapter 2** establishes the strategic context for Clean Growth in the Tay Cities Region;
- **Chapter 3** provides an overview of skills supply in terms of areas of education and training of relevance to Clean Growth;
- **Chapter 4** examines current and future Clean Growth skills demand, including particular areas of demand and challenges in understanding the nature of demand;
- **Chapter 5** considers challenges regarding the supply of Clean Growth skills across the region;
- **Chapter 6** set out conclusions and recommendations arising from the research; and
- **Chapter 7** sets out a proposed roadmap for delivery against recommendations.

1.9 This report is accompanied by a number of appendices:

- **Appendix 1** details organisations consulted for this research;

[4] The findings of the *Green Jobs in Scotland* report recognise the current limitations of understanding green occupations and skills.

- **Appendix 2** sets out the definition of Clean Growth skills used to inform this research; and
- **Appendix 3** details the subject areas used to inform the analysis of skills supply.

2 Clean Growth and the Tay Cities Region

Introduction

2.1 Within a wider transition to Net Zero and in response to the Climate Emergency, there are a number of concepts that exist in policy and wider public discourse. One of which is Clean Growth, which is an economic target that exists within an environmental context, ensuring that economic growth is created by and supportive of environmental targets such as cutting greenhouse gas emissions. A key component of Clean Growth is the promotion of skills, referring to the knowledge, competencies, and expertise required to support and drive the transition to a low-carbon and sustainable economy. These skills are essential for the implementation of any economic strategy and are therefore reflected throughout, with opportunities for the creation or promotion of Clean Growth skills placed as a key priority.

2.2 Clean Growth is all-encompassing for a region. It requires a comprehensive review of demand for and supply of skills to support Clean Growth, and the current challenges and opportunities in developing them. Through this process, the challenges and barriers to future provision of Clean Growth skills can be addressed, creating a successful pipeline of skilled workers in a sustainable workforce.

2.3 The five key Clean Growth sectors of most importance to the Tay Cities Region are: Circular Economy, Clean Energy, Green AgriTech, Sustainable Mobility, Data and Digital Solutions. These areas of economic activity are pivotal for growth across the Tay Cities Region.

Strategic context

2.4 The clean growth agenda in the Tay Cities Region aligns with the broader UK wide objectives and commitment to sustainable development and transitioning to a low-carbon economy. Scotland has ambitious climate change targets, including a legally binding target to achieve Net Zero greenhouse gas emissions by 2045, five years sooner than the rest of the UK[5]. These overarching ambitious targets drive the need and urgency for clean growth initiatives, renewable energy development, energy efficiency improvements, and carbon reduction efforts across sectors. As clean growth objectives exist across a wide range of sectors, understanding the strategic context requires a comprehensive review across national and regional policy.

National strategic context

National Strategy for Economic Transformation

2.5 In May 2022, the Scottish Government published the National Strategy for Economic Transformation which sets out the priorities for Scotland's economy over the next 10 years. Recognising the importance of the next ten years within the context of pandemic recovery and the wider transition to Net Zero, the document details aims to ensure success in the "decisive decade". In order to address these wider challenges, the Scottish Government recognises that Scotland has pre-existing challenges such as weak productivity and a lack of new business growth, that need to be encompassed in its strategy. Therefore, the five key aims and policy programmes of action are:

- Establishing Scotland as an entrepreneurial nation with a culture and infrastructure to support innovation.
- Strengthen Scotland's position in new markets through support for well paid jobs.

[5] https://www.gov.scot/policies/climate-change/

- Make Scotland a more innovative and productive environment across not just regions but sectors and industries.
- Supporting and meeting the needs of a changing economy through creating a more skilled workforce.
- Reorient the economy towards wellbeing and fair work to address the pre-existing challenges in Scottish society.

2.6 The NSET aims to build on the success of the pre-existing skills development approaches across Scotland by also addressing reskilling and upskilling challenges. Whilst recognising the importance of these broad approaches to skills development in the Scottish economy, the NSET also targets Green Jobs as an area in which skills development can be targeted to support and grow Scotland's economy. The creation of a Green Jobs Skills Hub is crucial to the success of this strategy, gathering and cascading information on skills shortages in the labour market. This collaborative environment aims to not only address skills and labour demand, but to promote the innovative culture in which, an agile and skilled workforce can support emerging and important sectors such as renewable energy. Through creating jobs and a skilled workforce in these emerging clean and green sectors, the NSET begins to address wider and long-term societal challenges, with well-paid sustainable jobs.

Programme for Government

2.7 The Programme for Government sets out the Scottish Government's legislative programme for each parliamentary year. Within the Programme for Government 2020/21, there was a commitment to the Building Scotland's Green Recovery report[6], which emphasised the importance of investment in green and clean skills throughout the pipeline, from school leavers to reskilling opportunities[7]. These commitments were made in the context of post-pandemic recovery, placing clean skills as an exciting opportunity from Scotland through innovation and investment in sectors of importance for the transition to Net Zero and climate targets. These included: £100m investment in a Green Jobs Fund to support businesses to create and maintain jobs that align to the Scottish Government Net Zero policies; £60m investment in the Youth Guarantee to ensure people between 16-24 have the opportunity of work, education or training; and a £25m investment in the National Transition Training Fund which aims to help 10,000 people over the age of 25 retrain into clean skills jobs. The following year, the Programme for Government was titled 'A Fairer, Greener Scotland', which built on the strategy of creating skills and employment opportunities throughout the different stages of one's career and across sectors. This was demonstrated in the creation of the Green Jobs Workforce Academy[8], which provided £45 million through local partnerships to provide training and employment opportunities and initiatives[9]. Alongside this, funding was made available to specific areas such as small to medium sized enterprises (SME) to improve digital skills, recognising sector and regional specific challenges to supporting Clean Growth. These skills and training specific funding streams take a nation-wide approach, creating an environment in which clean skills jobs are promoted through targeted action[10]. However, these developments are to be understood within the context of a commitment from national government to support expanding Community Wealth Building to more local authorities, such as those within the Tay Cities region, to take a more active role in economic development[11].

[6] https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/

[7] https://www.gov.scot/news/scotlands-green-recovery/

[8] https://careers.myworldofwork.co.uk/green-jobs-workforce-academy

[9] https://www.gov.scot/publications/fairer-greener-scotland-programme-government-2021-22/

[10] https://www.gov.scot/news/scotlands-green-recovery/

[11] https://www.gov.scot/policies/cities-regions/community-wealth-building/

2.8 With Scotland's commitment to Net Zero by 2045, clean and renewable energy has been identified as an area in which Scotland has an opportunity to capitalise on for both environmental and economic benefit. Therefore, the Scottish Government's Energy Strategy is of great importance for the Tay Cities Region and the creation and promotion of clean skills. Scotland's Energy Strategy and Just Transition Plan is currently at the draft stage, but it is important for understanding the future of Scottish Clean Growth, within the context of both jobs and energy generation[12]. Scottish Government stated that the Clean Energy transition is to be accelerated. With an overarching aim of 'developing a multi skilled green workforce, boosting jobs, our domestic supply chain and manufacturing capabilities'. The Scottish Government have committed to:

- More than 20 GW of additional renewable electricity on- and offshore by 2030;
- An ambition for hydrogen to provide 5 GW or the equivalent of 15% of Scotland's current energy needs by 2030 and 25 GW of hydrogen production capacity by 2045;
- Increased contributions from solar, hydro and marine energy to our energy mix;
- Accelerated decarbonisation of domestic industry, transport and heat;
- Establishment of a national public energy agency – Heat and Energy Efficiency Scotland;
- By 2030, the need for new petrol and diesel cars and vans phased out and car kilometres reduced by 20%;
- Generation of surplus electricity, enabling export of electricity and renewable hydrogen to support decarbonisation across Europe;
- Energy security through development of our own resources and additional energy storage;
- A just transition by maintaining or increasing employment in Scotland's energy production sector against a decline in North Sea production; and
- Maximising the use of Scottish manufactured components in the energy transition, ensuring high-value technology and innovation.

Climate Emergency Skills Action Plan (CESAP) 2020-2025

2.9 Crucial to the success of the wider transition to Net Zero is the ongoing success of The Climate Emergency Skills Action Plan which was launched in December 2020 to support the facilitation of skills identification, planning and development at a national level to respond to the need for green jobs. It sets out a clear direction of the required changes in the skills system, highlighting the role that industry, communities and individuals across Scotland will play in achieving these changes, both immediately in the short term and systemically in the longer term. It covers the five-year period 2020-2025, with an update planned for the end of 2023.[13] The CESAP categorises the green jobs required as:

- New and emerging jobs that relate directly to the transition to Net Zero e.g. hydrogen cell technicians, carbon monitoring technicians, and urban miners;
- Jobs affected by the transition to Net Zero that will need enhanced skills or competencies e.g. architects and environmental consultants; and

[12] https://www.gov.scot/publications/scotlands-energy-strategy-transition-plan-ministerial-statement/

[13] https://www.skillsdevelopmentscotland.co.uk/media/47336/climate-emergency-skills-action-plan-2020-2025.pdf

- Existing jobs that will be needed in greater numbers as the result of the transition to Net Zero e.g. insulation installers, energy assessors and designers and multiskilled on-site operatives.

2.10 The CESAP gives a good overall insight into the jobs required over the next five years and is a useful overview at a Scotland level. Its six defined priorities set out the direction for the changes needed in the skills system to respond to the climate emergency. Of specific relevance to the Tay Cities Region are two priorities:

- **Priority 2**: Building better understanding and evidence of future skills needs to support Scotland's transition to Net Zero; and
- **Priority 6**: Taking a collaborative approach to ensure a skills system responsive to changing demands.

Green Jobs in Scotland

2.11 The Green Jobs in Scotland report[14] was published in November 2022. Building on research undertaken by the Warwick Institute for Employment Research, the report recognises the challenges associated with identifying green jobs, given the nascent and rapidly evolving nature of such occupations, essential for supporting Net Zero ambitions and a Just Transition in Scotland. The report provides a new, inclusive definition of green jobs. Green jobs are jobs that, through an ongoing process of 'greening', can be classified as either (1) new and emerging, (2) subject to significant changes in work and worker requirements, or (3) increasing in demand. Based on this definition, the report estimates that there are up to 100,000 new and emerging green jobs in Scotland.

Making Things Last

2.12 Making Things Last: a circular economy strategy for Scotland is another important strategy which is reflected in The Tay Cities Approach to Clean Growth skills. The strategy was released in 2016 and outlines Scotland's approach to transitioning toward a circular economy, where resources are kept in use for as long as possible, waste is minimized, and the value of products and materials is maximized[15]. In May 2022, The Scottish Government proposed Circular Economy Bill was put out for consultation, aiming to build on 'Making Things Last'[16]. The central focus of "Making Things Last" was to serve as a roadmap for Scotland's transition to a circular economy. It highlights the economic, environmental, and social benefits of adopting circular economy principles and outlines actions to be taken by the Scottish Government, businesses, and individuals to realize this vision. Focussing on the entire life cycle of a product, the strategy aims to go further than just waste prevention and recourse efficiency, it aims to generate business innovation and investment into circular economy activities, creating a far-reaching impact. The impact of this upon the Tay Cities Region and the Clean Growth skills agenda cannot be ignored, with circular economy principles highlighted as a key area for the region[17].

The Tay Cities Region Deal

2.13 Clean Growth skills play a large part in the 2020 Tay Cities Region Deal, encompassing a range of competencies and knowledge related to renewable energy, sustainable technologies, and environmentally friendly practices. Representing a long-term commitment to driving economic transformation and improving the prosperity of the Tay Cities Region, the deal involves collaboration between different levels of government, local authorities, and key stakeholders. The key elements and priorities of the Tay Cities Region Growth Deal include: Investment in

[14] https://www.skillsdevelopmentscotland.co.uk/media/49856/green-jobs-in-scotland-report_final-4.pdf

[15] https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/

[16] https://www.gov.scot/publications/delivering-scotlands-circular-economy-consultation-proposals-circular-economy-bill/

[17] https://www.taycities.co.uk/sites/default/files/tay_cities_deal_doc_feb_8.pdf

Infrastructure, including investments in transport networks, digital connectivity, and research and innovation facilities; supporting research and development initiatives, promoting collaboration between academia and industry, and creating innovation hubs to drive economic diversification and productivity; investments in cultural and tourism infrastructure, events, and marketing campaigns; supporting initiatives related to renewable energy, environmental conservation, sustainable transportation, and waste management to promote clean growth and address climate change; creating inclusive growth and community regeneration.

2.14 Aligned with the Tay Cities Deal is the Michelin Scotland Innovation Parc (MSIP)[18], and its MSIP Skills Academy.[19] MSIP was established following a £60 million agreement between Michelin, previous owners of the tyre factory on site that closed in 2020, and the Scottish Government. MSIP is an ambitious joint venture between Michelin, Dundee City Council, and Scottish Enterprise, focused on supporting business growth and innovation in sustainable mobility and decarbonisation.

2.15 An important aim in the context of Clean Growth skills is skills and workforce development. Therefore, as a part of the Tay Cities Region Deal, a Skills Investment Plan[20] was created to support and guide skills learning and opportunities within the region. Created by Skills Development Scotland (SDS) alongside a range of partners including local authorities, colleges and universities, the plan highlights key areas in which Clean Growth skills will be supported, utilising funding of up to £20million from Scottish Government through the Tay Cities Deal for skills and employability investments.[21] The deal includes initiatives to enhance skills training, vocational education, and lifelong learning opportunities to ensure a pipeline of talent and support the transition to high-value sectors. An example of this is the Digital Skills project, which is part of the £20 million Regional Skills and Employability Development Programme.[22] The project aims to create an innovation hub, supporting research and jobs creating Clean Growth skills within green sectors.

Clean Growth sectors in the Tay Cities Region and opportunities

2.16 The Tay Cities Region presents several clean growth opportunities across various sectors. However, five key sectors have been highlighted as Clean Growth sectors, presenting clear opportunities for the Tay Cities Region. Figure 2.1 presents a schematic illustration of projects by Clean Growth sector. It is worth noting that over time, the aim is to expand the portfolio of Clean Growth projects within the Tay Cities Region.

[18] https://www.msipdundee.com/

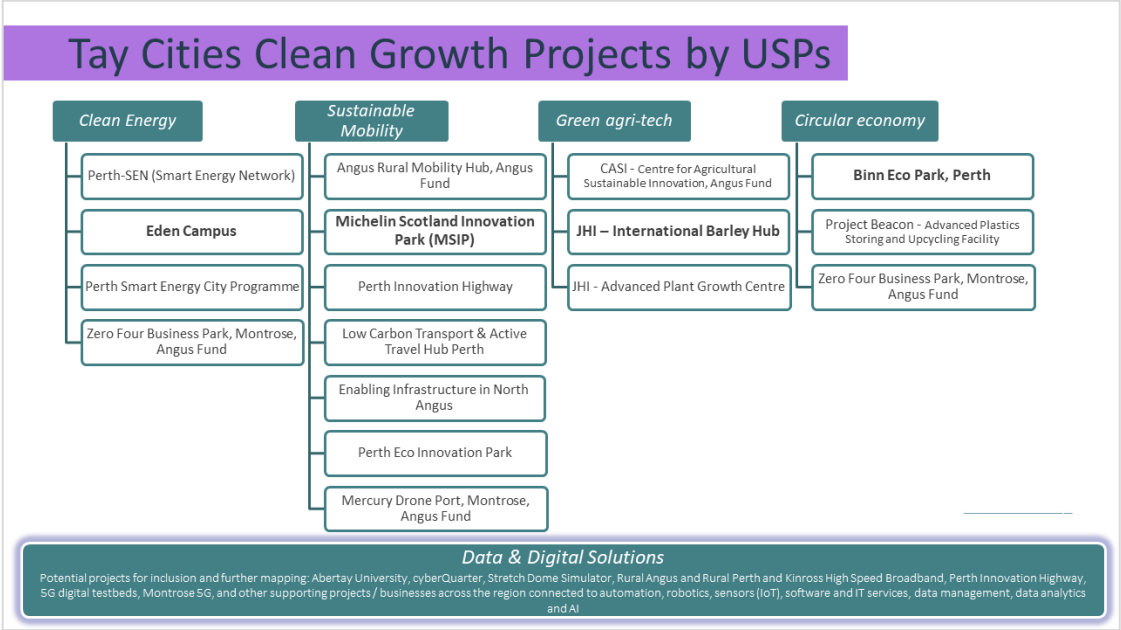
[19] https://www.msipskillsacademy.com/

[20] https://www.skillsdevelopmentscotland.co.uk/media/45888/final-skills-investment-plan-tay-cities-region.pdf

[21] https://www.taycities.co.uk/news/tay-cities-skills-plan-launched

[22] https://www.taycities.co.uk/sites/default/files/2022-12/221202%20TCD%20Digital%20Skills%20Project.pptx

Figure 2.1: Clean Growth projects by sector



Source: Tay Cities Region (2023)

2.17 **Renewable and Clean Energy**: The region has significant potential for renewable energy generation, particularly in offshore wind, and the Clean Energy sector in the region is well-positioned to support developments such as the SeaGreen Offshore Wind Farm, which will be one of the largest in Scotland.[23] Specific Clean Energy project activity in the region includes the Perth Smart Energy Network, which will support the development of smart, flexible energy systems across different property portfolios.[24] Additionally, the Eden Campus at the University of St Andrews will support a range of Clean Energy activity, including hydrogen fuel cells and battery storage, onshore wind, energy infrastructure, smart energy systems and energy supply chain development.[25]

2.18 **Onshore Wind, and Tidal Energy**: The coastal areas along the Tay estuary offer favourable conditions for renewable energy projects. Developing and expanding renewable energy infrastructure can not only contribute to decarbonisation but also create job opportunities in the sector. Initiatives are underway to develop offshore wind farms, such as the Seagreen Offshore Wind Farm, which will be one of the largest in Scotland[26]. This project will contribute to clean energy generation, job creation, and economic growth in the region.

2.19 **Sustainable Mobility**: Promoting low-carbon transport options is an essential aspect of clean growth and this is influential throughout the Tay Cities Region. Through the promotion of regional and national transportation, Clean Skills can be supported in areas such as rail and newer technologies such as those supporting the adoption of electric vehicles and developing cycling and walking infrastructure related to active travel. A key actor within the Sustainable Mobility space is MSIP, a founding member of the Clean Growth Initiative, as discussed above. Also, the Angus Rural Mobility Hub will be a Clean Growth Business Park with infrastructure, services and skills to both enable and support the wider region's transition to low carbon and sustainable transport. This £5.9 million multisectoral development in Brechin is currently at the consultation stage but will provide clean transport infrastructure on the national trunk road

[23] https://www.seagreenwindenergy.com/

[24] https://taycitiescleangrowth.scot/project/perth-smart-energy-network/

[25] https://innovation.st-andrews.ac.uk/

[26] https://www.seagreenwindenergy.com/

network and create the opportunity to develop Clean Growth skills and career opportunities within the region[27].

2.20 **Circular Economy**: Fostering a circular economy can contribute to waste reduction, resource efficiency, and job creation. Encouraging recycling and reusing materials, supporting sustainable manufacturing practices, and developing local supply chains can enhance the region's economic resilience and environmental sustainability. The concept of the circular economy will be important across all areas within the Tay Cities Region, but will be supported in all of the clean growth sectors. A key project within the context of the Tay Cities Region is Project Beacon at Binn Eco Park, which will focus on materials recovery and advanced mechanical and chemical plastics recycling.[28] Additionally, EcoTechnic is a business network supported by Scottish Enterprise and other stakeholders such as the University of the Highlands and Islands (UHI), that operates in the region to accelerate sustainable development and in part, encourage collaboration through sharing information, advice and best practices[29]. Whilst focusing on renewable energy, low carbon technology and resource efficiency, the circular economy concept is embedded in their work, demonstrating how Clean Growth objectives and specific skills can proliferate across different sectors, ensuring a more sustainable, innovative and collaborative region.

2.21 **Green Agritech**: Supporting and encouraging innovation in the use of technology in agriculture to improve productivity, efficiency, and sustainability. The James Hutton Institute's Advanced Plant Growth Centre (APGC)[30] is a flagship project in this field, supported by Tay Cities Deal funding to develop and deliver innovative plant and horticultural solutions targeting food sustainability. The creation of a Centre for Agricultural Sustainable Innovation (CASI) has also been announced and will be receiving funding from the UK Government's £26.5 million Angus Fund, as part of the Tay Cities Region Deal[31]. The CASI will be managed cooperatively by the private sector in partnership with Angus Council and the James Hutton Institute. Opportunities like these will encourage investment within the region, creating jobs that value Clean Growth skills.

2.22 **Data and Digital Solutions**: The development of data and digital skills is crucial for the Tay Cities region in Scotland to thrive in the digital age and support economic growth. The Clean Growth Initiative has identified opportunities and solutions around (remote) sensing, Internet of Things (IoT), data analytics and Artificial Intelligence, amongst other areas. Data and digital skills encompass a broad range of competencies related to data analysis, digital technologies, coding, cybersecurity, and digital literacy. With targeted investment and support coming from across the public, private and third sector, the Tay Cities Region has the potential to become a hub for innovation. Recognising that data and digital skills are needed to support the Clean Growth agenda along with other sectors, £10,000 was made available for tech training providers and Further and Higher education institutions to offer new data skills courses within the region. Funded by the Scottish Government, The Data Lab and the Tay Cities Digital Skills Project collaboration aims to address the regional and national skills gap, creating a skilled workforce that can move into clean growth sectors such as data and digital skills.[32] An important element of this funding is the targeted support given to people within certain demographics that are currently underrepresented within the sector, ensuring that this emerging sector within the Tay Cities Region is one that is better representative of the region and an attractive opportunity for both investment and recruitment.

[27] https://investinangus.com/tay-cities-deal/the-angus-fund/low-carbon/angus-rural-mobility-hub/

[28] https://binngroup.co.uk/about-us/binn-ecopark/

[29] https://www.perth.uhi.ac.uk/business-and-employee-support/ecotechnic/

[30] https://apgc.org.uk/

[31] https://www.taycities.co.uk/news/driving-forward-development-agricultural-technology

[32] https://www.fife.gov.uk/news/2023/50,000-data-skills-boost-for-tay-cities-region

The importance of skills

2.23 The opportunities raised by the promotion of Clean Growth skills require a clear and consistent skills plan. Therefore, across each of the five key Clean Growth skills areas, there needs to be targeted and specific action that both reskills, attracts and trains a successful and sustainable workforce.

> *"Clean and sustainable growth will be central to our economic transformation. The transition to net zero will require innovation and large-scale collaboration between businesses, communities, and public services. This initiative is creating an online community to make new connections and help secure a greener future."*[33]

2.24 A key component of The Tay Cities Region's approach towards Clean Growth is fostering a culture of research and innovation. This includes supporting collaborations between academia, research institutions, and businesses to develop new technologies, processes, and solutions that contribute to clean growth and sustainability. This builds on the success of 'triple helix' partnership models, which utilise the unique strengths of each sector, creating a collaborative environment in which the innovation needed for Clean Growth skills, is supported. This has been demonstrated in the creation of the Tay Cities Clean Growth website, which establishes 'an online community designed to enable and encourage businesses, industry and academia to collaborate and push low carbon and clean growth innovation, while driving investment within the region'[34].

2.25 The region has been investing in training programs to develop Clean Growth skills in specific sectors, but the success of this must be understood within a wider Scottish context. Recognising that there are skills gaps in certain Clean Growth areas, the Tay Cities Region has recognised the benefits of reskilling the workforce, creating opportunities across all of the different stages in one's career. Therefore, whilst educational institutions have a large role to play in attracting young people into green jobs, retraining and reskilling the pre-existing workforce is crucial for creating a sizeable workforce with Clean Growth skills. This includes providing training and certifications for individuals already involved in established sectors, including through the newly established Tay Cities Engineering Partnership.[35] To support the transition to Net Zero, the Tay Cities Region and wider national economic strategies such as NSET rely on creating a skilled workforce to move into these new green jobs, therefore support must be provided to both attract and support people through the reskilling process. Importantly for the Tay Cities Region, gaps in Clean Growth skills in the renewable energy sector can be addressed through retraining and upskilling of those who have worked or are working in other, possibly higher-carbon, sectors such as in the North Sea oil and gas industry. As Scotland and the wider UK transition away from fossil fuels towards renewable energy, the ability to provide jobs and investment remains key to its success. This is best exemplified in the North Sea Transition Deal which aims to support the wider energy industry in the transition to renewable whilst supporting 40,000 jobs[36].

2.26 The Tay Cities Region is well placed within Scotland to benefit from both skilled workers and future renewable energy projects such as SeaGreen Offshore Wind Farm. It has been stated that over 90% of the UK wide oil and gas workforce have medium to high skills transferability and are therefore well positioned to work in adjacent energy sectors.[37]

2.27 Building on the success of specific training and learning opportunities across all areas of Clean Growth, the transferable skills acquired will create a workforce that can be innovative, agile and

[33] https://taycitiescleangrowth.scot/

[34] https://www.fife.gov.uk/news/2023/scottish-minister-for-energy-launches-tay-cities-region-clean-growth-platform

[35] https://www.taycities.co.uk/news/green-light-multi-million-pound-tay-cities-engineering-partnership

[36] https://www.gov.uk/government/publications/north-sea-transition-deal

[37] https://www.rgueti.com/wp-content/uploads/2021/05/workforce-transferability-report.pdf

collaborative in their approaches across sectors. This is recognised within educational institutes in the region, with key activities being delivered by the Michelin Scotland Innovation Parc (MSIP) and its Skills Academy, which was established to support collaboration between academia and industry. The aims of the MSIP Skills Academy is to be an accessible national skills centre for sustainable mobility and decarbonisation; inspire, educate and prepare the future workforce; and engage, influence and support delivery of government policy[38]. The MSIP Academy, which opens in 2023 features zones focusing on specific Clean Growth skills and by summer of 2023, the Academy aims to have welcomed 500 school pupils as part of its STEM outreach activity and be training 250 full-time students and apprentices[39,40]. With an increased focus on low carbon transport and sustainable mobility, this increase in places will help create skilled workforce in transport. The Tay Cities Region also has the opportunity to be a leader in this sector, with Dundee and Angus College being only one of three in the country to offer training relating to Electric Vehicles and Hybrid vehicles. The courses range from three hours to five days, from £40 to £495, and are delivered over a range of days, weekends, and evenings. There is also reference to the Institute of Motor Industry's Approved Training Centre Network, which offers EV training and qualifications which lead to IMI TechSafe registration[41].

[38] https://www.msipskillsacademy.com/about-skills-academy/

[39] https://esp-scotland.ac.uk/wp-content/uploads/2020/09/Copy-of-College-EV-Training-Info-1.pdf

[40] https://www.scottish-enterprise-mediacentre.com/news/gbp-2-1m-boost-for-drive-to-greener-transport-skills

[41] https://esp-scotland.ac.uk/wp-content/uploads/2020/09/Copy-of-College-EV-Training-Info-1.pdf

3 Clean growth skills supply

Introduction

3.1 This chapter provides an overview of education and training provision in the Tay Cities Region, giving consideration to enrolments and attainments for subjects of relevance to Clean Growth skills across college, university and apprenticeship pathways. The analysis of education and training data presented here is based on subject areas likely to contribute to the green skills and qualifications defined previously, on behalf of Skills Development Scotland, during the creation of the Climate Emergency Skills Action Plan (CESAP).[42] As per the Regional Economic Strategy there are four universities in scope, for this research, and four regional colleges. The universities, in scope, include Abertay University, the University of Dundee, the University of Highlands and Islands and the University of St. Andrews. The regional colleges in scope include Dundee and Angus College, Fife College, Perth College, and Scotland's Rural College (SRUC).[43] The chapter draws on data from the available sources including the Scottish Funding Council (SFC), the Higher Education Statistics Agency (HESA) and SDS.

3.2 There are recognised limitations on education and training data. It is retrospective and the data is collated for policy development and for a greater understanding of sectors rather than specifically to identify skills supply and demand mismatches. It should also be recognised that there is a wide variety of qualifications being delivered through various teaching/training modes, and so any comparison is not like-for-like. As such, it does not attempt to present a total potential pipeline figure for provision.

3.3 It should be noted that there may be a degree of overlap across some levels of education. For example, college data will overlap with Modern Apprenticeship (MA) data to an extent, since much SVQ delivery for MAs will be college-based.

Apprenticeship frameworks

Modern Apprenticeship, Foundation Apprenticeship, and Graduate Apprenticeship uptake on frameworks relevant to Clean Growth skills has increased in the Tay Cities Region with the largest number of MA starts occurring in Fife across ever year during the period 2018/19 to 2021/22

Modern apprenticeships

3.4 Figure 3.1 below shows the uptake on Modern Apprenticeship (MA) frameworks of relevance to Clean Growth in the Tay Cities Region from 2018/19 to 2021/22.[44] Over the period, there has been an increase in uptake from 1,131 to 1,400. There was a significant decrease in uptake during 2020/21, with 837 starts, which may have resulted from the implications of lockdown restrictions imposed due to the Covid-19 pandemic.

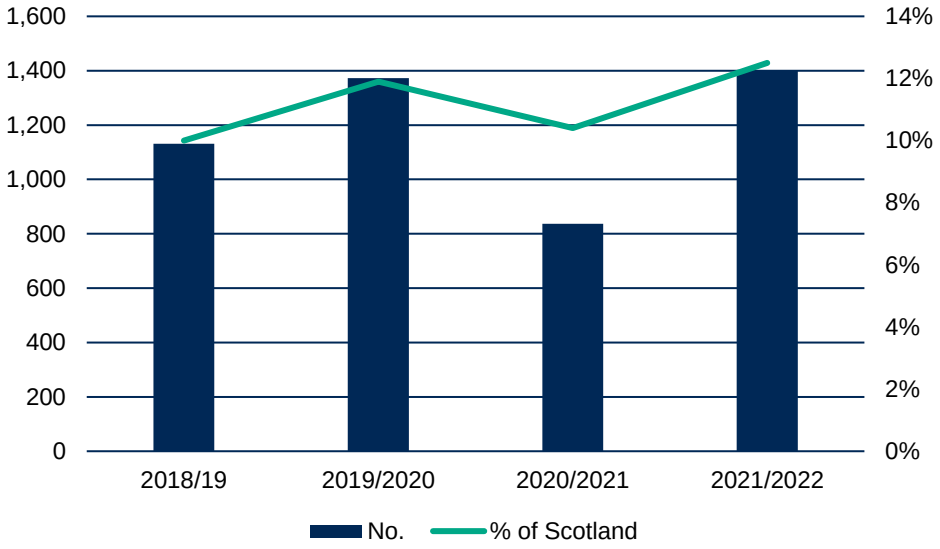
[42] The approach mirrors similar work undertaken by SDS around skills for the climate emergency. However, there is no agreed taxonomy for green skills presently. SDS and partners are working to develop the evidence base to inform the implementation of CESAP. This work will further define and establish an approach to measuring green skills and provision and will include those subjects relevant to the Energy sector and the transition to net zero. Further discussion on the challenges of defining green skills and green jobs is provided by ONS: https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/thechallengesofdefiningagreenjob

[43] The Al-Maktoum College of Higher Education (https://www.almcollege.ac.uk/) delivers an MSc in Law and Sustainability, as well as an MSc and Diploma in Moral Economy & Sustainable Development; however, data on enrolments are not readily available, though it should be noted that these courses are delivered and awarded in collaboration with Abertay University. Other courses offered by Al-Maktoum College are awarded in collaboration with the University of Dundee.

[44] Local authority based on MA postcode.

3.5 In 2018/19 starts on MA frameworks of relevance to Clean Growth in the region accounted for 10% of total MA starts in Scotland and this rose to 13% over the period highlighting the growing interest in Clean Growth skills in the Tay Cities Region.

Figure 3.1: Tay Cities MA uptake in relevant frameworks 2018/19 to 2021/22



Source: SDS 2023

3.6 Table 3.1 below shows uptake on Clean Growth relevant MA frameworks in the Tay Cities region from 2018/19 to 2021/22.[45] Freight logistics (624), construction: civil engineering (467), engineering (426), food and drink operations (413), and construction: technical (403) had the largest uptake over the period 2018/19 to 2021/22. A number of relevant MA frameworks (including, for example, Power distribution) received zero starts over the period. However, if these frameworks were taken up in the Tay Cities Region then this may help to increase the uptake of Clean Growth skills.

Table 3.1: Tay Cities MA uptake on relevant frameworks 2018/19 to 2021/22

Framework	2018/19	2019/20	2020/21	2021/22	Total
Furniture, Furnishings and Interiors	0	0	0	192	192
Boat Building and Repair	0	0	0	177	177
Construction: Specialist	18	29	16	151	214
Engineering Construction	0	11	0	146	157
Construction: Technical Apprenticeship	53	83	61	132	329
Electronic Security Systems	5	0	0	114	119
Freight Logistics	177	232	111	104	624
IT and Telecommunications Technical Apprenticeship	10	6	14	102	132
Data Analytics Technical Apprenticeship	0	0	0	85	85
Plumbing and Heating	0	0	12	63	75
Industrial Applications	12	10	0	28	50
Construction: Technical	123	150	103	27	403
Electrical Installation	91	87	76	13	267
Information Security	0	0	0	13	13
Equine	0	0	5	10	15

[45] Local authority based on MA postcode.

Framework	2018/19	2019/20	2020/21	2021/22	Total
Agriculture	6	5	12	9	32
Digital Applications	23	21	40	8	92
Land-based Engineering	0	5	0	8	13
Engineering	156	165	99	6	426
Life Science and Related Science Industries	0	0	0	6	6
Rail Engineering	0	0	0	6	6
Construction: Civil Engineering	144	228	95	0	467
Food and Drink Operations	111	181	121	0	413
IT and Telecommunications	148	97	49	0	294
Horticulture	24	38	5	0	67
Glass Industry Occupations	8	10	11	0	29
Heating, Ventilation, Air Conditioning and Refrigeration	6	5	0	0	11
Trees and Timber	5	5	0	0	10
Water Industry	0	0	7	0	7
Rural Skills	6	0	0	0	6
Game & Wildlife Management	5	0	0	0	5
Supply Chain Management	0	5	0	0	5
Aquaculture	*0*	*0*	*0*	*0*	*0*
Aquaculture Management Technical Apprenticeship	*0*	*0*	*0*	*0*	*0*
Bus and Coach Engineering and Maintenance	*0*	*0*	*0*	*0*	*0*
Facilities Management	*0*	*0*	*0*	*0*	*0*
Fashion & Textile Heritage	*0*	*0*	*0*	*0*	*0*
Information Security Technical Apprenticeship	*0*	*0*	*0*	*0*	*0*
Life Science and Related Science Industries Technical Apprenticeship	*0*	*0*	*0*	*0*	*0*
Life Sciences	*0*	*0*	*0*	*0*	*0*
Maritime Occupations	*0*	*0*	*0*	*0*	*0*
Power Distribution	*0*	*0*	*0*	*0*	*0*
Print Industry Occupations	*0*	*0*	*0*	*0*	*0*
Signmaking	*0*	*0*	*0*	*0*	*0*
Spirits Operations	*0*	*0*	*0*	*0*	*0*
Sustainable Resource Management	*0*	*0*	*0*	*0*	*0*
Wood and Timber Industries	*0*	*0*	*0*	*0*	*0*
Total	1,131	1,373	837	1,400	4,741

Source: SDS 2023

3.7 The largest number of starts on MA frameworks of relevance to Clean Growth MAs in the Tay Cities Region occurred in Fife[46] across every year during the period 2018/19 to 2021/22 as shown below in Table 3.2. Dundee City has seen the greatest increase in Clean Growth MA provision over the period with a 70% increase in starts by 2021/22. Angus is the only Tay Cities local authority to experience a decrease in starts on Clean Growth MAs (-8%). Overall, there was a 24% increase in Clean Growth MA uptake in the Tay Cities Region.

[46] Whilst only North East Fife is within the Tay Cities Region, Apprenticeship data is not available below the Fife LA level

Table 3.2: Tay Cities MA uptake on relevant frameworks by local authority 2018/19 to 2021/22

MA Starts	2018-19	2019-20	2020-21	2021-22	Total	% change 2018-19 to 2021-22
Fife	614	665	471	756	2,506	23%
Perth & Kinross	197	260	163	251	871	27%
Dundee City	128	219	97	217	661	70%
Angus	192	229	106	176	703	-8%
Total	1,131	1,373	837	1,400	4,741	24%

Source: SDS 2023

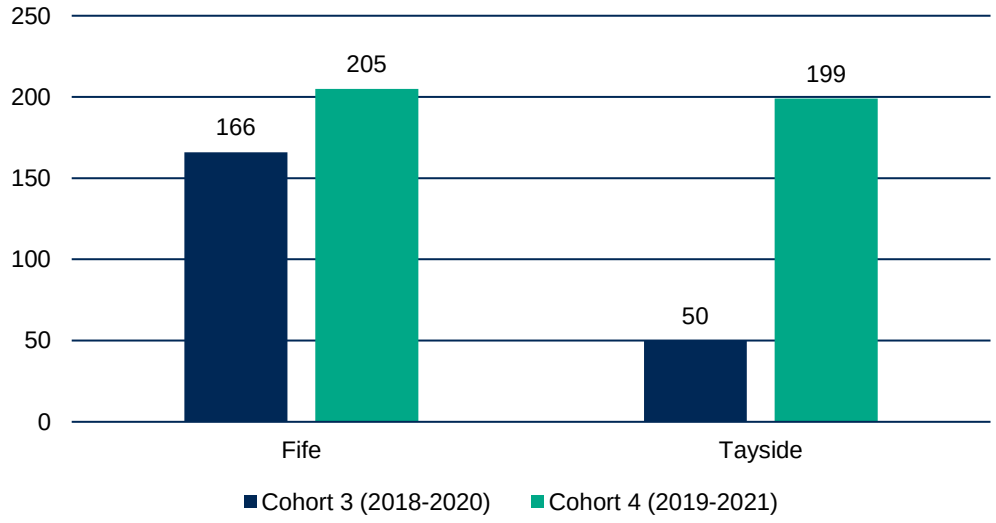
Foundation apprenticeships

3.8 Foundation Apprenticeships (FA) are two-year programmes that were first introduced in 2016, following two early pathfinder cohorts in 2014 and 2015. The period 2016-18 was the first time that the FA starts and cohorts participated in the fully designed and certified FA frameworks.

3.9 The general growth in uptake of FA opportunities, particularly between 2018-20 and 2019-21 was also driven by wider availability of the shorter-duration delivery model (SDDM), which enables pupils to complete their FA within one rather than two years. This means greater flexibility for pupils and a shorter-term commitment for those who are studying across a range of qualifications, not just the FA. These factors, as well as pupil motivations to gain a qualification, work experience and get a head start on a career path, have widened the appeal of FAs overall. Scope therefore exists to deliver more frameworks aligned to increase skills of relevance to Clean Growth in the future.

3.10 The general growth in uptake of FAs across Scotland is also evident in the Tay Cities Region. Figure 3.2, below, shows total FA enrolments on cohorts three and four in the two college regions that cover the Tay Cities Region; Fife and Tayside. Cohort three was constituted by 166 apprentices in Fife and 50 in Tayside.[47] Cohort four was constituted by 205 apprentices in Fife and 199 apprentices in Tayside. This represents a 23.5% increase in uptake in Fife and a 298% in Tayside. Tayside's large percentage increase followed a national trend and Fife saw a similarly large percentage increase from cohort two to three.

Figure 3.2: Total FA uptake in Fife and Tayside from 2018/20 to 2019/2021



Source: SDS FA Progress Report 2022

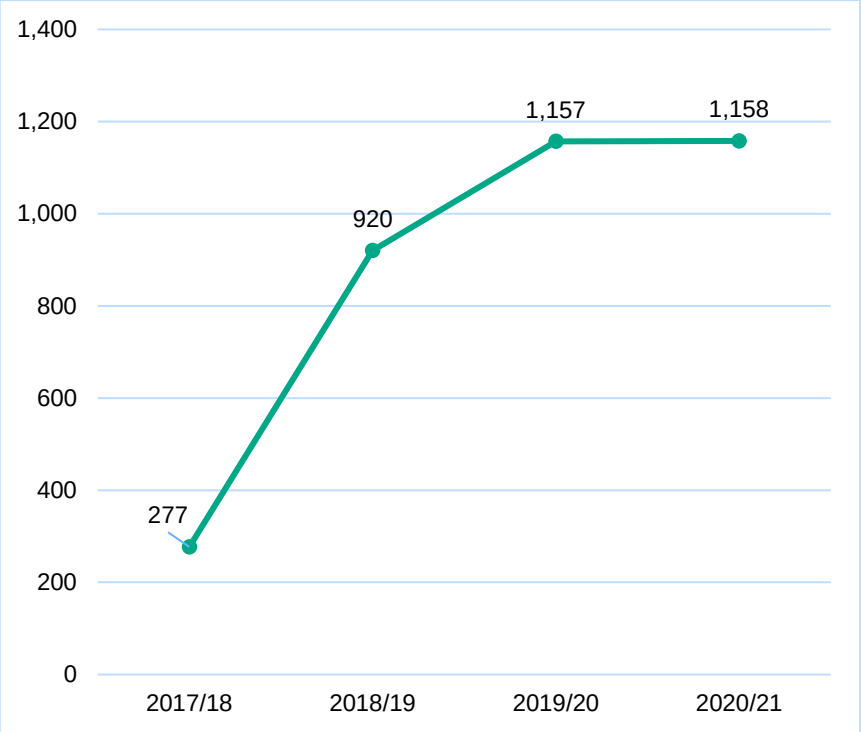
[47] Note that figure 3.2 represents total FA uptake and that only a portion of these are starts on frameworks relevant to Clean Growth Skills.

Graduate apprenticeships

3.11 Graduate Apprenticeships (GA) were introduced in 2017-18. Wider GA delivery has been bolstered by a range of frameworks being made available, including GAs associated with Clean Growth skills, e.g. Engineering.[48]

3.12 The success of pilot and early frameworks has almost certainly led to increased uptake generally. However, the increased uptake has also been driven by a greater number of employers engaged in the GA programme, enabling new and existing employees to undertake skills development through the programme. This highlights, for both learners/employees and employers, a greater focus on developing higher-level Clean Growth skills demanded across-sectors, and importantly greater opportunity in future to deliver frameworks aligned to emerging Clean Growth skills needs. The increased uptake, for GAs in Scotland over the most recent four-year period, can be seen below in Figure 3.3.

Figure 3.3: GA uptake in Scotland from 2017/18 to 2020/21



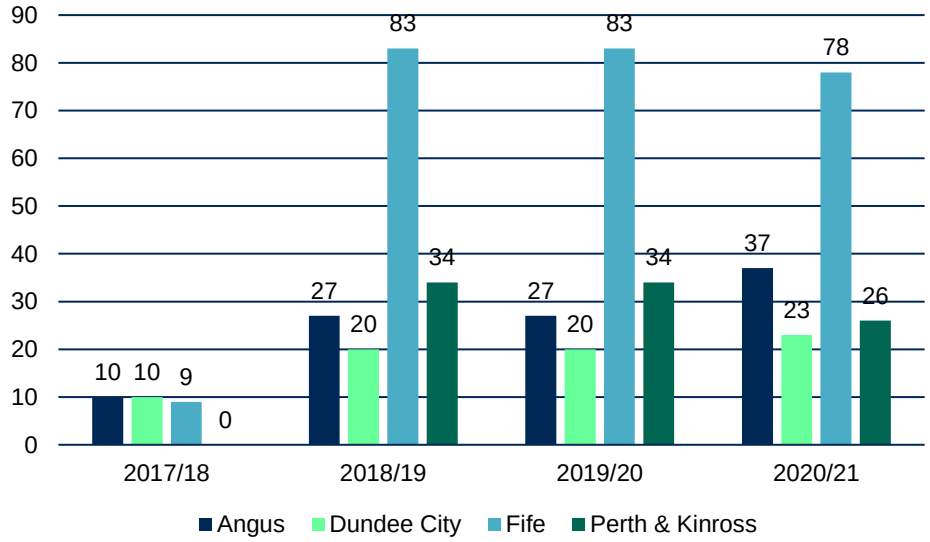
Source: SDS GA Progress Report 2022

3.13 Across all four of the Tay Cities Local Authorities, GA uptake increased by at least double from 2017/18 to 2018/19. As shown below, in Figure 3.4.

3.14 In all four Tay Cities local authorities there was an uptake in GAs from 2017/18 to 2018/19. As shown in Figure 3.4 there was a significant uptake in Fife from less than ten GAs in 2017/18 to more than 80 in 2018/19. This uptake is maintained for the next two years and amounts to more than double that of any of the other individual local authorities.

[48] Data for individual frameworks by local authority isn't publicly available so this section has analysed total GA uptake by local authority.

Figure 3.4: Tay Cities GA uptake by apprentice local authority from 2017/18 to 2020/21



Source: SDS GA Progress Report 2022

3.15 Table 3.3 below shows the number of registered GAs by their employer's local authority. Employers in Dundee City provided significantly more apprenticeships than other Tay Cities local authorities in 2017/18. This indicates that most of the GAs in the Tay Cities region travelled to Dundee City for their apprenticeships during that year. This trend continued as Dundee City provided more apprenticeships than there were apprentices over the following years. However, the significant uptake in the number of graduate apprentices from Fife from 2017/18 to 2018/19 can also be seen, in Table 3.3, as the number of graduate apprenticeships provided in Fife increased from seven to 53. Perth & Kinross also saw a relatively large increase in graduate apprenticeships provided from 2018/19 to 2019/20. This indicates that there was less of a reliance on Dundee City's employers' provision of graduate apprenticeships over the period 2017/18 to 2020/21 as registered graduate apprentices began to be employed slightly more equally across the Tay Cities region.

Table 3.3: Registered GAs by employer LA from 2017/18 to 2020/21

Local Authority	2017/18	2018/19	2019/20	2020/21
Fife	7	53	46	54
Perth & Kinross	0	10	26	32
Dundee City	17	32	33	35
Angus	0	17	17	18
Total	**24**	**112**	**122**	**139**

Source: SDS GA Progress Report 2022

College provision

College enrolments on subjects of relevance to Clean Growth skills have decreased by 20%, over the period 2018/19 to 2021/22, in the Tay Cities Region

3.16 Colleges in Scotland deliver a wide range of education provision in subject areas that are of relevance to the Clean Growth skills. This section provides an analysis of the college provision in the Tay Cities Region and the potential it has for meeting the needs of the Clean Growth sector. It should be noted that enrolments for 2019-20 largely happened before the COVID-19 pandemic: enrolments from September 2019 and January 2020 intakes will not have been affected by COVID-19, and only May 2020 intake, where offered, would have been impacted by COVID-19.

3.17 Table 3.4 below sets out the enrolments on courses in subjects of relevance to Clean Growth at colleges in the Tay Cities Region from 2018/19 to 2021/22. Fife College[49] accounted for the largest proportion of enrolments on courses in subjects of relevance to Clean Growth in the region accounting for approximately 74% of enrolments in 2021/22 even though it saw a 25% decrease in enrolments over the period. Perth College saw a 9% decrease over the period whilst Dundee & Angus College saw a 5% increase in enrolments. Overall, there was a 20% decrease in enrolments in Clean Growth college courses in the Tay Cities region from 2018/19 to 2021/22.

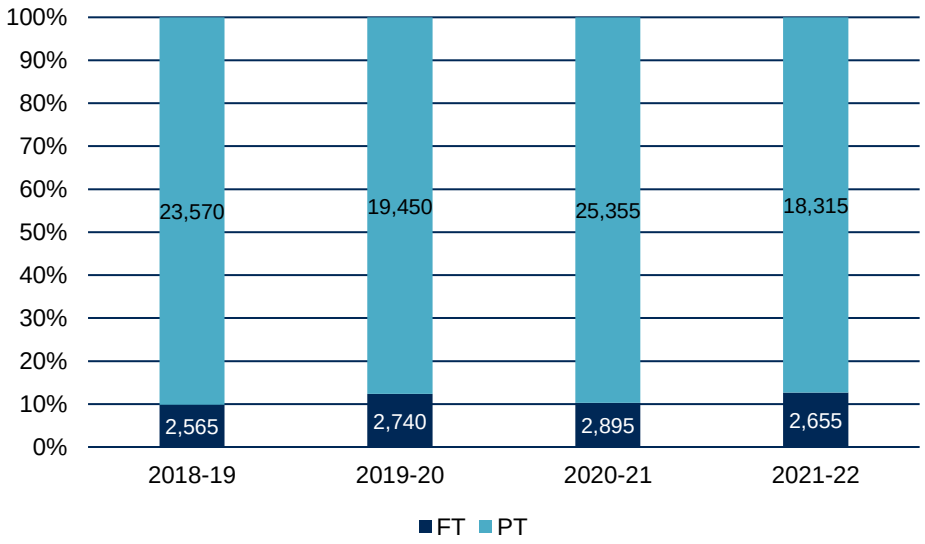
Table 3.4: Tay Cities enrolments on Clean Growth college courses from 2018/19 to 2021/22

College	2018/19	2019/20	2020/21	2021/22	% change from 18-19 to 21-22
Dundee & Angus College	4,485	4,480	5,530	4,700	5%
Fife College	20,950	17,110	22,180	15,630	-25%
Peth College	700	600	540	640	-9%
Total	**26,135**	**22,190**	**28,250**	**20,970**	**-20%**

Source: SFC 2023

3.18 Enrolments on subjects of relevance to Clean Growth skills is typically part-time with a large majority of students enrolled under this mode of study over from 2018/19 to 2021/22 at Tay Cities colleges as shown below in Figure 3.5.

Figure 3.5: Tay Cities full-time/part-time enrolment split on Clean Growth college courses from 2018/19 to 2021/22



Source: SFC 2023

3.19 The college superclass area with the most enrolments over the period from 2018/19 to 2021/22 is engineering, as shown in Table 3.5 below, accounting for 62% of enrolments on subjects of relevance to Clean Growth skills in 2021/22.[50] However, enrolments in the engineering superclass area decreased by 28% over the period which is a larger decrease than the overall decrease in enrolments on subjects of relevance to Clean Growth skills in the Tay Cities Region (-20%). Construction and property (built environment), politics/economics/law/social sciences and sciences and mathematics accounted for large proportions of enrolments on subject areas of relevance to Clean Growth skills over the period.

[49] Whilst only North East Fife is within the Tay Cities Region, college enrolment data is not available below the Fife College level

[50] Most enrolments on engineering superclass courses are due to a number of introductions to STEM partnership initiatives with local primary schools for P6 and P7 pupils.

Table 3.5: Tay Cities enrolments on Clean Growth college courses from 2018/19 to 2021/22 by superclass area

Superclass	2018/19	2019/20	2020/21	2021/22	% change
Engineering	17,995	14,615	19,970	13,010	-28%
Construction and Property (Built Environment)	3,515	3,220	3,345	3,245	-8%
Politics/Economics/Law/Social Sciences	1,620	1,635	1,845	2,085	29%
Sciences and Mathematics	2,340	1,815	2,200	1,840	-21%
Agriculture, Horticulture and Animal Care	390	630	550	450	15%
Services to Industry and Commerce	25	120	30	170	580%
Environment Protection/Energy/Cleansing/Security	80	90	265	90	13%
Oil/Mining/Plastics/Chemicals	135	25	45	50	-63%
Transport Services	35	40	0	30	-14%
Total	**26,135**	**22,190**	**28,250**	**20,970**	**-20%**

Source: SFC 2023

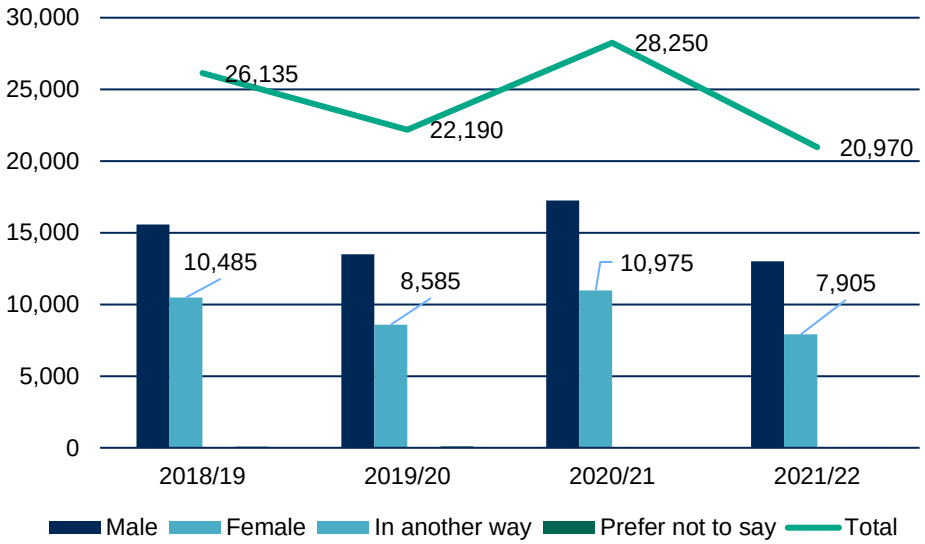
3.20 Table 3.6 below shows the male/female enrolment split on subjects of relevance to Clean Growth skills by college superclass area in the Tay Cities region. Enrolments are largely made up by male students and this has increased slightly over the period from 60% to 62%. Enrolments by students identifying in another way than male or female, or preferring not disclose their gender, accounted for 0.3% in 2018/19, 0.5% in 2019/20, 0.1% in 2020/21 and 0.2% in 2021/22 (see Figure 3.6 below).

Table 3.6: Tay Cities male female enrolment split on Clean Growth college superclass areas from 2018/19 to 2021/22

	2018/19		2019/20		2020/21		2021/22	
	Male	Female	Male	Female	Male	Female	Male	Female
Politics/Economics/Law/ Social Sciences	810	810	705	915	645	1,195	700	1,365
Environment Protection/Energy/ Cleansing/Security	45	35	50	40	210	55	65	25
Sciences and Mathematics	985	1,355	750	1,065	970	1,230	745	1,085
Agriculture, Horticulture and Animal Care	150	240	240	390	320	230	210	240
Construction and Property (Built Environment)	2,880	590	2,825	330	3,260	85	3,130	95
Services to Industry and Commerce	25	0	80	40	30	0	155	15
Engineering	10,515	7,450	8,790	5,805	11,770	8,180	7,940	5,070
Oil/Mining/Plastics/ Chemicals	130	5	25	0	45	0	50	0
Transport Services	35	0	40	0	0	0	20	10
Total	**15,575**	**10,485**	**13,505**	**8,585**	**17,250**	**10,975**	**13,015**	**7,905**
% split of male and female	***60%***	***40%***	***61%***	***39%***	***61%***	***39%***	***62%***	***38%***

Source: SFC 2023

Figure 3.6: Tay Cities enrolment split by gender on Clean Growth college courses from 2018/19 to 2021/22



Source: SFC 2023

3.21 Most enrolments in the Tay Cities Region on subjects of relevance to Clean Growth skills were under the age of 16 in 2021/22 (59%) followed by students aged 16-19 (21%) as shown in Table 3.7 below. The high proportion of enrolments by students under 16 is likely due to a number of 'introduction to STEM' (Science, Technology, Engineering, Mathematics) partnership initiatives, delivered in conjunction with local primary schools for P6 and P7 pupils, that have recently been introduced. These are designed to stimulate interest in and appetite for further STEM study amongst pupils at later stages of their secondary and tertiary education.

Table 3.7: Tay Cities age category enrolment split on Clean Growth college superclass areas in 2021/22

	Under 16	16-19	20-24	25-29	30-39	40-49	50-59	60+
Politics/Economics/Law/Social Sciences	240	895	265	155	240	145	120	25
Environment Protection/Energy/Cleansing/Security	5	55	10	0	10	10	0	0
Sciences and Mathematics	840	525	220	105	115	25	5	5
Agriculture, Horticulture and Animal Care	85	185	85	25	30	25	15	0
Construction and Property (Built Environment)	775	1,360	795	100	120	55	40	0
Services to Industry and Commerce	0	70	30	25	40	0	5	0
Engineering	10,475	1,235	585	245	270	125	70	5
Oil/Mining/Plastics/Chemicals	0	0	0	5	20	10	15	0
Transport Services	0	0	0	5	20	5	0	0
Total	**12,420**	**4,325**	**1,990**	**665**	**865**	**400**	**270**	**35**
% of total	***59%***	***21%***	***9%***	***3%***	***4%***	***2%***	***1%***	***0%***

Source: SFC 2023

3.22 Most enrolments in the Tay Cities Region on college superclass areas relevant to Clean Growth skills, in 2021/22, are on SCQF level two courses (52%) as shown below in Table 3.8.[51] SCQF

[51] STEM partnership initiatives with local primary schools for P6 and P7 pupils.

level six enrolments are the second highest (20%), followed by level five (18%), level four (8%) and level three (2%).

Table 3.8: Tay Cities enrolments on Clean Growth college superclass areas from 2021/22 by SCQF level

	SCQF L2	SCQF L3	SCQF L4	SCQF L5	SCQF L6
Politics/Economics/Law/Social Sciences	0	75	125	695	760
Environment Protection/Energy/Cleansing/Security	0	5	0	85	0
Sciences and Mathematics	5	65	130	175	25
Agriculture, Horticulture and Animal Care	5	40	650	820	1,415
Construction and Property (Built Environment)	0	35	5	105	10
Services to Industry and Commerce	10,015	30	550	780	805
Engineering	0	0	0	50	0
Oil/Mining/Plastics/Chemicals	0	0	0	0	30
Transport Services	0	75	125	695	760
Total	***10,025***	***325***	***1,585***	***3,405***	***3,805***
% of total	***52%***	***2%***	***8%***	***18%***	***20%***

Source: SFCS 2023

University provision

Enrolments on university subjects of relevance to Clean Growth skills have increased slightly, by 4%, over the period 2019/20 to 2021/22 in the Tay Cities Region.

3.23 Table 3.9 below shows the Tay Cities Region enrolments on university courses of relevance to Clean Growth skills from the period 2019/20 to 2021/22. It should be noted that UHI enrolments account for enrolments across all UHI campuses and not solely Perth College UHI. Overall, enrolments on subjects of relevance to Clean Growth skills increased over the period by 4%. Abertay University saw an 18% decrease whilst the University of St Andrews, the University of Dundee and UHI saw 14%, 9% and 1% respective increases in Clean Growth-related subject enrolments over the period. In 2021/22, the University of St Andrews accounted for the most enrolments on university subjects of relevance to Clean Growth skills in the Tay Cities Region. However, evidence suggests that Abertay University's significant reduction in enrolments on subjects of relevance to Clean Growth skills is partly driven by a reclassification of some of its computing modules, rather than a reduction in enrolments.[52] Anecdotal evidence also suggests that there has been an increase in take-up of micro-credential courses through Abertay University.

[52] Interrogation of HESA data highlights a corresponding increase in enrolments in subjects coded under CAH25, which sits outwith the current CESAP-linked definition, used to inform the analysis of skills in this study. CAH25 includes subjects related to design, product design, graphic design, etc. along with fine art, painting, hair and make-up, etc. This would suggest the need to review and revise the CESAP definition in future. However, disaggregated data below CAH Level 1 data is not readily available, and as such enrolment numbers for design-related courses cannot be isolated.

Table 3.9: Tay Cities enrolments on Clean Growth university courses, by university, from 2019/20 to 2021/22

	2019/20	2020/21	2021/22	Total	% change from 2019/20 to 2021/22
St Andrews	5,035	5,590	5,760	16,385	14%
UHI	4,720	5,055	4,785	14,560	1%
Dundee	4,465	4,460	4,855	13,780	9%
Abertay	2,905	2,780	2,390	8,075	-18%
Total	**17,125**	**17,885**	**17,790**	**52,800**	**4%**

Source: HESA 2023

3.24 Table 3.10 below shows enrolments, by HESA Common Aggregation Hierarchy (CAH)[53] level one subject area, on university subjects of relevance to Clean Growth skills in the Tay Cities Region. Social sciences accounted for the highest proportion of enrolments over the period (15,195) followed by computing (8,460) then biological and sports sciences (6,005). Geography, earth and environmental studies (social sciences) experienced the highest percentage change over the period (45% increase) followed by physical sciences (23%), agriculture, food and related studies (23% increase), geography, earth and environmental studies (natural sciences) (13% increase), and biological and sports sciences and law (12% increase respectively). Computing and engineering and technology were the only two subject areas to experience a decrease in enrolments over the period (with a 16% and a 9% decrease respectively).

Table 3.10: Tay Cities enrolments on Clean Growth university courses, by subject area, from 2019/20 to 2021/22

	2019/20	2020/21	2021/22	Total	% change from 2019/20 to 2021/22
Social sciences	4,940	5,090	5,165	15,195	5%
Computing	2,990	2,970	2,500	8,460	-16%
Biological and sport sciences	1,850	2,080	2,075	6,005	12%
Engineering and technology	1,630	1,570	1,490	4,690	-9%
Physical sciences	1,345	1,530	1,650	4,525	23%
Law	1,175	1,210	1,315	3,700	12%
Geography, earth and environmental studies (natural sciences)	1,035	1,085	1,170	3,290	13%
Mathematical sciences	805	825	850	2,480	6%
Architecture, building and planning	655	640	700	1,995	7%
Agriculture, food and related studies	500	605	585	1,690	17%
Geography, earth and environmental studies (social sciences)	200	280	290	770	45%
Total	**17,125**	**17,885**	**17,790**	**52,800**	**4%**

Source: HESA 2023

3.25 Table 3.11, below, shows the undergraduate/post-graduate enrolment split on CAH level one subjects of relevance to Clean Growth skills at Tay Cities universities from the period 2019/20 to 2021/22. Most students study enrolled at undergraduate level throughout the period, however, this slightly decreased from 2019/20 to 2021/22 from 84% to 82%.

[53] https://www.hesa.ac.uk/support/documentation/hecos/cah

Table 3.11: Tay Cities universities' undergraduate and post-graduate enrolment split on courses in clean growth subject areas from 2019/20 to 2021/22

Subject area	2019/20		2020/21		2021/22	
	Under-graduate	Post-graduate	Under-graduate	Post-graduate	Under-graduate	Post-graduate
Biological and sport sciences	1,495	360	1,670	410	1,690	385
Agriculture, food and related studies	470	35	560	45	540	45
Mathematical sciences	705	100	720	105	740	110
Engineering and technology	1,450	190	1,420	145	1,285	205
Computing	2,545	445	2,465	505	2,000	510
Architecture, building and planning	495	165	560	80	585	115
Geography, earth and environmental studies (natural sciences)	815	220	785	300	840	330
Social sciences	4,365	575	4,345	745	4,455	720
Law	840	335	900	310	880	435
Geography, earth and environmental studies (social sciences)	180	20	255	30	255	30
Physical sciences	1,085	260	1,225	305	1,315	330
Total	**14,445**	**2,705**	**14,905**	**2,980**	**14,585**	**3,215**
% split	***84%***	***16%***	***83%***	***17%***	***82%***	***18%***

Source: HESA 2023

3.26 Table 3.12, below, details the full-time/part-time enrolment split on CAH level one subjects of relevance to Clean Growth skills at Tay Cities universities from 2019/20 to 2021/22. Students largely prefer full-time study with approximately 85% to 84% preferring this more throughout the period 2019/20 to 2021/22.

Table 3.12: Tay Cities universities' full-time and part-time enrolment split on courses in clean growth subject areas from 2019/20 to 2021/22

Subject area	2019/20		2020/21		2021/22	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
Biological and sport sciences	1,700	150	1,905	175	1,900	170
Agriculture, food and related studies	330	175	400	205	360	225
Mathematical sciences	800	5	815	5	830	10
Engineering and technology	1,215	425	1,215	355	1,120	365
Computing	2,695	290	2,580	395	2,155	350
Architecture, building and planning	550	110	545	95	600	100
Geography, earth and environmental studies (natural sciences)	940	100	980	110	1,065	110
Social sciences	3,730	1,210	3,830	1,260	3,845	1,320
Law	1,085	90	1,140	75	1,215	95
Geography, earth and environmental studies (social sciences)	190	0	275	0	280	5
Physical sciences	1,290	50	1,455	80	1,605	35
Total	**14,525**	**2,605**	**15,140**	**2,755**	**14,975**	**2,785**
% split	***85%***	***15%***	***85%***	***15%***	***84%***	***16%***

Source: HESA 2023

Training and re-training support in the Tay Cities Region

There have been a number of funds allocated to training of relevance to Clean Growth skills in recent years across Scotland and in the Tay Cities Region.

3.27 In recent years, there have been several funds allocated to the development of Clean Growth skills in Scotland (some of which align with upskilling courses mentioned below)[54]. For example, the National Transition Training Fund[55], Advanced Manufacturing Training Fund[56], Scottish Oil and Gas Transition Training Fund[57], the National Energy Efficiency Transition Support and Heat Pump Training Fund[58], and SP Energy Networks' Green Economy Fund[59]. These funds will have contributed to Clean Growth skills across the nation including the Tay Cities Region.

3.28 Tay Cities Clean Growth, supported by the Tay Cities Region Deal, hosts a community for professionals who contribute Clean Growth projects and opportunities and they identify specific funding opportunities for Tay Cities Region organisations (some of which are detailed below).[60]

3.29 This funding largely came from the EU but the UK Government has now taken control and has secured £212 million for Scotland as part of the UK Shared Prosperity Fund (UKSPF) for 2022-25, including through the Multiply adult numeracy strand.[61] People and Skills is one of three investment priorities for the UKSPF in Scotland and this will help to boost Clean Growth skills

[54] Note that there may be crossover between funds due to funding and policy management.

[55] https://www.gov.scot/news/sustainable-economic-recovery/

[56] https://www.scottish-enterprise.com/support-for-businesses/develop-products-and-services/innovation-support/advancing-manufacturing-challenge-fund

[57] https://www.gov.scot/publications/foi-202200277106/

[58] https://select.org.uk/SELECT/Website/About/News/News_Content/2021/May_2021/national_transition_fund.aspx

[59] https://esp-scotland.ac.uk/green-economy-fund/

[60] https://taycitiescleangrowth.scot/

[61] https://www.gov.uk/government/publications/uk-shared-prosperity-fund-prospectus/ukspf-allocations

in the Tay Cities Region going forward.[62] However, there is concern regarding the amount received through the UKSPF, and the available budget for skills. In comparison, Scotland received €941 million through the European Structural Investment Funds (ESIF) during the 2014-20 programming period, with €465 million of this allocated through the European Social Fund (ESF).[63]

3.30 The Scottish Oil and Gas Transition Fund was established to help oil and gas workers affected by facilities closures to re-skill and further train themselves in order to find employment again. It was launched in 2020 and supported 4,000 people across Scotland.

3.31 The National Energy Efficiency Transition Support and Heat Pump Training Fund was supported by ESP and was put in place by the Scottish Government to support those in the energy, engineering and construction sectors whose careers were affected by the COVID-19 pandemic. It provided fully-funded college places on upskilling subject areas across nine colleges in Scotland. These courses were of significant relevance to Clean Growth skills, for example, heat pump installation, solar panelling, and energy battery storage awareness.

3.32 SP Energy Networks' Green Economy Fund was established to established to accelerate the delivery of innovative green energy solutions with the aim of delivering a better future for Scotland's communities. Minimum grant awards are available from £10,000 and eligible organisations, small, medium, and large, can express and interest until July 2023.

3.33 Tay Cities Clean Growth hosts a project library, as part of its community engagement, which has a filterable list and a map of various clean growth projects and related organisations in the Tay Cities Region.[64] Some of the projects identified include:

- St Andrew's University's Eden Campus: a platform for innovative economic activity in North-East Fife with a focus on de-carbonising society;
- Perth Smart Energy Network: flexible energy systems offer potential for any organisation that manages a dispersed and diverse portfolio of properties such as a local council;
- Low Carbon Transport and Active Travel Hub Perth: a project that aims to contribute to the Tay Cities Region shared vision and objectives by improving sustainable connectivity, workforce mobility and innovation;[65] and

3.34 Tay Cities Clean Growth community members also gain access to an aggregated and frequently updated list of funding opportunities for the Clean Growth sector. Currently, 107 organisations, across the Tay Cities Region, are involved.

Education and training provider activity

The Michelin Scotland Innovation Parc and Dundee & Angus College, amongst others, provide various upskilling and short courses of relevance to Clean Growth skills in the Tay Cities Region.

3.35 There are various private, public and third sector Clean Growth skills training providers that operate within the Tay Cities Regions. Notably, this includes the MSIP Skills Academy, which focuses on existing and next generation technologies across the sustainable mobility and

[62] https://www.gov.uk/government/publications/uk-shared-prosperity-fund-interventions-outputs-and-indicators/interventions-list-for-scotland

[63] https://www.gov.scot/policies/european-structural-funds/

[64] https://taycitiescleangrowth.scot/projects/

[65] Ibid.

decarbonisation industries, with particular focus on low carbon transport, renewable energy, hydrogen and battery technology.[66]

3.36 There are a number of upskilling courses and related activity that align with Clean Growth skills at MSIP Skills Academy such as: advanced manufacturing, cobots (collaborative robots), electric vehicles, renewables, wind turbine safety and technical training, motor vehicles, STEM space, SeaGreen skills for the Future Lab, and computer-aided design. Several of MSIP Skills Academy's upskilling courses are co-facilitated in collaboration with Dundee & Angus College, and other providers.[67]

3.37 Dundee & Angus College also provide their own upskilling and short courses. For example, they have developed a Net Zero and carbon accounting offer for businesses. This package is delivered by Dundee and Angus College, in collaboration with carbon accounting specialists Imperium, and is provided at three levels. As part of course registration Dundee & Angus College provide access to initial training in the use of the software, plus guidance on input of datasets to businesses for up to a year.[68]

3.38 With regards to the Sustainable Mobility strand of Clean Growth, Dundee & Angus College is the first place in Scotland to offer hydrogen courses with respect to vehicles. They also offer courses in the maintenance of electric and hybrid vehicles. These courses are accredited by the Institute of the Motor Industry (IMI), and are offered at three distinct levels. Level One courses are at SCQF Level 4 and are awareness-raising courses, giving an introduction to the knowledge of safe working practices and precautions required to avoid injury when working near hydrogen vehicles. Level Two courses offered at SCQF Level 5 relate to the knowledge and skills required to carrying out routine maintenance and repair activities. Level Three courses that are provided are at SCQF Level 6 and are with respect to the knowledge and skills required to work safely around a vehicle that may have had damage to its high energy/electrical system.

3.39 Dundee & Angus College are offering a considerable number of courses that fit within the Data and Digital strand of Clean Growth. There are full-time FE courses in advanced manufacturing, automation and robotics that are offered to school pupils in the region. In many instances, these pupils would not otherwise be able to undertake them, as their schools do not offer the subjects. These courses also have full-time provision, and are offered to industry both in terms of an apprenticeship route and also by way of ad-hoc training for businesses. The college is also offering the first eSports degree in Scotland, which can be perceived as a possible introduction to transferable wider data and digital skills for new entrants to the sector.

3.40 Dundee & Angus College are also offering a course relating to Agritech in the form of an Introduction to Agriculture and Estates Skills course that helps learners gain an understanding of the countryside and the people who work there. The College are currently seeking funding from the Scottish Funding Council to create a course in respect to how to collect, use and report on data relating to agriculture. It was, however, noted in consultation that the College's low registration profile in agriculture and horticulture suggests that there is low visibility with regards to innovations and equipment in the wider agricultural sector in the region, meaning that unless learners have a prior agricultural background, it is difficult to encourage agriculture as a career option.

3.41 The region's colleges have a host of courses that are being delivered that lead to positive Clean Growth skills outcomes. These include courses such as an HNC in the Built Environment offered by Fife and Dundee & Angus Colleges (NC in Built Environment at UHI Perth). These are well-established and have been in operation for years. Fife College have reintroduced an HNC in

[66] https://www.msipskillsacademy.com/future-focussed/

[67] https://www.msipdundee.com/

[68] https://dundeeandangus.ac.uk/for-businesses/features/net-zero-carbon-accounting/

Civil Engineering this academic year (22/23) as a part time qualification (delivered over one afternoon and evening per week) which was originally taken out due to low uptake to the full-time course. Fife College's Dunfermline campus also offers a HNC in Construction Management, which is currently being delivered to first- and second-year entrants in a combined rolling programme as a result of current low registration number (prior to this year, it was being delivered online as a result of Covid restrictions and as such the lack of a social aspect and the need to work as a team on projects was lost when it was being delivered digitally) but it was discovered through consultation that Fife College expect this to rise again now that it's being delivered in the classroom.

3.42 Fife College also offer a wide degree of upskilling and entry-level courses, such as their two Skills Boost programmes, including Skills for Work Engineering which has been noted as popular, receiving double the amount of signups over the last couple of years than in previous years and can lead to a qualification in production support operative courses that Fife College also run. Another popular Skills Boost programme that is also ran by Fife College is their Electric Vehicle Upskilling course which is delivered to commercial customers that have prior knowledge in vehicle maintenance (that require a "top up" to handle the intricacies of electric vehicles) at their Glenrothes and Rosyth campuses.

3.43 Fife College also work in partnership with a range of businesses and organisations to deliver Clean Growth skills-related courses, such as the Global Wind Organisation's Basic Technician Training course that is delivered at their Rosyth campus. This course is designed for tradespeople that are looking to upskill and reskill for new technologies in renewable wind energy.

3.44 Other education institutions in the Tay cities region provide courses at various SCQF levels such as Abertay University's Climate Change, Carbon, and Sustainability CPD upskilling course[69], Perth College's Engineering Skills NQ[70] or Water Resources in a Changing Climate CPD Award[71], and there is some evidence to suggest that these are increasing in popularity.

3.45 Online, membership-based training providers are also accessible to people living in the Tay Cities Region. The Supply Chain Sustainability School, for example, provides e-learning resources to its members and it focuses on all aspects of the built environment, and including eight main topics; sustainability, digital, FIR, lean construction, management, offsite, people and procurement.[72]

[69] https://www.abertay.ac.uk/courses/upskilling-short-courses/climate-change-carbon-and-sustainability/

[70] https://www.perth.uhi.ac.uk/courses/nq-engineering-skills/

[71] https://www.perth.uhi.ac.uk/courses/cpd-award-water-management/

[72] https://www.supplychainschool.co.uk/

4 Current and future Clean Growth skills demand

Introduction

4.1 As identified key sectors for the Tay Cities Region, the constituent sectors of Clean Growth – Circular Economy, Clean Energy, Gren AgriTech, Sustainable Mobility (along with Data and Digital as a cross-cutting sector) – represent a significant growth opportunity. Data and digital aside, these are relatively nascent sectors, but already there is emerging demand for skills to support their growth, and as activities scale up and opportunities for development and inward investment are realised, there will be a commensurate increase in demand for skills.

4.2 This demand is not constrained to particular specialist skillsets or roles. Skilled workers are required across the range of roles and functions in each sector, and at all levels of operation and experience. It is worth noting that digital skills should be considered an overarching skillset that every business will need going forward, in line with the need and demand set out in the Digital Economy Skills Action Plan.[73] This is already acknowledged by the Tay Cities Skills Plan.[74]

4.3 However, there are challenges in understanding the extent of this skills demand, driven largely by the (limited) nature of engagement with the Clean Growth business base in the region. Dissonance at the interface of businesses, education and training providers and government is preventing an appreciation of the full range of skills demanded by businesses, thus preventing education and training providers and strategic actors from formulating an adequate and effective skills response.

Nature and volume of skills required

Cross-sectoral skills demand

The volume of skills required across all Tay Cities Clean Growth sectors is a critical challenge

4.4 Consultations identified that across all Clean Growth sectors in the Tay Cities Region, there is considerable demand for skilled workers at all levels, to meet both current and future demand. This level of demand is not unique to Clean Growth sectors: there is well-documented high-volume demand for skilled workers across a range of sectors not just in the Tay Cities Region, but across Scotland as well, including for example in digital technologies, adult social care, construction, etc.

4.5 Whilst consultees were unable to give an indication of likely numbers of skilled workers required to meet either current or future demand, all were able to provide some perspectives on, or evidence of, the likely scale of demand from employers in Clean Growth sectors.

4.6 Though there is clear unmet demand for skills currently, this is expected to increase as activity across Clean Growth sectors increases, and development opportunities are realised. In many respects, these are still nascent sectors, or the modes of operation are relatively recent. As the sectors mature, greater volumes of workers will be required. This is in part being driven by the policy agenda of the Scottish Government with regard to the climate emergency, energy and the ambitions of the NSET. However, global market trends in these areas will undoubtedly

[73] https://www.skillsdevelopmentscotland.co.uk/media/50035/digital-economy-skills-action-plan.pdf

[74] https://www.taycities.co.uk/news/tay-cities-skills-plan-launched

contribute to an acceleration of growth if the Tay Cities Region, and Scotland, wishes to remain competitive in UK and global markets.

Skilled workers are required across all Clean Growth sectors in the Tay Cities Region – at all levels, and at all points of sectoral value chains

4.7 There is clear evidence through consultations that a range of skills are required at all levels and across the breadth of value chains within each Clean Growth sector. Consultees pointed to the need for operational and skilled roles and workers, as well as in management, leadership and strategic roles.

4.8 This suggests the need for a stratified or segmented approach to developing Clean Growth skills, with interventions tailored to specific levels or degrees of specialism. However, current perspectives from consultees indicate that this is more about what occupational skills and levels of expertise (e.g. engineering, project management) can be *applied* in a Clean Growth context.

Demand is less about specific Clean Growth roles or skills, and more about skilled individuals or roles with an understanding of or competency in Clean Growth issues

4.9 One area where consultees have been unequivocal is regarding the *nature* of skills required. There is a broad consensus that, apart from in a small number of instances, there is limited demand for Clean Growth-specific skills or workers. Rather, there is – and will continue to be – a demand and need for workers that are equipped with the skills and capabilities required and necessary to respond to the challenges of the climate emergency and more sustainable patterns of development or economic operation.

4.10 It is worth noting that role requirements are of course changing and evolving. For example, roles in engineering or fabrication – in great demand not only in Clean Energy but also in other Clean Growth sectors – are typically cleaner, with higher levels of automation and use of technology, compared to typical engineering and fabrication trades in traditional modes of industry.

4.11 In addition, some specialist areas of skills will be required. For example, Non-Destructive Testing (NDT) is increasing in importance for the offshore wind industry, given the nature of the marine environment that windfarms are located in – and this is likely to increase as sites further offshore are developed.[75] The developing hydrogen energy sector will also require specific skills and knowledge relating to the electrolysis process, essential for the conversion and storage of hydrogen, as well as specialised safety, maintenance and logistics/transportation roles.

4.12 However, for the most part, the workers or skills required could be considered largely mainstream or conventional, but with a portion of their skillset being focused on Clean Growth-relevant capabilities. Consultees regularly described this as being the 'top 10%' of their skillset needing to be climate literacy, or understanding of sustainability principles to inform how their skillset is applied – a 'Clean Growth top-up' for skillsets.

"There is no such thing as a renewables engineer, it is an engineer that works in renewables."

Education qualifications are becoming less relevant; base knowledge, meta skills and ability to engage in systems thinking are much more important

4.13 Allied to this, employers are less fixed on what qualifications workers and sector entrants have, and are more concerned with base knowledge, and an ability to problem solve and think

[75] See for example: https://www.emec.org.uk/press-release-cleanwintur-biofouling-solutions-for-offshore-wind-turbines/

critically. This was often described in different ways depending on the background of the consultee. However, there was a clear focus on meta skills[76], and the ability to work in an agile way in the workplace – the ability to act in a professional role using competences, abilities, knowledge and skills to continuously perform in a dynamic work environment.

4.14 Such capabilities can often enable more inexperienced workers, or new workforce entrants within Clean Growth sectors, bridge the challenge in meeting a demand for more experienced workers. We know, for example, that many employers seek workers with three to five years of experience. Whilst apprenticeships and other modes of training with a high degree of relevant work-based learning may provide this experience, demonstrating an ability to be agile, flexible, and to problem-solve is increasingly invaluable to employers. Further, there is a recognition amongst some employers that that there is considerable value in taking on relatively inexperienced workers and education leavers, and challenging them from the offset, to gauge their capabilities and competences, and then develop a career development approach for them on that basis:

"[Businesses should] treat them as 'blanks', find out where their skills are at, and then train and invest, test and challenge."

4.15 A further requirement amongst many employers is an ability to engage in systems thinking, and understand the wide range of dependencies in a given value chain. This is seen as an essential part of climate literacy, engaging with concepts such as the climate emergency, Net Zero and sustainability, and recognising how to apply skills in engineering or manufacturing within a Clean Growth context.

Transitioning skillsets from other sectors has a role to play in meeting Clean Growth skills demand

4.16 There is scope for workers to transfer or to transition from other sectors, such as oil and gas. Recent research indicates that the majority of oil and gas workers are 'transition-ready' in terms of skills transferability.[77] However, the transferability of certifications and qualifications for higher-skilled roles, and their recognition in some other sectors, such as in the offshore wind industry, may be problematic. Some pilot schemes are currently testing processes for 'converting' such qualifications, in recognition of the commonalities across many (marine) energy industries.[78]

Wrap-around skills are also in demand, and must not be ignored

4.17 Allied to the demand for strong meta skills as discussed above, findings from the research indicate that 'core' skills in each Clean Growth sector must not be viewed in isolation, and wrap-around skills must not be ignored. This includes skills such as contract management, procurement, negotiation, project management, legal, business modelling and commercialisation, change management, scenario planning, etc. – all essential to the effective operation of Clean Growth businesses and sectors.

Identifying opportunities to develop skills in live 'test beds'

4.18 A number of consultees identified the need to develop skills in a live environment. This is not simply in terms of creating more opportunity for work-based learning and work experience or placements, but giving education leavers and workers the space to test out new approaches –

[76] As per SDS research: https://www.skillsdevelopmentscotland.co.uk/media/44684/skills-40_a-skills-model.pdf

[77] https://www.rgueti.com/wp-content/uploads/2021/05/workforce-transferability-report.pdf

[78] For example, the BOSIET for renewable Energy (Transition); see: https://downloads.opito.com/downloads/OPITO-Product-Datasheet-BOSIET-for-Renewable-Energy-Transition-Full-Access.pdf

room to develop competencies, learning from trial, error and failure, etc. A number of consultees with sector-specific focuses suggested the need for a 'sandbox' approach, in line with wider Tay Cities Region ambitions for creating a test-bed environment.

AgriTech

An increasing demand for skills in plant science and biology is anticipated

4.19 One of two key skills areas in demand in AgriTech is for expertise in plant science and biology. Given the focus of AgriTech on efficient plant growth, climate change resilience/resistance in crops, pre- and post-growth production, crop storage and indoor/closed-system production, a workforce skilled in plant biology is critical. Similarly, businesses reported a need for skills in horticulture, food science and regenerative AgriTech.

4.20 There are already key assets in the region including Intelligent Growth Systems, who have a vertical farm near Dundee, the Eden Campus at the University of St. Andrews, and the James Hutton Institute in Invergowrie. The International Barley Hub is a key project in the Tay Cities Deal, and a contract for construction was in January 2023 for a combined Advanced Plant Growth Centre and International Barley Hub.[79] The Centre for Agricultural Sustainable Innovation (CASI) is another important asset that will be delivered by the Tay Cities Deal through the Mercury Programme's AgriTech strand.[80]

4.21 This demand for skills is equally applicable for both food and non-food crops. AgriTech applications in pharmaceutical, cosmeceutical and crop production for human health is a real growth area, and one that Scotland could exploit. For example, the James Hutton Institute's Advanced Plant Growth Centre are currently exploring the potential for of unharvested broccoli biomass (stem and stalk) to create low-cost, low-impact, highly nutritious protein from a previously wasted side stream.[81]

4.22 There is a sense amongst some consultees that plant science knowledge could be relatively generic from a production point of view – one consultee considered this as needing to be 'pre-degree'. However, demand for horticultural skills is likely to increase, and some consultees consider that horticultural training has declined in Scotland in recent years.

The application of technology, digital and data systems will drive demand for digital skills across AgriTech

4.23 The second significant area of skills demand in AgriTech in in digital and data skills. The development of advanced horticulture systems, including vertical farming, is driving an increase in demand in what the Digital Economy Skills Action Plan (DESAP) terms *Integrated Digital Skills*, as well as *Professional Digital skills*.[82]

4.24 As such, there is a demand for workers and sector entrants that are trained in digital and/or data, but have an interest in agriculture and horticulture – recognising the twin demand for plant and digital/data skills. As one consultee noted:

"Lots of AgriTech [and related investment] is around data management."

4.25 These digital skills need to be balanced with multiple other skills besides agricultural or horticultural understanding. This includes meteorology, finance and accounting, energy

[79] https://www.hutton.ac.uk/news/contract-signed-construction-%C2%A3287m-combined-advanced-plant-growth-centre-and-international

[80] https://investinangus.com/tay-cities-deal/the-angus-fund/agri-tech/centre-for-agricultural-sustainable-innovation-casi/

[81] https://apgc.org.uk/800k-government-grant-for-broccoli-protein-upcycling-consortium/

[82] https://www.skillsdevelopmentscotland.co.uk/media/50035/digital-economy-skills-action-plan.pdf

management, engineering, monitoring and remote sensing, and so on. Digital skills are considered particularly important for supporting the shift away from more traditional and resource intensive modes of agriculture.

Mechanical and engineering skills will continue to be required

4.26 Agriculture has traditionally required a myriad of mechanical, electrical or engineering skills. Despite the anticipated demand for digital skills, consultees consider that this will continue to be the case. In some instances, this may need a shift from purely mechanical abilities towards 'mech-tech', with skills requirements in at least pre-degree mechanical and electrical engineering, given the need to support more complex growing systems. This may include, but is not limited to, regenerative agriculture, vertical farming and indoor/covered horticulture and permaculture.

Circular Economy

Problem solving and systems thinking are critical skills for workers in the Circular Economy

4.27 The Circular Economy is an area of strength for the Tay Cities Region, and industry operators see the area as somewhere that can have a strong impact quickly in terms of sector development. Key to achieving this potential is access to high-level problem-solving skills, as well as to workers with an aptitude for systems thinking.

> *"Problem-solving and systems thinking are key – either designing out waste in the first place, or working out how to deal with waste – finding a customer, market or end-use."*

4.28 There is a wealth of research being undertaken on systems thinking within Circular Economy approaches.[83] Zero Waste Scotland supports a range of Circular Economy and related activity in Scotland. The application of Circular Economy and systems thinking approaches is essential in either create products that are meant to be recycled or reused, or in developing novel ways in dealing with waste.

4.29 To this end, consulted employers reported that do not see much difference in the abilities or value of school leavers and graduates with regard to typical challenges in the Circular Economy space, since both are capable of tackling a particular challenge (e.g. plastics) even if from very different ends of the problem. Further, there is demand for skilled workers in frontline operative roles as well as in more senior positions such as team leaders, managers, etc. and all must be capable of systems thinking, problem-solving and have a highly-developed meta skills. Thus there is scope for a variety of education pathways including Apprenticeship frameworks to support demand for skilled workers in the Circular Economy sector.

Understanding of Circular Economy principles is essential to all skills and roles in demand within the Circular Economy sector

4.30 In line with the discussion above regarding the 'top 10%' knowledge and skills of workers needing to be focused on Clean Growth or sustainability/climate emergency literacy, full understanding of Circular Economy principles is essential. This is true for those working in waste management, construction, manufacturing, textiles (and particularly fashion and clothing) as well as in other areas.

4.31 Given the systems change required to move away from more linear economies and modes of production, it is not only those directly involved in frontline roles in fields such as waste

[83] See for example: https://www.sciencedirect.com/science/article/abs/pii/B978012819817900034X, or: https://link.springer.com/article/10.1007/s11356-020-11725-9

management that require this understanding. For example, economists and financial professionals need to both understand and communicate the practicalities of Circular Economy principles, so that they are more able to appreciate – and communicate – the value of Circular Economy principles and processes beyond pure monetary and cashflow terms – i.e. the value of conservation, keeping resources in cycle, impact and benefits of moving away from linear systems, or embodied carbon.

Clean Energy

The Tay Cities Region has clear strengths in Clean Energy-related activity: opportunities in renewable generation is a clear driver for skills demand, but significantly increasing demand for skills in this area is anticipated

4.32 The Tay Cities Region is well-positioned to take advantage of the energy transition, and be at the vanguard of Clean Energy developments. Its ports, including Dundee and Montrose, stand to benefit from the recent ScotWind leasing round, with the ports already handling a wide range of renewables and (oil & gas) decommissioning activity. For example, Montrose is the operational base for the Seagreen offshore windfarm development, and energy from Seagreen is exported to the grid via a new substation at Tealing near Dundee.[84]

4.33 Whilst there may be an existing labour pool to meet current demand for renewable energy skills, the consensus amongst stakeholders is that the volume of available skills in the region is insufficient to meet the employment and skills requirements of an expected significant growth in renewable energy capacity in and around the region.

4.34 The Scottish Offshore Wind Energy Council's Skills Intelligence Model is forecasting a significant increase in the total Scottish offshore wind workforce over the next decade or so – potentially more than doubling. This will of course be influenced by how many inward investments are landed in the region – not just for marshalling and assembly activity for offshore wind, but also for fabrication.

4.35 However, this increasing demand is not, and will not be, unique to the region. Renewable energy (both terrestrial and marine) is of national significance to Scotland, and other regions are also experiencing similar patterns of actual and forecast demand for skills. For example, the Highlands and Islands is at the forefront of developments for ScotWind, and is also witnessing an increase in demand for such skills. Yet the competition and demand for skills is not confined to Scotland: there is a global marketplace for skilled Energy sector workers, with staff willing to travel for higher rates of pay across short-term contracts. There is therefore a need to demonstrate the long-term pipeline of opportunities in the area.

New models of energy generation will require different skillsets in grid management and local energy systems

4.36 The trend towards renewable forms of energy generation, the increasing prevalence of micro-renewables, and the direction of travel under the Scottish Government's draft Energy Strategy and Just Transition Plan means that the energy grid of the future will need to be different. In response to this, there is anticipated to be greater demand for skills in grid management, local energy systems and Local Area Energy Planning (LAEP).[85]

4.37 Alongside this, there is also increasing demand anticipated for skills and technical knowledge in (battery) hydrogen storage. This may be required for example to store curtailed energy from

[84] https://www.seagreenwindenergy.com/

[85] https://es.catapult.org.uk/tools-and-labs/local-area-energy-planning/

onshore commercial or community windfarms, or for the storage of energy generated by offshore windfarms.

Decarbonising heating systems will require a shift in skillsets

4.38 The shift away from fossil fuels for electricity and heating means that there will be increasing demand for more electricians, electrical engineers. Employers point towards some specific skills and understanding in fields such as insulation, Passivhaus standards, maintenance of low carbon tech (including district heating, EV charge points, heat pumps, solar DC systems, etc.), as well as the need for more 'mainstream' skills applied in a low carbon or Clean Growth context.

4.39 Already there are large-scale programmes of retrofitting, with domestic gas boilers being replaced with air- or ground-source heat pumps. From 2025, gas and oil boilers will not be permitted in newbuild homes. The H100 Fife project[86] is a demonstrator project providing green hydrogen through a new gas network to around 300 households in Buckhaven and Dunbeath.

4.40 This means that the incumbent workforce will require to develop (more) electrical skills to complement existing gas engineering or plumbing skills. This will not only be for the installation of low carbon heating systems, but the replacement of electricity distribution boards in domestic and commercial properties where such heating systems are retrofitted. However, evidence from consultations suggests that these skills are already in great demand, with evidence of companies struggling to fill positions as a result of short supply.

Sustainable Mobility

As electric vehicle use increases, greater knowledge of and skills in electric vehicle charging, maintenance and repair is required

4.41 As electric vehicle use, and ownership increases, there is a recognised demand for skills in electric vehicle charging, maintenance and repair. Battery and hybrid electric vehicles (PHEV and HEV) account for over one third of new vehicle registrations in the year to date across the UK.[87]

4.42 Already, training providers in the area, including Dundee & Angus College, have responded to opportunities in this space, and are delivering training on electric vehicle maintenance. Dundee & Angus College is one of eight colleges across Scotland currently delivering electric vehicle training, with more developing their electric vehicle training offer. However, consultations have identified that this is an area where there is likely to be increasing demand for skills as the market share of electric vehicles increases.

Skilled workers are required across the full Sustainable Mobility value chain

4.43 A particular challenge identified through the research is the dearth of skills across the spectrum of Sustainable Mobility activity. As discussed above, there is particular focus amongst industry on electric vehicles, and the skills required to support their operation, maintenance and repair. For example, there is significant update of electric vehicles amongst local authorities and public transport providers. However, this is only a small part of the Sustainable Mobility landscape: a range of other skills needed in the region to support the development of Sustainable Mobility were also identified.

[86] https://www.h100fife.co.uk/

[87] https://www.smmt.co.uk/vehicle-data/evs-and-afvs-registrations/

4.44 Smart Perth[88] is a flagship programme for the development of Perth as a smart city. Planning skills are increasing in demand both for smart cities and also for supporting the development of 20-minute neighbourhood, which is a key feature of National Planning Framework 4 (NP4).[89] This skills demand is of relevance for smart cities, and for planning more widely.

4.45 Operational and strategic skills are also required for the implementation of intelligent transport systems (ITS). ITS is increasingly critical for traffic management, signal controls, variable speed limits, etc. Novel applications include collision avoidance and co-operative systems on the road. With the advent of driverless vehicles, more skills in ITS planning, development and management will be required. Aligned to this, cybersecurity skills to protect ITS in the region, and indeed across Scotland will be required – and it is anticipated that there will be significant medium- and long-term demand for cybersecurity skills for ITS.

4.46 Active travel is a key part of Scotland's transport strategy.[90] A considerable proportion of Scottish Government transport budget is committed to active travel. In the Tay Cities Region, the Low Carbon Transport & Active Travel Hubs Programme is delivering three complementary transport developments, including an active travel hub in Perth. Similarly, the Angus Mercury Programme will establish a rural mobility hub in Brechin.[91] Other projects, such as the Levelling Up Funded Green Transport Hub and Spokes project[92] at the former Bell Street Car Park in Dundee will also support sustainable and multi-modal transport. With the trend towards increasing active travel and modal shift, there is an anticipated increase in demand for skills related to active travel, ranging from transport and active travel planners, through to design and infrastructure engineers and active travel management.

4.47 The modal shift away from private vehicle use will also require more workers skilled in public transport provision. This is necessary to ensure that there is fit-for-purpose, demand-responsive public transport provision – to support planning and making journeys, and also to encourage greater behaviour change and modal shift amongst people living, working and travelling in (and through) the Tay Cities Region.

Public sector and strategic bodies require a significant level of skills and capabilities in Sustainable Mobility and wider transportation

4.48 The research highlighted considerable demand for skills in Sustainable Mobility within the public sector. Consultees reported that there exists a shortage of skills across the Sustainable Mobility and transportation value chain – in operational roles, transport planning and strategy, operational roles – and at all levels.

4.49 This impacts on the public sector's ability to deliver transport services, and manage the transport network in the region. It also impacts on the public sector's ability to engage with the private sector regarding developments.

4.50 Consultees report that much of this shortage of and demand for skills has stemmed from austerity measures and cuts to public budgets. This is also impacting on the ability to develop skills in-house, and progress workers in their roles. A consequence of this is the over-reliance on consultants to deliver transport services, and provide platforms such for mobility as a service (MaaS). As one consultee noted with regard to developing skills and competencies in-house within the public sector:

[88] https://www.investinperth.co.uk/smart-perth/

[89] https://www.gov.scot/publications/national-planning-framework-4/

[90] https://www.transport.gov.scot/active-travel/

[91] https://investinangus.com/tay-cities-deal/the-angus-fund/low-carbon/angus-rural-mobility-hub/

[92] https://www.dundeecity.gov.uk/news/article?article_ref=4483

"There is a real gap in being able to take people in and develop them right from the start."

4.51 Whilst it was not specifically raised through consultations, anecdotal evidence suggests that this skills shortage is also a factor for other parts of the public sector, for example in planning. This may in turn impact on understanding and approving Clean Growth-related plans.

Data and Digital

Demand for digital and data skills will be significant

4.52 Developments in ICT and digital technologies are transforming how we live and work. Technology is increasingly prevalent across the economy and wider society, as an enabler for increased productivity, efficiency and innovation. Digital skills are no longer about a single sector or small number of sectors. Digital skills are required in all sectors, industries and in most jobs. Employees are increasingly being asked to carry out their roles with the use of digital technology, and business leaders need to be able to be 'digitally informed' employers and customers of their supply chain.

4.53 As recognised in the DESAP, there are varying categories or segments of digital skills competences:

- **Operational Digital skills**: skills that are needed for the business to digitally transition, and digital adoption amongst employees to enable a transition to digital ways of working;
- **Integrated Digital skills**: a skillset that combines expertise and competency in a given professional discipline with advanced Digital user skills; and
- **Professional Digital skills**: those skills that are essential in 'hard' Digital Technologies roles and occupations.

4.54 Data and digital is considered a cross-cutting sector for the Scottish economy. In the context of the Tay Cities Clean Growth Initiative, it is an important cross cutting sector, given the extent to which it underpins Clean Growth activity in other Clean Growth sectors, and in other parts of the economy. Data and digital skills can also be considered cross-cutting. Skills development in data and digital is a particular strength in the region, and for Dundee in particular. However, such skills are already in high demand in line with evidence at a national level regarding the need for increased digital capabilities the workforce, and greater numbers of digital workers with at least some degree of digital skills. Further, it is anticipated that demand for digital and data skills in the region will be increasingly significant in future. There is evidence from businesses that digital and data skills will be in highest demand amongst businesses operating in Clean Growth.

Workers will be needed to apply strong digital skills in an industry-specific context

4.55 It is clear that the application of strong digital skills in an industry-specific context will be essential. In this regard, digital and data skills must be considered part of a worker's meta skills – a core part of their competences, abilities, knowledge and skills that allow them continuously act in a professional role and perform in a dynamic work environment.

4.56 This skillset must also be agile and applicable to a number of different contexts – i.e. easily transferable. So rather than being considered transport-specific digital skills for example, they would be digital skills applied in transport.

Challenges in understanding skills demand

4.57 There are many factors influencing the ability of strategic actors to fully understand the scale and nature of skills demand within and across Clean Growth sectors. These are discussed in this section.

Understanding employer need and accessing reliable intelligence on skills demand from businesses is difficult

4.58 This challenge is the first in a number of issues relating to (limited) business engagement with those strategic bodies able to act on intelligence and influence the skills response to business demand, as identified through the consultations. The challenge of business engagement is not unique to the Tay Cities Region, nor is it confined to issues around Clean Growth skills. This lack of business engagement means that there is a lack of clear and specific information on employer skills need. Consequently it is hard to gauge demand from businesses – and thus plan learner provision in response. In short, employers are not necessarily demanding the skills they need now, or in the future. The Independent Review of the Skills Delivery Landscape identified this as a particular issue, and suggested that one solution may be for enterprise agencies like Scottish Enterprise to play a role in future workforce planning as part of wider business support activity.[93]

4.59 For many businesses, there is a degree of short-termism and a focus on business as usual. This is in part a result of pandemic recovery, the pressures of increasing costs and inflation, economic uncertainty and many businesses focusing on survival.

4.60 Thus, the target group for both informing skills planning and for potential courses or training programmes are hard to reach.

4.61 There is a consensus amongst consultees that education and training providers have the capacity to respond to the skills needs of businesses and to skills challenges they are set. However, without a pipeline of information or data from businesses, and no corresponding direction from strategic partners based on analysis of information, they are unable to react – nor are they able to speculatively develop courses, as discussed below in Chapter 5.

Businesses do not communicate their skills needs effectively – and smaller businesses are not engaged in conversations about future skills demand and need

4.62 Consultees from both strategic organisations and businesses were in agreement that businesses do not communicate their skills needs effectively.

4.63 This is in part due to the focus on operational aspects of business, as described above. Particularly for smaller businesses, their lack of thinking more strategically, and engaging in horizon-scanning activity means that many businesses are unsighted on sector developments, or macro-economic trends, and so do not relate it to the skills needs of their business.

4.64 While larger businesses necessarily have the capacity to engage in more strategic activity around skills and workforce development, they are also more likely to be engaged with education and training providers, and indeed with strategic actors such as enterprise and skills agencies. This makes them more able to be at the forefront of Clean Growth skills development, and thus more aware of what skills they need.

[93] https://www.gov.scot/publications/fit-future-developing-post-school-learning-system-fuel-economic-transformation/

There is a degree of dissonance at the interface of businesses, education and training providers and government

4.65 There is a need for a triple helix connected environment of businesses, skills, education and training providers and strategic actors in the Tay Cities Region. There is some evidence of this taking place, e.g. through the Michelin Scotland Innovation Parc (MSIP) Skills Academy. However, it can be argued that what is happening currently is more piecemeal than done in a strategic, joined up way.

4.66 Strategic partners need to do more to understand and aggregate demand across Clean Growth sectors, and to harness engagement from smaller businesses. A clear strategy on Clean Growth may help to achieve this. It is perhaps something that could be addressed in due course through a Regional Economic Partnership approach and activity flowing from this. The current regional strategy[94] for the Tay Cities Region has some reference to Clean Growth through its Cities Deal programme commitments, such as to deliver the Mercury Programme in Angus, or developing the Eden Campus at Guardbridge in Fife.

4.67 However, it is arguable that there is currently no strategic approach to Clean Growth. The regional strategy pre-dates the NSET[95], and has areas where greater alignment with commitments for sustainability and Climate Emergency actions could be made.

Employers do not have confidence in the 'stickiness' of solutions

4.68 The research identified a particular challenge amongst some businesses in that there was potentially a lack of confidence amongst employers about either the longevity of direction of travel for particular technologies or approaches to sustainability challenges. To some extent, this may be because we are still at a relatively early stage of adoption in terms of the sustainability transition. However, this is acting to constrain demand for skills by preventing employers exploring options for change or developing solutions for Clean Growth, and thus also not working to understand what the skills implications of such investment might be.

"Employers are not yet willing to invest as the target is not instructive – there is no roadmap"

Terminology is a barrier to understanding Clean Growth, and therefore the skills needed for it

4.69 A final challenge in understanding skills demand for Clean Growth is in understanding the language and terminology around Clean Growth itself. Throughout the research, there was a clear distinction between those who understood and engaged with Clean Growth as a concept, and those who did not readily grasp it without a degree of discussion and exploration of the topic.

4.70 Strategic stakeholders, large enterprises, education and training providers, etc. are typically comfortable with Clean Growth terminology. They see it as interchangeable with other comparable terms, such as Green growth, sustainable growth, and so on. However, not all are clear on what Clean Growth means in the context of the Tay Cities Deal.

4.71 In contrast, SMEs see the landscape around the Climate Emergency, Net Zero and sustainability, and the terminology associated with it as very confusing. The majority of employers are not clear on what Clean Growth is, particularly when considering the distinction

[94] https://www.taycities.co.uk/sites/default/files/tay_cities_res_2019.pdf

[95] https://www.gov.scot/publications/scotlands-national-strategy-economic-transformation/

between the Net Zero aspirations of the Scottish Government, and the opportunities that exist in the Clean Growth space for businesses in the region.

4.72 Therefore, there is no shared definition or understanding of what is meant by Clean Growth, or even Green skills, common across industry, education, researchers, employers, workers, or public agencies and bodies. This contributes to the dissonance between different types of stakeholders, and thus understanding of skills and competences demanded and needed by employers to drive Clean Growth ambitions.

5 Challenges for the supply of clean growth skills

Introduction

5.1 There is a clear need for developing the capacity of the education and training system in the Tay Cities Region to respond to the anticipated increase in employer demand for Clean Growth skills. That is not to understate the range of Clean Growth-focused activity that is already in place and being delivered by the region's colleges, universities and other training academies and providers. Rather, it is acknowledging the need to bolster provision, and ensure that it is effective and responsive.

5.2 A range of factors impinge on the ability to ensure that skills provision meets industry need. Along with employer engagement as discussed in the previous chapter, understanding of Clean Growth and the opportunities it presents is also an issue. Other factors such as talent attraction and retention in the region, and the evident competition of skills across both sectors and geographical areas also disrupt the supply of skills necessary for these sectors. This raises a question of how well-placed the Tay Cities Region is to position itself to attract and retain talent from outwith the region.

5.3 Recent changes in the funding landscape are constraining Clean Growth activity amongst businesses, strategic bodies and education and training providers. Some of these are changes in the funding landscape post-Brexit; others are a result of increasing pressures on public budgets.

5.4 Ensuring – and demonstrating – a proactive and responsive skills system is essential for business and investor confidence, and thus the successful development of Clean Growth sectors in the Tay Cities Region.

Education and training

There is a lack of teaching and staff across the region with the skills to support education and training in the Clean Growth space

5.5 The research found that that there was a perceived lack of teachers and practitioners with the skills to support Clean Growth-related education and training. Consultees raised concern that some providers did not have access to staff with current, relevant knowledge and expertise in Clean Growth areas (rather than there being a shortage of staff per se).

5.6 Though no specific institutions were identified during consultations, the general perception was that this was the case more for colleges rather than for universities. However, for a small number of consultees, there was a perception that universities potentially struggled to pitch micro-skills and micro-credential training at an applied, industry-ready level. One consultee reported that they felt such training was often "too theoretical". A contrasting view offered by another suggested that current funding models and structures do not incentivise the delivery of short, flexible courses, and as such, industry partners might wish to consider if this is an area it is able to support the development of further.

Growing capacity for teaching, training and developing the skills required by businesses working in Clean Growth needs to be done in a much more strategic way

5.7 Related to the above point, there appears to be a consensus that capacity-building for education and training providers is done in a piecemeal manner. In essence, this is driven by increasingly disparate sources of funding to support professional learning for education and training

providers. Some consultees provided evidence of providers and strategic partners effectively chasing small pots of funding. This in turn prevents a coherent approach to developing the Clean Growth education and training offer required to support the region's ambitions in this regard.

5.8 Therefore, greater investment in facilities and teaching staff across the region on a more strategic basis is needed. Whilst there have been some positive developments in recent years, such as the MSIP Skills Academy, across the broader landscape of education and training providers in the region investment in equipment, resources and the skills of staff needs a more cohesive and joined-up approach.

Emerging approaches for skills development within college and university provision in the Tay Cities Region needs to be better connected with employability provision

5.9 One particular challenge noted by consultees was the tendency for employability services to focus on more traditional industry pathways. This may reflect a lack of understanding or awareness of Clean Growth sectors and the opportunities within them. It may also be indicative of a need to ensure that emerging activity within colleges, universities and other training providers is joined up with employability services, so that new training opportunities are not crowded out by more established, mainstream pathways.

Responding to industry need

A lack of employer engagement with the Clean Growth agenda is impacting on the ability of education and training providers to effectively respond to areas of skills need and demand

5.10 As discussed in the previous chapter, there is a general lack of industry engagement with the Clean Growth agenda. This is more acute for SMEs in particular.

5.11 This means that there is a limited understanding of the skills requirements of employers, and education and training providers cannot fully engage with businesses that may need access to provision to respond to changes or opportunities within their industry. In turn, colleges and universities cannot secure sufficient enrolments to sustain courses – one consultee pointed to the example of a clean energy technology degree developed by Abertay University that struggled to get enough participants despite its relevance to the direction of travel for Clean Growth in the region.

5.12 Colleges and universities also noted that even though macro-economic trends indicated that there would in theory be a market for courses targeted at Clean Energy, AgriTech or Circular Economy and waste management, for example, this has not yet fully materialised in terms of demand amongst employers in the region. Further, it was stated that speculative course development on this basis alone – without an identified and engaged local target market – was costly, and too risky to undertake. Ultimately, this means that any course development in this area in future is likely to be reactive and behind the curve in terms of wider Clean Growth trends globally, thus putting the Tay Cities Region at a disadvantage.

There is considerable variation between providers in how quickly they are able to adapt training provision to industry need

5.13 Consultees reported that colleges were typically more agile and able to respond to industry need, and adapt or develop new training offers. It was suggested that this was in part due to a somewhat greater level of engagement by businesses with colleges than with universities, but is also related to difference in length of courses, means of assessing and validating qualifications, etc.

5.14 University consultees themselves noted that they needed greater lead-in time to develop course materials – with one consultee suggesting that in some instances this may be up to two years' notice for more bespoke courses.

5.15 There are two implications here. First, that greater engagement with universities along with colleges and other training providers more generally will allow providers greater foresight into business need, thus reducing the time required to develop courses. Second, consideration needs to be given to how businesses access skills and training provision – what type of skills training, and when – and to the relevance of different types of provision to businesses' operational phases, to better target offerings. This may mean that more micro-credentials are required to respond to a dynamic and changing need in skills requirements on the part of businesses, and allowing individuals to top-up or add on to their existing qualifications.

Understanding of Clean Growth and opportunities

Clean Growth opportunities and careers pathways are still comparatively unknown

5.16 Amongst education and training leavers and potential sector entrants, there is limited knowledge and understanding of employment opportunities and career pathways in Clean Growth sectors. This includes (mis)perceptions of the sectors themselves, and the roles within them. Part of this challenge is wrapped up in the lack of knowledge and misunderstanding of STEM roles and industries, which is a widely documented issue and the focus of the current STEM Education and Training Strategy[96] for Scotland, and also for much activity driven by Education Scotland and targeted at school-age children.

5.17 Equally, there was an admission from some business stakeholders that they are "not necessarily any good" at conveying what their industry entails, or what career development opportunities there are. For some this is a marketing issue; for others, there was too much framing of opportunities in 'old job' or 'traditional industry' terms, meaning that the full spectrum of opportunities or activities was not being conveyed.

5.18 Again, this is not unique to Clean Growth sectors, and a commonly reported challenge for businesses operating in wider STEM industries or sectors. This was identified as a particular challenge for the Circular Economy. Whilst a career within parts of the Circular Economy, e.g. waste management, was a conscious choice for some, this typically accounts for a small proportion of the workforce. For the majority, one consultee suggested that workers "fall into" careers in the sector. In such instances, 'on-the-job' training and employer-led workforce development becomes critical.

5.19 As a consequence, this constrains the extent to which Clean Growth sectors are able to engage with particular groups – i.e. young people, career changers, returners to the labour market, or those from disadvantaged areas or backgrounds. This means that the potential labour market pool that employers have access to is considerably restricted.

Industrial challenges in and applications of Clean Growth approaches are crowded out by discussions of societal challenges of the Climate Emergency

5.20 A number of consultees argued that the current discourse around the Climate Emergency and Net Zero is too focused on the societal challenges posed. It was considered that this was particularly the case in schools. Whilst this may serve to build climate literacy in general terms, consultees felt that there is a corresponding lack of understanding of industry approaches within Clean Growth sectors and other parts of the economy to responding to the Climate Emergency. Consequently, there is also limited understanding of the growth opportunity that climate change,

[96] https://www.gov.scot/policies/science-and-research/stem-education-training/

and responding to the challenges of the Climate Emergency, presents for industry and businesses in the region.

Overarching challenges

A hampered ability to address skills shortages can impact on inward investment

5.21 Understanding skills shortages and demonstrating solutions to such challenges are essential to providing assurance to potential inward investors, and that an inability to address skills shortages effectively can swing investment decisions. Thus, skills supply and training provision is especially important outside of Scotland's Central Belt, where demanded skills are arguably more readily available, or can be attracted with relative ease.

5.22 There is no suggestion that strategic actors in the region do not understand the broad challenges around meeting skills demanded by employers operating in Clean Growth sectors. However, the issues explored throughout this report indicate that there are particular challenges in understanding the nature of skills need, and working with businesses to address these skills gaps and shortages. This is not a challenge that is constrained to the Tay Cities Region, and similar issues have been identified elsewhere in Scotland.

Talent retention remains a critical challenge for the Tay Cities Region

5.23 Since the establishment of the Tay Cities Region and the production of the Deal and accompanying regional strategy, talent attraction and retention has been a key component of economic development activity. Many education leavers move outwith the region to access employment and career opportunities.

5.24 This was re-emphasised by both strategic and industry consultees with regard to challenges faced by Clean Growth sectors in accessing necessary skills. It was suggested that one means of countering this was for a more explicitly themed economy to help retain and attract workers. As discussed above, this requires better communication and understanding of what Clean Growth entails, and what opportunities there are within each sector.

Competition with other sectors for key skills will impact on the ability to address skills shortages for Clean Growth

5.25 Stakeholders and businesses agree that a degree of competition for skills across sectors already exists, and they are anticipating significant competition for skills in future. This is a challenge that is not only restricted to individual Clean Growth sectors, but for a wider range of skilled workers – noting the types of skills in demand as discussed in Chapter 4. This is a challenge already recognised by the Climate Emergency Skills Action Plan with regard to green skills, but is also an issue in terms of other skills areas such as digital and data, a key cross cutting sector for Clean Growth in the Tay Cities Region.

5.26 For many in the region's labour market, and for entrants to it, higher-paid sectors such as oil and gas, will always appear more attractive – and particularly so for those from disadvantaged areas and backgrounds. Though some opportunities in oil and gas that the region may stand to benefit from, such as those related to the Innovation and Targeted Oil and Gas (INTOG) leasing round[97], arguably fall under the Clean Energy strand of Clean Growth in the region, oil and gas overall represents a significant challenge in terms of competition for skills. This is

[97] https://www.crownestatescotland.com/scotlands-property/offshore-wind/intog-leasing-round

despite the potential for skilled workers in sectors such as oil and gas to transition to Clean Growth and other low carbon sectors, as discussed previously.

5.27 Further, competition for skills is not a local phenomenon. Rather, there is a global marketplace for skilled workers in areas of activity that fall within the sphere of Clean Growth, and particularly with regard to Clean Energy, with staff willing to travel for higher rates of pay across short-term contracts. There is therefore a need to demonstrate the long-term pipeline of opportunities in the area, something that can be achieved through articulating the proposition of the Tay Cities Clean Growth Initiative.

External factors

A range of macro-economic factors are contributing to a call for a reduction or easing of climate targets, which may in turn impact on Clean Growth activity; combined with misinformation (and disinformation) around the Climate Emergency and sustainable development responses, this is influencing the perception of Clean Growth and related activity

5.28 The current period of economic turbulence and uncertainty following Brexit, the COVID-19 pandemic and the ongoing conflict in Ukraine has resulted in a range of economic factors such as inflation, higher energy prices and an increase in the cost of living and operation for businesses, and exacerbating budgetary pressures for public sector bodies. This has led to calls for a reduction or softening of climate targets, which may in turn impact on Clean Growth activity.

5.29 In particular, this may reduce demand for climate-focused products and services, reducing the attractiveness for businesses to operate in this space. Examples cited during the research included the relative cost and effectiveness of switching from gas boiler systems to heat pumps for domestic and commercial heating.

5.30 A further consideration is the degree of misinformation and disinformation that exists regarding climate change, and government responses to implement a more sustainable pattern of development. Whilst such views are easy to deconstruct, they undoubtedly have an effect on public discourse surrounding Clean Growth and related activities. Short term action to counter this, along with longer term messaging on climate change and Clean Growth opportunities is therefore important.

Recent changes in the funding landscape are constraining Clean Growth activity amongst businesses, strategic bodies and education and training providers

5.31 The funding landscape for supporting education and training, business support and strategic economic development has changed significantly in recent years. There has been a significant shift towards a more competitive mode of securing funding versus allocations and multi-year financial envelopes that were a feature of European funding programmes in particular. Budgetary pressures within the public sector, and in Scottish Government funding programmes in particular, have seen a reduction in available funding.

5.32 This has removed a degree of certainty around available funding for a variety of investment programmes. Consultees also noted that the year-on-year funding model prevents a more sustainable approach to course development, with the financial uncertainty contributing to the risk aversion of education and training providers regarding speculative course development.

Austerity measures and ongoing public sector budget constraints are significantly impacting the ability of local authorities and government agencies to develop the required Clean Growth competences and capability, and thus adequately support sector growth

5.33 One effect of budgetary cuts and austerity measures is the ability of public sector bodies to develop skills and capacity in-house to support Clean Growth activity. A number of consultees pointed out that local authorities and government agencies have an acute issue of progression and growing their own skills within their organisations.

5.34 This brings a reliance on contractors to deliver certain activities, and negatively impacts on the continuity of knowledge and Clean Growth capital of the public sector.

Supporting infrastructure and services will support the region's ability to attract and retain new talent and returners and help to grow Clean Growth sectors

5.35 Access to housing and associated services is a critical attractor for skilled workers. Businesses may be able to attract workers, but there is a need to ensure adequate provision of housing and access to essential services – schools, GP surgeries, shops and amenities, etc. to accommodate spouses and families. Access to affordable housing, as well as housing of the right type, is an important issue in more rural parts of the region.

5.36 A lack of public transport and connectivity in more rural areas can also be a barrier to travelling to work locations, particularly if there is limited intermodal connectivity, or if shift work patterns do not align with connections. It can also make it difficult for people who live outwith the region's urban areas to undertake education and training including work-based learning. This can impact on the skills supply for employers and sectors, and can also make it a less attractive proposition for people to live, work and learn in the region. Access to private transport is often necessary in more rural areas given limited coverage of public road transport and lack of proximity to either the Highland Main Line and Glasgow-Dundee-Aberdeen line for train transportation.

5.37 These issues are key factors in place attractiveness. This is a key differentiator for recruitment and talent attraction, and for individual workers' decision-making on locating to the Tay Cities Region, or to another (competing) region.

6 Addressing Clean Growth skills demand

Introduction

6.1 Following the analysis of findings presented in the preceding chapters, this concluding chapter sets out some concluding remarks regarding the priority issues for strategic partners in the Tay Cities Region regarding skills for Clean Growth. It then sets out a series of recommendations intended to address these issues, and provide the required response for skills delivery.

Priority issues for Clean Growth skills in the Tay Cities Region

6.2 The preceding chapters of this report have illustrated the particular challenges relating to addressing demand for Clean Growth skills in the Tay Cities Region. Though these are identified growth sectors with potential to contribute to the national effort to transition to Net Zero, there remains a number of difficulties in ensuring the skills required to support their development.

6.3 The existing supply-side picture in terms of skills is reasonably strong. There are increasing starts in MA frameworks of relevance to Clean Growth, with a somewhat stable picture of enrolments amongst the region's colleges and universities. However, the demand for skills amongst employers operating in Clean Growth sectors is not being met. The current volume of skills demanded is considerable and is anticipated to scale up in future. Also, the nature of skills demanded means that workers are required at all levels, and at all points of each sectoral value chain.

6.4 Taking a broad look at courses, subject areas and apprenticeship frameworks of relevance to Clean Growth is the correct approach, since demand is typically less about specific Clean Growth roles or skills, and more about skilled individuals able to apply their knowledge, capabilities and expertise in Clean Growth areas. Employers value meta skills, adaptability and resilience more – durable skills supplemented by Clean Growth or sustainability know-how. That is not to say that specialised skillsets or specific skills requirements are not in demand, and there some clear patterns of need by Clean Growth sector have emerged as outlined in Chapter 4. Nevertheless, more softer skills develop, coupled with development of some broader technical skills, may be more attractive in terms of meeting Clean Growth skills demand.

6.5 However, there remains a significant challenge in fully understanding skills demand across the region, by sector and for Clean Growth as a whole. Business engagement is a critical factor here. There is limited intelligence, poor channels of communication on need where there is engagement, and no smooth engagement with businesses. This serves to constrain education and training providers' ability to respond to business skills need effectively. There is a clear requirement to engage with businesses to drive participation in and contribute to the discourse on Clean Growth, and to stimulate meaningful conversations around skills need in this area. This is particularly important in light of some of the findings of the recently published Independent Review of the Skills Delivery Landscape.[98] As well as Scottish Enterprise and relevant economic development teams within local authorities, the Tay Cities Enterprise Forum may have a role in achieving this.

6.6 The position that the Tay Cities Region is at on the Net Zero transition/Clean Growth journey means that there is a lot of uncertainty for businesses around solution permanence in terms of industry and societal response to the Climate Emergency. As such there is a degree of risk aversion in following particular solutions, modes of operation, etc.

[98] https://www.gov.scot/publications/fit-future-developing-post-school-learning-system-fuel-economic-transformation/

6.7 Despite the evident supply pipeline, more skilled workers are required to support the development of Clean Growth sectors in the Tay Cities Region. There is a need for growing capacity in the region's education and training system. This is not just for volume, but for effectiveness, responsiveness and connectivity between education and training providers and the Clean Growth business base.

6.8 Understanding of what Clean Growth is, and of the terminology surrounding Clean Growth, is also problematic. Whilst strategic stakeholders have no problem with understanding or at least seeing it as interchangeable with other similar terminology (e.g. sustainable growth), businesses typically have limited understanding. This issue is tied up with the lack of engagement from and communication with businesses in the region that operate in Clean Growth sectors.

6.9 In an environment where there is significant inter-sector and geographical competition for skills, and talent attraction and retention is an identified problem for the Tay Cities Region, not being able to address skills shortages and adequately demonstrate education, training and skills solutions can impact on levels of investment and growth that the region can realise.

6.10 As such, there are a number of priorities that are reflected in the following recommendations. These are grouped thematically, but are not necessarily presented in order of importance.

Recommendations

Demand- and employer engagement-focused strategic interventions

Recommendation 1: Establish a regional strategic approach to funding a Clean Growth skills response

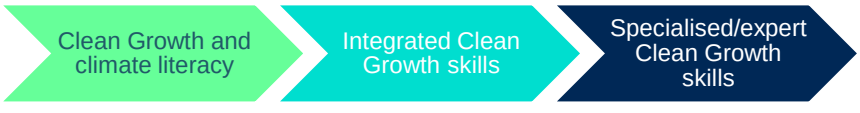
There is a clear need to make sure that funding intended for skills development and capacity building within education and training providers can adequately support the skills response for Clean Growth within the Tay Cities Region. This will require partners to better influence funding organisations to adopt a more strategic approach to funding skills provision for potential and current workers in Clean Growth sectors, as well as for supporting professional learning for teaching staff amongst education and training providers.

There is alignment here with some of the findings of the Independent Review of the Skills Delivery Landscape regarding funding models, and empowering regional partners to develop their own skills solutions. Taking this sort of approach will contribute to an appropriate skills response for a strategically important growth area for the Tay Cities Region.

Recommendation 2: Develop a segmented skills approach for Clean Growth

Strategic partners should give consideration to taking a skills segmentation approach for Clean Growth (and potentially wider Climate Emergency) skills. This is an approach that is used successfully by the Digital Economy Skills Action Plan, recognising the increasing ubiquity of digital processes, products, services and ways of working. It is arguable that in future, there will be a similar need for Clean Growth skills at a range of levels, and in varying degrees of expertise – potentially with greater need for more specialised expertise in areas of Clean Growth as sectors mature. A skills segmentation approach would augment Clean Growth skills provision by allowing better targeting of skills interventions.

Figure 6.1: Possible Clean Growth skills segmentation



As part of this, it should be noted that Clean Growth skills should not only be focused on new sector entrants and more operational roles. As the research has found, there is a need to develop a pipeline of skills in more professional and senior roles. Further, there is a need to develop the Clean Growth skills and understanding of middle managers and business leaders – developing their Clean Growth literacy so that they have a more detailed understanding of Clean Growth opportunities and aligned skills needs. This should include making use of language and terminology that businesses as well as the public and academic sector can relate to, which will help overcome challenges in engagement.

Recommendation 3: Aggregate demand for Clean Growth skills from employers

Given the lack of employer engagement particularly amongst SMEs in the region, there is a real need for strategic partners, including the Tay Cities Enterprise Forum, to act with regard to stimulating and aggregating demand from employers around Clean Growth skills. This is critical to developing an understanding of employer skills demand in very dynamic, evolving and nascent sectors.

This will help to influence employers (especially SMEs) to engage with the Clean Growth agenda. This is important for better understanding what skills will be required by employers themselves. It can also help to foster greater business engagement with education and training providers – and in particular augmenting engagement with colleges, and stimulating greater engagement with universities. Aggregating demand for skills in this regard can help to build critical mass for education and training providers, and work to de-risk the development of new courses – either bespoke, or speculative. A key component of aggregation activity will be ensuring that the language and terminology used is accessible to and thus understood by businesses in the region.

Investment or intervention in the SME base in the region to aggregate demand can serve to stimulate interest, and drive appetite, understanding and demand for Clean Growth skills development and wider business support. Part of such activity will invariably require co-ordinated communications to influence industry – setting out opportunities, scale, timing, etc. at appropriate points to stimulate demand. Encouraging employers to work more co-operatively to co-ordinate their demand for skills will also make it more attractive for supply system to respond.

The skills response

Recommendation 4: Embed Clean Growth skills in education and training

Linked to Recommendation 2 regarding Clean Growth skills segmentation, there should be a medium-term approach to embedding of Clean Growth skills in all courses and apprenticeships. This will help to build climate literacy and Clean Growth competency amongst education leavers and sector entrants. It will also contribute to developing the professional ability to act using the competences, abilities, knowledge and skills to continuously perform in a changing work environment increasingly concerned with Clean Growth and dealing with the Climate Emergency. Given that there is a clear steer from employers that for the most part, there is a need for workers with Clean Growth understanding rather than Clean Growth workers, taking such embedding measures will help to build the pipeline of workers with the required understanding across a range of disciplines. It is understood that some providers are already taking measures to introduce climate literacy provision in pre-entry learning, and are planning to develop this further throughout degree schemes, so will be well placed to demonstrate delivery against this recommendation.

Recommendation 5: Use micro-credentials and short courses to respond to changing need

Given the changing, dynamic nature of Clean Growth, and trends across each of the sectors, there is a need for continued development and delivery of short courses and micro-credentials. This can help to respond in an agile way to short term need, especially given the lead-in time that may be required to develop longer or more substantial courses. This is a particularly useful approach to upskilling existing workforces in Clean Growth sectors, or those making a transition in from other sectors.

Education and training providers have the appetite and ability to create a bigger portfolio of such courses. However, business need and demand must be aggregated to make them viable (see Recommendation 3).

Recommendation 6: Ensure flexibility and resilience is a key component of the Clean Growth skills response

There needs to be continued focus on the development of meta skills and wrap-around competences and capabilities. This is critical to building a flexible and resilient workforce with the required underpinning skills: digital capabilities; problem-solving, critical thinking, interpersonal skills, and so on – skills increasingly referred to as durable skills, to sit alongside the raft of sector- and role-specific technical and Clean Growth skills.

Recommendation 7: Maximise the Tay Cities Region's ambition to be a test-bed

Strategic partners and businesses (potentially including the Tay Cities Engineering Partnership) should explore the potential for developing 'sandboxes' or live learning operational environments in which to practice and develop Clean Growth skills. This would form part of the test bed principle/ambition of the Tay Cities Region. It is of particular importance for certain Clean Growth sectors, e.g. AgriTech. This will help to secure live, on-the-job experience. The region is seen as an ideal place in which to push the drive towards Clean Growth; taking a 'sandbox' approach for skills development will be a very tangible sign of a skills response or solution to skills needs challenges for the incumbent business base and potential inward investors.

More widely, the opportunity for learning and training through experience should be maximised, in order to provide those undergoing training with real work learning that fully satisfies employer need regarding relevant work experience. This will not only help to develop critical cross-cutting and meta skills that are increasingly sought by employers, but also will develop the professional competency of workers over and above the acquisition of qualifications.

Pathways, retention, and attraction

Recommendation 8: Ensure co-ordination to deliver a coherent, streamlined education and training system for Clean Growth skills

There should be greater co-ordination amongst education and training providers to offer streamlined Clean Growth skills pathways across colleges, universities, and other providers such as the MSIP Skills Academy, or the Binn Group's Training & Education Centre. Though it is recognised that the curriculum development amongst the region's universities is driven to a lesser extent by the skills needs of the regional labour market than, for example, colleges and other providers, there nevertheless needs to be a greater degree of collaboration and cohesiveness to develop Clean Growth skills pathways in the region. These pathways should reflect joint opportunities and areas of common need across Clean Growth sectors in the region.

There must be parity of pathways into Clean Growth sectors, in line with the recommendations of the Independent Review of the Skills Delivery Landscape, but also with wider aspirations for parity of education and training pathways and efforts in recent years to influence business thinking on Apprenticeship frameworks and work-based learning modes in relation to more academic pathways. In effect, the Clean Growth education offer should be aggregated. The Clean Growth Initiative website may be one means of achieving this – incorporating functionality for education providers to set out their Clean Growth offers. There may also be scope for exploring the potential for a Clean Growth skills Pathfinder[99], or similar approach to a targeted skills intervention on a regional basis.

[99] https://www.sfc.ac.uk/skills-economic-transformation/regional-skills-development/pathfinders.aspx

Alongside this, there should be greater influencing of careers guidance advisors to better understand and promote Clean Growth sectors and roles as viable career pathway choices. This may be linked to wider efforts to influence careers guidance advisors regarding STEM career pathways.

In addition, there is an aligned need to stimulate greater engagement and collaboration between education and training providers and employability services. This will help to shift an existing focus away from more 'traditional' career pathways to ones that benefit the need for Clean Growth skills. It will also allow for more proactive engagement of disadvantaged and hard-to-reach groups, opening up new employment opportunities in Clean Growth sectors, and enabling an enhanced employability offer required to ensure fair(er) distribution of benefits.

Recommendation 9: Targeted promotion of Clean Growth employment opportunities

Alongside employer-focused demand aggregation activity, there should be greater promotion of employment opportunities in Clean Growth sectors to education leavers, as attractive, high-value careers. This should be combined with other actions including emphasising the quality of life in the Tay Cities Region- maximising its areas of competitive advantage. This will help to retain skilled workers and students, in line with wider Tay Cities Region ambitions.

7 Roadmap

Introduction

7.1 The preceding chapter drew together the findings of the study to set out a number of conclusions and recommendations for a Clean Growth skills response. Here, we present a possible roadmap to delivering against these recommendations, and putting in place measures to deliver the skills required by Clean Growth sectors and businesses.

Roadmap

7.2 Table 7.1 sets out a Roadmap for planning and driving activities to support the development of strong and sustainable Clean Growth sectors in the Tay Cities Region. It reflects the study findings and conclusions, and builds on the recommendations presented in Chapter 6. It is worth noting that the timescales set out here, and partners may wish to consider more ambitious timescales in response to identified and emerging need.

7.3 Ultimately, it will be for partners to determine responsibility for delivering against these actions. It will also be important to ensure that these actions are not seen in isolation from other identified skills needs in the region, and must be considered within the work of the Tay Cities Region Skills Advisory Board and wider Tay Cities Deal Skills Programme. Given that many of the challenges targeted by the recommendations and actions contained within the roadmap are not unique to the Tay Cities Region, partners may wish to consider whether additional national strategic stakeholders and larger employer representatives should be involved in delivery.

Table 7.1: Proposed roadmap

Recommendation	Activities	Proposed timescales	Potential lead and partners
Recommendation 1: Establish a regional strategic approach to funding a Clean Growth skills response	• Development of strategic funding approach for capacity building and course development for Clean Growth skills • Influencing and lobbying of funding organisations, including Scottish Government to consider a more joined-up approach across the region to better meet need	3-6 months 6-9 months	***Lead:*** TCR Skills Advisory Board ***Partners:*** Skills Development Scotland Scottish Enterprise TCR HE-FE Forum Individual colleges, universities and training providers
Recommendation 2: Develop a segmented skills approach for Clean Growth	• Identification of Clean Growth skills segments • Stratification of skills actions based on skills need by segmentation level	3-6 months 6-9 months	***Lead:*** Skills Development Scotland ***Partners:*** TCR Skills Advisory Board TCR HE-FE Forum

	• Development of programme of activity targeted at the Clean Growth skills of managers and business leaders • Promotion of related activity to businesses and strategic partners across the region, for example through the Tay Cities Clean Growth Initiative website		Individual colleges, universities and training providers Industry bodies such as Ceed, SMAS
Recommendation 3: Aggregate demand from employers	• Plan the role/function of Clean Growth aggregator • Develop sector aggregation plan or strategy to increase business engagement • Put in place appropriate resourcing and support for Clean Growth aggregation activity, including linking stimulated/aggregated demand to FE/HE supply	3-6 months 6-9 months 6-9 months	***Lead:*** Scottish Enterprise Tay Cities Enterprise Forum ***Partners:*** Local authorities Tay Cities Region Chambers of Commerce (Angus, Dundee, Fife, Perthshire) TCR HE-FE Forum
Recommendation 4: Embed Clean Growth skills in education and training	• Identification of opportunities to build in Clean Growth principles across a range of FE, HE and work-based courses and training frameworks • Establish programme of revision for course content and material	6-9 months 9-24 months	***Lead:*** TCR Skills Advisory Board ***Partners:*** TCR HE-FE Forum Tay Cities Engineering Partnership Individual colleges, universities and training providers
Recommendation 5: Use micro-credentials and short courses to respond to changing need	• Development and promotion of portfolio of short courses to meet short-term and emerging Clean Growth skills needs	6-12 months	***Lead:*** TCR Skills Advisory Board ***Partners:*** TCR HE-FE Forum Individual colleges, universities and training providers
Recommendation 6: Ensure flexibility and resilience is a key component of the Clean Growth skills response	• Identifying opportunities to augment the development of meta skills/durable skills through FE, HE and work-based courses and training frameworks	6-9 months	***Lead:*** TCR Skills Advisory Board ***Partners:*** Skills Development Scotland

			TCR HE-FE Forum Individual colleges, universities and training providers
Recommendation 7: Maximise the Tay Cities Region's ambition to be a test-bed	• Exploration of potential for sandboxes and/or live learning operational environments • Promotion of opportunities to businesses and strategic partners across the region, for example through the Tay Cities Clean Growth Initiative website	9-12 months	***Lead:*** Tay Cities Region Tay Cities Enterprise Forum ***Partners:*** Scottish Enterprise TCR Skills Advisory Board Tay Cities Engineering Partnership
Recommendation 8: Ensure co-ordination to deliver a coherent, streamlined education and training system for Clean Growth skills	• Review of Clean Growth education and training pathways across the Tay Cities Region • Development of promotional programme for Clean Growth training pathways • Engagement with careers guidance advisors and employability services to raise awareness and understanding of Clean Growth sectors and employment/career opportunities • Explore the possibility of delivering a Clean Growth Skills Pathfinder	6-9 months 9-12 months	***Lead:*** TCR Skills Advisory Board ***Partners:*** TCR HE-FE Forum Individual colleges, universities and training providers
Recommendation 9: Targeted promotion of Clean Growth employment opportunities	• Establishment of a programme of activity to raise awareness of Clean Growth sectors and employment/career opportunities amongst education and training leavers, and workers in other sectors who may consider transitioning into a Clean Growth sector	6-9 months	***Lead:*** Tay Cities Region Local authorities ***Partners:*** Scottish Enterprise Skills Development Scotland

Appendix 1: Consultee organisations

- Abertay University
- Angus Council
- Arbikie Distillery
- Ardler Engineering Design
- ATL Turbine Services
- Autoservices Perth
- Binn Eco Innovation Park
- Binn Group
- Calpac Resources
- Ceimig
- Digiflec
- Duncan Simpson Associates
- Dundee & Angus College
- Dundee and Angus Chamber of Commerce
- Dundee City Council
- Dundee University
- EcoideaM Ltd
- Electrogenos Alba
- Energy Skills Partnership
- Fife College
- Forster Group
- Helm Training
- Intelligent Growth Solutions
- James Hutton Institute – Advanced Plant Growth Centre (APGC)
- J-RAO Limited
- Láidir. Circular Mobility
- Lyons
- Michelin Scotland Innovation Parc
- Morris Leslie
- MSIP Skills Academy Dundee
- NHS Tayside
- Perth & Kinross Council
- Ristol Consulting
- Scottish Enterprise
- Scottish Gas Networks (SGN)
- Skills Development Scotland
- SOENEC
- Tayside and Central Strategic Transport Partnership (Tactran)
- UHI Perth
- University of St Andrews
- Wemyss and March Estate

Appendix 2: Clean Growth skills definition

Skills Development Scotland (SDS) published the Climate Emergency Skills Action Plan (CESAP) in 2020. The CESAP sets out a clear direction for changes needed in the skills system, and signals the role that industry, communities and individuals across Scotland should play in response to the climate emergency. The plan provides skills direction from 2020 to 2025 with an update scheduled for the end of 2023.

The CESAP states that to understand green jobs and skills we must accept that "*there is no single agreed definition of 'net zero skills', 'green skills' or 'climate emergency skills' with the terms often being used interchangeably. There is a recognition that green jobs include renewable energy, circular economy and zero waste, and renewable energy and the nature based sector with wider 'green skills' sitting on a spectrum ranging from highly specific requirements in sectors directly supporting the transition to net zero such as energy, transport, construction, agriculture, and manufacturing, through to more generic requirements across all sectors to thrive in a net zero economy, in various occupations such as lawyers, accountants, programme managers, financers, teachers and trainers.*[100] *While technical skills will be key, soft skills will also play an important role in driving behavioural change, communicating to businesses, communities, and individuals the ethics and urgency of these changes and ultimately the benefits of the transition to net zero*".[101]

This report has adopted the definition outlined above and has applied it to 'clean growth skills' because of its interchangeability with, what SDS describe as, 'net zero skills', 'green skills' or 'climate emergency skills'. 'Clean growth skills' are, sometimes, stereotypically associated with the renewable energy, circular economy and zero waste, and nature-based sectors. However, according to the evidence base produced by Cambridge Policy Consultants for the CESAP, 'clean growth skills' have a requirement range. Highly specific 'clean growth skill' requirements may include technical skillsets such as training in wind turbine installation whereas less specific 'clean growth skill' requirements may include environmental policy knowledge gained through studying a social science subject. Both hard (highly specific) and soft (less specific) skills are necessary to achieve 'clean growth' on the path to Net Zero in Scotland and in the Tay Cities Region. Consequently, the analysis conducted in this report uses SDS's CESAP definition. The subjects, frameworks, and courses used as part of the skills analysis in this report can be found in Appendix 3. These subjects, frameworks, and courses incorporate both hard and soft 'clean growth skills' in line with the CESAP definition.

[100] Cambridge Policy Consultants (2020) Evidence base for a Climate Emergency Skills Action Plan (Final Report)

[101] https://www.skillsdevelopmentscotland.co.uk/media/47336/climate-emergency-skills-action-plan-2020-2025.pdf

Appendix 3: Subjects and courses used for analysis of provision and supply

Table A3.1: FE College Superclasses			
Superclass code	**Superclass area**	**Superclass code**	**Superclass area**
E	**Politics/Economics/Law/Social Sciences**	**V**	**Services to Industry and Commerce**
EA	Government/Politics	VD	Quality and Reliability Management
EB	Economics	VE	Industrial Control/Monitoring
EC	Law	VF	Industrial Design/Research and Development
ED	Social Sciences	VG	Engineering Services
EE	Social Studies	VH	Facilities Management
Q	**Environment Protection/Energy/Cleansing/Security**	VJ	Contracting (Business/Industry)
QA	Environmental Protection/Conservation	W	Manufacturing/Production Work
QB	Energy Economics/Management/Conservation	WA	Manufacturing
QC	Pollution/Pollution Control	WB	Manufacturing/Assembly
QD	Environmental Health/Safety	WC	Instrument Making/Repair
QE	Cleansing	WD	Testing Measurement and Inspection
QG	Funerary Services	WE	Chemical Products
QH	Security/Police/Armed Forces	WF	Glass/Ceramics/Concretes Manufacture
QJ	Fire and Rescue Services	WG	Polymer Processing
R	**Sciences and Mathematics**	WH	Textiles/Fabrics (industrial)
RA	Science	WJ	Leather Footwear and Fur
RB	Mathematics	WK	Woodworking/Furniture Manufacture
RC	Physics	WL	Paper Manufacture
RD	Chemistry	WM	Food/Drink/Tobacco (industrial)
RE	Astronomy/Space Science	**X**	**Engineering**
RF	Earth Sciences	XA	Engineering/Technology
RG	Land and Sea Surveying/Cartography	XD	Metals Working/Finishing
RH	Life Sciences	XE	Welding/Joining
RJ	Materials Sciences	XF	Tools/Machining
RK	Agricultural Science	XH	Mechanical Engineering
S	**Agriculture, Horticulture and Animal Care**	XJ	Electrical Engineering
SA	Agriculture/Horticulture	XK	Power/Energy Engineering

Table A3.1: FE College Superclasses			
Superclass code	**Superclass area**	**Superclass code**	**Superclass area**
SC	Crop Protection/Fertilisers/By products	XL	Electronic Engineering
SD	Crop Husbandry	XM	Telecommunications
SE	Gardening/Floristry	XN	Electrical/Electronic Servicing
SF	Amenity Horticulture	XP	Aerospace/Defence Engineering
SG	Forestry/Timer Production	XQ	Ship and Boat Building/Marine/Offshore Engineering and Maintenance
SH	Animal Husbandry	XR	Road Vehicle Engineering
SJ	Fish Production/Fisheries	XS	Vehicle Maintenance/Repair/Servicing
SK	Agricultural/Horticultural Engineering/Farm Machinery	XT	Rail Vehicle Engineering
SL	Agricultural/Horticultural Maintenance	**Y**	**Oil/Mining/Plastics/Chemicals**
SM	Rural/Agricultural Business Organisation	YA	Mining/Quarrying/Extraction
SN	Veterinary Services	YB	Oil and Gas Operations
SP	Pets/Domestic Animal Care	YC	Chemicals/Materials Engineering
SQ	Land Based Studies	YD	Metallurgy/Metals Production
T	**Construction and Property (Built Environment)**	YE	Polymer Science/Technology
TA	Built Environment	**Z**	**Transport Services**
TC	Property: Surveying/Planning/Development	ZM	Logistics
TD	Building Design/Architecture	ZN	Purchasing/Procurement and Sourcing
TE	Construction	ZP	Distribution
TF	Construction Management	ZQ	Transport Services
TG	Building/Construction Operations	ZR	Aviation
TH	Building Maintenance/Services	ZS	Marine Transport
TJ	Interior/Fitting/Decoration	ZT	Rail Transport
TK	Construction Site Work	ZV	Road Transport
TL	Civil Engineering	ZX	Driving/Road Safety
TM	Structural Engineering		
Source: Scottish Funding Council, FE Superclasses[102]			

[102] http://www.sfc.ac.uk/web/FILES/guidance_sfcgd022018/FES_3_Guidance_2018-19.pdf

Table A3.2: HE University Subject Areas			
Subject code	**CAH subject area/subdiscipline**	**Subject code**	**CAH subject area/subdiscipline**
CAH03	**Biological and Sport Sciences**	**CAH10**	**Engineering and Technology**
CAH03-01-01	Biosciences (non-specific)	CAH10-01-01	Engineering (non-specific)
CAH03-01-02	Biology (non-specific)	CAH10-01-02	Mechanical Engineering
CAH03-01-03	Ecology and Environmental Biology	CAH10-01-03	Production and Manufacturing Engineering
CAH03-01-04	Microbiology and Cell Science	CAH10-01-04	Aeronautical and Aerospace Engineering
CAH03-01-05	Plant Sciences	CAH10-01-05	Naval Architecture
CAH03-01-06	Zoology	CAH10-01-06	Bioengineering, Medical and Biomedical Engineering
CAH03-01-07	Genetics	CAH10-01-07	Civil Engineering
CAH03-01-08	Molecular Biology, Biophysics and Biochemistry	CAH10-01-08	Electrical and Electronic Engineering
CAH03-01-09	Hair and Beauty Sciences	CAH10-01-09	Chemical, Process and Energy Engineering
CAH03-01-10	Others in Biosciences	CAH10-01-10	Others in Engineering
CAH03-02-01	Sport and Exercise Sciences	CAH10-03-01	Minerals Technology
CAH06	**Agriculture, Food and Related studies**	CAH10-03-02	Materials Technology
CAH06-01-01	Animal Science	CAH10-03-03	Polymers and Textiles
CAH06-01-02	Agricultural Sciences	CAH10-03-04	Maritime Technology
CAH06-01-03	agriculture	CAH10-03-05	Biotechnology
CAH06-01-04	Rural Estate Management	CAH10-03-06	Others in Technology
CAH06-01-05	Forestry and Arboriculture	CAH10-03-07	Materials Science
CAH06-01-06	Food and Beverage Studies (non-specific)	**CAH13**	**Architecture, Building and Planning**
CAH06-01-07	Food Sciences	CAH13-01-01	Architecture
CAH06-01-08	Food and Beverage Production	CAH13-01-02	Building
CAH07	**Physical Sciences**	CAH13-01-03	Landscape Design
CAH07-01-01	Physics	CAH13-01-04	Planning (urban, rural and regional)
CAH07-01-02	Astronomy	**CAH15**	**Social Sciences**
CAH07-02-01	Chemistry	CAH15-01-01	Social Sciences (non-specific)
CAH07-04-01	Physical Sciences (non-specific)	CAH15-01-02	Sociology
CAH07-04-02	Forensic and Archaeological Sciences	CAH15-01-03	Social Policy

CAH07-04-03	Sciences (non-specific)	CAH15-01-04	Anthropology
CAH07-04-04	Natural Sciences (non-specific)	CAH15-01-05	Development Studies
CAH09	**Mathematical Sciences**	CAH15-01-06	Cultural Studies
CAH09-01-01	Mathematics	CAH15-02-01	Economics
CAH09-01-02	Operational Research	CAH15-03-01	Politics
CAH09-01-03	Statistics	CAH15-04-01	Social Work
CAH11	**Computing**	CAH15-04-02	Childhood and Youth Studies
CAH11-01-01	Computer Science	CAH15-04-03	Health Studies
CAH11-01-02	Information Technology	**CAH16**	**Law**
CAH11-01-03	Information Systems	CAH16-01-01	Law
CAH11-01-04	Software Engineering	**CAH26**	**Geography, Earth and Environmental Studies**
CAH11-01-05	Artificial Intelligence	CAH26-01-01	Geography (non-specific)
CAH11-01-06	Computer Games and Animation	CAH26-01-02	Physical Geographical Sciences
CAH11-01-07	Business Computing	CAH26-01-03	Human Geography
CAH11-01-08	Others in Computing	CAH26-01-04	Environmental Sciences
		CAH26-01-05	Others in Geographical Studies
		CAH26-01-06	Earth Sciences

Source: Higher Education Statistics Agency, Common Aggregation Hierarchy[103]

[103] https://www.hesa.ac.uk/support/documentation/hecos/cah

Table A3.3: Apprenticeship Frameworks			
Apprenticeship Type	**Framework**	**Apprenticeship Type**	**Framework**
Modern	Agriculture	**Foundation**	Civil Engineering
	Aquaculture		Engineering
	Aquaculture Management Technical		Food and Drink Technologies
	Automotive		IT: Hardware and System Support
	Boat Building and Repair		IT: Software Development
	Bus and Coach Engineering and Maintenance		Scientific Technologies
	Construction Technical Apprenticeship	**Graduate**	Civil Engineering
	Construction: Building		Civil Engineering: Higher Apprenticeship SCQF L8
	Construction: Civil Engineering		Construction and the Built Environment
	Construction: Specialist		Cyber Security
	Construction: Technical		Data Science
	Data Analytics: Technical		Engineering: Design and Manufacture
	Digital Applications		Engineering: Instrumentation, Measurement & Control
	Electric Installation		IT: Software Development
	Electronic Security Systems		
	Engineering		
	Engineering Construction		
	Engineering Technical		
	Equine		
	Facilities Management		
	Facilities Services		
	Fashion and Textiles Heritage		
	Food and Drink Operations		
	Food and Drink Technical		
	Freight Logistics		
	Furniture, Furnishing and Interiors		
	Game and Wildlife Management		
	Glass Industry Occupations		
	Heating, Ventilation, Air Conditioning and Refrigeration		
	Horticulture		
	Industrial Applications		

Table A3.3: Apprenticeship Frameworks			
Apprenticeship Type	**Framework**	**Apprenticeship Type**	**Framework**
	Information Security		
	Information Security Technical		
	IT and Telecoms		
	IT and Telecoms Technical		
	Jewellery and Silverware Manufacturing and CAD		
	Jewellery and Silverware Manufacturing and CAD Technical		
	Land Engineering		
	Life Sciences and Related Science Industries		
	Life Sciences and Related Science Industries Technical		
	Maritime Occupations		
	Plumbing and Heating		
	Power Distribution		
	Print Industry Occupations		
	Process Manufacturing		
	Rail Engineering		
	Rural Skills		
	Signmaking		
	Spirit Operations		
	Supply Chain Management		
	Supply Chain Management Professional		
	Supply Chain Management Technical		
	Sustainable Resource Management		
	Trees and Timber		
	Upstream Oil and Gas Production		
	Water Industries		
	Water Treatment Management		
	Wood and Timber Industries		
Source: Skills Development Scotland, Apprenticeship Frameworks[104]			

[104] https://www.apprenticeships.scot/browse-frameworks/?frameworkAudience=Individual&searchTerm=&type=All&sector=null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