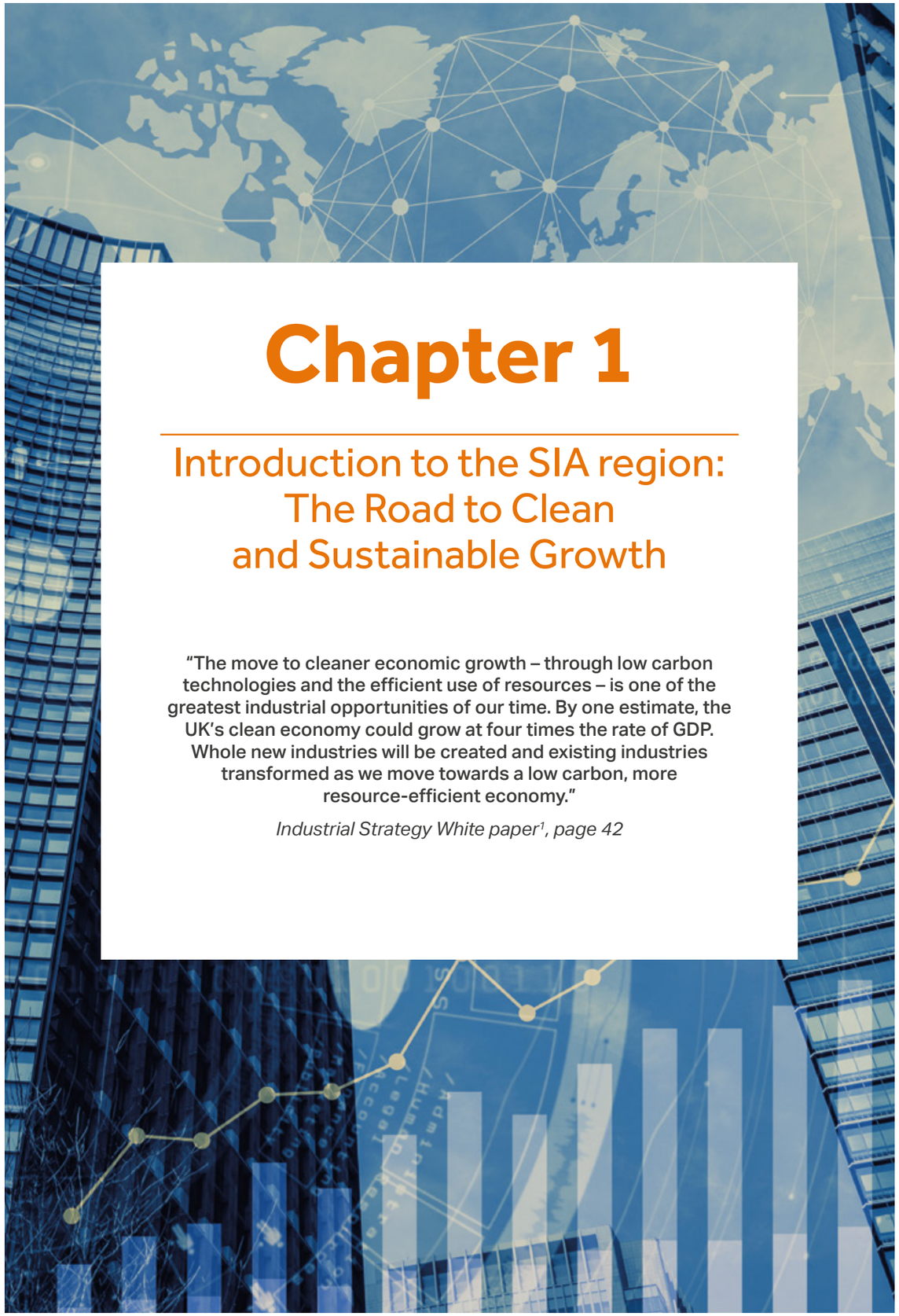

Chapter 1

Introduction to the SIA region: The Road to Clean and Sustainable Growth

"The move to cleaner economic growth – through low carbon technologies and the efficient use of resources – is one of the greatest industrial opportunities of our time. By one estimate, the UK's clean economy could grow at four times the rate of GDP. Whole new industries will be created and existing industries transformed as we move towards a low carbon, more resource-efficient economy."

Industrial Strategy White paper[1], page 42

1.1 Background to this audit

The 2017 UK Industrial Strategy White Paper[1] recognises that Clean Growth is not simply a challenge, but a very significant opportunity to increase productivity, create good jobs and scale-up earning power right across the country – accordingly clean growth is highlighted as one of four grand challenges in the Industrial Strategy. The Government's Clean Growth Strategy[2] (2018) highlights how technological and environmental innovations are driving new high value jobs, transforming industry and creating new companies. This conclusion is equally clear in estimates of the international opportunities for Clean Growth. It is also evident in the 2016 Northern Powerhouse Independent Economic Review[3] (IER) and across all of the strategic plans of the region's LEPs and North Wales Economic Ambition Board (Annex 1).

International opportunities for Clean and Sustainable Growth

The World Bank (2014) currently estimates the global market for low carbon products and processes alone as being worth $3.4 trillion and predicted to rise to in excess of $8 trillion by 2025[4]. In the UK employment, turnover and GVA in this sector are all growing rapidly (12%, 25% and 28% respectively between 2010 and 2013) and is predicted to grow by 11% per year between 2015 and 2030 – 4 times faster than the rest of the economy. This could deliver between £60 billion and £170 billion of export sales by 2030[5]. Capturing part of this global opportunity for Clean and Sustainable Growth can play a key role in our Industrial Strategy, building on our strengths to drive economic growth and boost earning power across the country.

Clean Growth is also inseparable from the aims of the Government's 25 Year Environment Plan[6] (2018) to protect the climate and environment upon which we and future generations depend. For that reason, this Science and Innovation Audit (SIA) refers to 'Clean and Sustainable Growth' rather than simply 'Clean Growth' to emphasise that opportunities are not limited to the energy sector. Meeting the changing patterns of demand in the global marketplace will need new products, services and technologies- 'eco-innovations'- across multiple sectors. It is Clean and Sustainable Growth solutions that are needed to deliver the objectives of both the UK Industrial Strategy and the 25 Year Environment Plan. This SIA provides the evidence base to demonstrate that the Northwest Coastal Arc (NWCA) is exceptionally well-positioned to lead globally in developing both those solutions and the skilled people that will drive forward the economic and environmental benefits of Clean and Sustainable Growth.

The NWCA partners (Annex 2) share a collective vision of translating world class research via innovation for Clean and Sustainable Growth to create significant regional economic impact. That vision has been emerging and evolving for several years and has developed on four powerful foundations. Our first foundation is our industrial assets across multiple sectors, not least the low carbon sector for which the Northwest of England is ranked first for employment, with clear additional economic opportunities for further growth in business and employment across our region, the wider North and the whole UK. Our second foundation is the unique geography and natural assets of the NWCA as a natural test-bed for Clean and Sustainable Growth solutions (Figure 1.1). The third foundation is a substantial base of significant science and innovation assets (Annex 3).

Our fourth foundation is our experience in demonstrating the power of business-driven collaboration with the science and innovation base and our long-standing, successful, partnerships and co-operation in addressing the challenges and opportunities in global markets for low carbon goods and services (for example the award-winning Centre for Global Eco-Innovation, page 20).

The 2016 Northern Powerhouse Independent Economic Review (IER)

The IER, commissioned by Transport for the North highlights that the North of England is home to 16m people, and 7.2m jobs, and generated an economic output of around £290bn of Gross Value Added (GVA) in 2015, about one fifth of the UK's total. The IER went on to note '… persistent gaps in GVA per capita and productivity performance compared to the rest of the UK'. By using Smart Specialisation Principles the IER identified four 'Prime' capabilities at a pan-Northern level that perform well on productivity and can compete at a national and international scale. Relevant to this SIA, these include Advanced Manufacturing and Energy, in particular low carbon technologies.

Innovation for Clean and Sustainable Growth: Eco-innovation

The innovative products, services and technologies needed to deliver Clean and Sustainable Growth are often described as 'eco-innovations'. However, our experience, confirmed by this SIA, is that the term eco-innovation is poorly recognised. As we use the term in this SIA, eco-innovations deliver positive environmental impacts by virtue of their use, manufacture, raw materials, reuse or disposal but, fundamentally, they are commercially successful products, services and technologies that drive growth and exports, and deliver skilled jobs.

The innovative products, services and technologies needed to deliver Clean and Sustainable growth are often described as 'eco-innovations'. However, our experience, confirmed by this SIA, is that the term eco-innovation is poorly recognised.

Figure 1.1

The North West Coastal Arc™: a geography for Clean and Sustainable Growth

The NWCA hosts the unique set of assets (people, technology and place) to exploit the opportunity to become world leading in the development of low carbon and other eco-innovative products, services and technologies to support the Clean Growth Strategy.

The regional focus for this SIA in the NWCA is powerfully based on the region's specific business and natural assets, and their strong interface with its research excellence assets.

The diverse and varied geography of the NWCA presents significant opportunity and 'strength in place' for innovation from concept to demonstrator and from test bed to marketplace:

+ Extensive coastline
+ Largest mountains
+ Record-breaking river flow
+ Highest rainfall

THE NORTHWEST COASTAL ARC

BIS' UK Low Carbon Economy Report

BIS' The Size and Performance of UK Low Carbon Economy report highlights the substantial and sustained growth rate of this sector.

Between 2010 and 2013 the direct low-carbon economy grew by:

12%

in terms of employment

Gross Value Added (GVA) increased by

29%

in terms of employment

and increased by

25%

in terms of turnover

With a compound annual growth rate of

8.7%

and now stands at

£44.9 billion

This is almost nine times larger than aerospace and four times larger than the chemicals sector.

The same report showed that of the 9 regions in England, the Northwest has the greatest employment in the low carbon economy.

(80,500 from a total of 391,700)

Gross Value Added (GVA) in the region was **£130,084m** in 2015 and made up **7.9%** of the UK total. Broken-down by sector, the largest proportion of this value was generated by:

NORTHWEST COASTAL ARC IN NUMBERS

Population count of

6.25m

in 2015, 9.5% of the UK total

At this time

61.7% (3.86M)

of the population were of working age **(16-64)** and **3.04M** jobs were available within the region.

This represents

0.79

jobs per working age individual

Which is slightly lower than the UK average of

0.83

(where 34.06M jobs were available in a population where 63.1% were of working age).

1.2 Key NWCA Clean and Sustainable Growth Strengths and Assets

From our starting point of 'Eco-innovation' in our expression of interest (January 2017) the structure of this SIA has developed through discussion between partners and has been informed by Northern Powerhouse IER[3] and the subsequent publication of three key policy documents: the UK Industrial Strategy White paper[1], the Clean Growth Strategy[2] and the 25 Year Environment Plan[6]. This is complemented by the LEP Strategic Economic Plans (and Welsh equivalents) across our geography, across which Clean and Sustainable Growth is a common strategic priority (Annex 1). As a result, we have structured this audit around three prime capabilities in 'science and technology' strengths and assets (Box 1.3) plus a fourth enabling capability. We recognise the value in dealing with these broad sectors in separate chapters, and the links between our three prime capabilities and the three UK policy documents are summarised in Figure 1.2. We also recognise that activities map on to specific elements of other Science and Innovation Audits, and we have been pro-active in consulting with them to explore these relationships (Annex 4).

However, as we emphasise throughout this SIA, there are strong inter-linkages between all three prime capabilities, and the enabling capability is a vital element in that integration. By connecting our strengths in the science and technology of Clean and Sustainable Growth with complementary strengths in management and decision sciences, the enabling capability addresses needs highlighted in the 'Ideas' chapter of the Industrial Strategy White Paper[1]. For example, that 'While we score well on measures of research and innovation, we need to do more to ensure this translates in to improvements in earning power' and that 'within R&D the 'D' for development needs a particular boost'.

By bridging across disciplines and sectors, and from discovery to implementation, the enabling capability relates to one element of the fundamental hypothesis of this SIA: 'The NWCA will realise its potential as a global market leader for low-carbon and sustainable products, processes and services through greater networking, integration and connectivity across the whole of the region's research base and business community, beyond that which exists in our current networks'.

The strength in depth across the four capabilities, developed in more detail in subsequent chapters, has cemented our ambition to work together and to define ways ahead to establish the region as a global leader in innovation for Clean and Sustainable Growth (Chapter 7).

Capability 1

Environmental Industries, Technologies & Services – Chapter 3

Capability 2

Future Energy Systems – Chapter 4

Capability 3

Advanced Manufacturing, Chemistry and Materials – Chapter 5

Capability 4

Cross-cutting research and innovation for Clean and Sustainable Growth – Chapter 6

Figure 1.2

The relationships between the three prime 'Science and Technology' capabilities of this audit and elements

The relationships between the three prime 'science and technology' capabilities of this audit and elements of the three recent UK strategy documents, UK Industrial Strategy White paper, the Clean Growth Strategy and the 25 Year Environment Plan. Our enabling capability in research and innovation for Clean and Sustainable Growth naturally crosses both other capabilities and the different policy documents.

		IDEAS	PEOPLE	UK INDUSTRIAL STRATEGY					25 YEAR ENVIRONMENT PLAN			
				CLEAN GROWTH GRAND CHALLENGE					CHAPTERS			
				SECTORS								
				Improving Business & Industry Efficiency and supporting Clean Growth	Improving our Homes	Accelerating the shift to Low Carbon Transport	Delivering, Clean Smart Flexible Power	Enhancing the Benefits and Value of our Natural Resources	Recovering Nature and Enhancing the Beauty of Landscapes	Using and Managing land Sustainably	Increase resource efficiency and reducing pollution and waste	Protecting and Improving our global Environment
NWCA Clean and Sustainable growth SIA	**Chapter 3** Environmental Industries, Technologies & Services	■	■	■		■	■	■	■	■	■	■
	Chapter 4 Future Energy Systems	■	■	■	■	■	■					■
	Chapter 5 Advanced Manufacturing, Chemicals and Materials	■	■	■		■	■			■	■	■

The Centre for Global Eco-Innovation

The Centre for Global Eco-Innovation (CGE) is a long-standing collaboration between the region's higher education institutions and SMEs to drive Clean and Sustainable Growth through the joint development of new products, technologies and services for global markets.

CGE has grown from two periods of support from the European Regional Development Fund. The first phase (2012-2016) led by Lancaster University in collaboration with University of Liverpool supported SMEs from across the region then covered by a single European Structural and Investment Funds (ESIF) programme. From the start CGE has been 'challenge-led and solution focused', rather than driven by any particular technology, and has drawn on expertise and disciplines from across its partners to find multidisciplinary solutions to complex problems. The first phase of CGE drew on research from thirteen different academic departments across the two universities. It supported approximately 300 regional SMEs, including fifty business-led post-graduate research projects (all the researchers were registered for PhDs), fifty internships and fifty undergraduate research projects. The headline conclusions from an independent audit of CGE Phase 1 are summarised below.

In 2015, the success of CGE was recognised by it winning the "Outstanding Knowledge Exchange and Commercialisation Initiative" category in the Impact Awards, which are backed by all seven UK research councils, and the "Research and Development" category in the Green Gown awards.

The second phase of CGE (2016-2020) builds on these successes, supported by funding managed by the Cumbria, Cheshire, Lancashire and Liverpool City LEPs. Collaboration between higher education partners has broadened to include the Universities of Cumbria, Chester, Central Lancashire (UCLan) and Liverpool John Moores, together with the national research institute, the Centre for Ecology & Hydrology. This second phase of CGE is supporting 80+ business-led post-graduate research projects. By 2020 it will have supported a total of 660 businesses, across all partners.

In addition, CGE has begun to develop a genuine international dimension. In 2017 the University of Benin, in close collaboration with Lancaster, established CGE (Nigeria) to translate CGE's experience in the UK into West Africa. Lancaster also leads "RECIRCULATE", a £7M project funded by the Global Challenges Research Fund, with the University of Benin, the Council for Scientific and Industrial Research (Ghana) and Lancaster University Ghana, plus four more partners in Botswana, Kenya, Malawi and Zambia. Again, the aim of this project is to build the capacity of project partners to drive Clean and Sustainable Growth in their countries through eco-innovation collaborations with the research user communities, based on our experience in the UK.

Headline conclusions of independent audit of CGE carried out by Amnion, in 2014

Benefits to companies and graduate researchers

+ Over 80% of beneficiaries stated that the project had helped overcome the lack of qualified staff, the most commonly cited barrier to innovation.
+ Over 80% of respondents felt that the project had met the objective of developing new products and services, and to better understand the market. 75% of beneficiaries expected the support received to have either a significant or a very significant impact on the business.
+ 37% of the businesses surveyed forecast an increase in exports resulting from the support provided.
+ Those benefitting from the project have also benefitted from an increasing willingness to undertake further R&D and to collaborate with other businesses and the knowledge base.
+ The project has also had a positive impact on Graduate Researchers in relation to academic progress, employment prospects and developing employment related skills.

Benefits to the economy

+ It is forecast that by 2018 the first phase of CGE will have created 314 gross jobs and some £45 million of gross GVA, and £35 million in net additional GVA. By 2026 the forecast is for £65 million of gross GVA and £50 million in net additional GVA.
+ In terms of efficiency, CGE out-performed the regional benchmark for net additional jobs identified in the review of RDA spending: £20,922 per new job compared with the benchmark of £37,600.
+ In terms of return on investment for enterprise support projects, the forecasted ratio for CGE is 5.5:1 by the end of 2017 (10.2:1 by 2026), well above North West regional benchmark (1.8:1) and the national average (2.8:1).

Benefits to the environment

+ In early 2014 the environmental benefits of CGE were assessed both within the life of the project and out to 2027, with predictions based on project outcomes that are already being achieved, or where there was a very high confidence that they will be achieved.
+ The target for reductions in greenhouse gas emissions (27,000 tonnes CO_2 equivalent) was met well ahead of schedule.
+ Targets for reductions in water and material use are expected to be met by 2022 according to the evaluation, but were met and exceeded by 2016, with reductions of 78,000 tonnes and 60,000 tonnes respectively.

Lancaster University | Centre for Global Eco-Innovation