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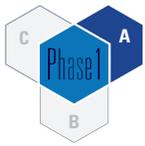
Phase 1

B

Infrastructure
Commission
for Scotland 

Part A

Context & Key Drivers



Part A:
Context & Key Drivers
(continued)

1. Introduction

Part A summarises both the evolving policy context of our work, and its interaction with the often complex and conflicting role of infrastructure in supporting policy priorities. It seeks also to demonstrate the interlinkages that mean that today's infrastructure decisions cannot be made in isolation. The Commission seeks to contribute to a better understanding of what needs to be done to maximise Scotland's success in meeting net zero carbon targets, and securing a socially-inclusive society and economy, over the next 30-years.

2. Remit and Scope

The Scottish Government gave the Commission a broad remit, reproduced at Appendix A. Uniquely, the Scottish Government definition of infrastructure captures both traditional economic infrastructure and assets often considered social infrastructure, with primarily social objectives:

Infrastructure includes economic and social aspects, defined as: The physical and technical facilities, and fundamental systems necessary for the economy to function and to enable, sustain or enhance societal living conditions. These include the networks, connections and storage relating to enabling infrastructure of transport, energy, water, telecoms, digital and internet, to permit the ready movement of people, goods and services. They include the built environment of housing; public infrastructure such as education, health, justice and cultural facilities; safety enhancement such as waste management or flood prevention; and public services such as emergency services and resilience.

Following engagement with Stakeholders, we have incorporated natural infrastructure in our work, and are suggesting it be included in this definition



UK Gov annual investment

2.6%
of GDP



OECD average
annual spend

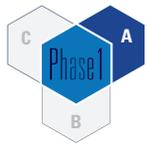
3.6% GDP

Source:
<https://sp-bpr-en-prod-cdnep.azureedge.net/published/2019/1/15/Scottish-Government-infrastructure-investment/SB%2019-02.pdf>

Whilst this scope was broadly welcomed by stakeholders, it was also suggested by a number of the initial call for evidence respondents that natural infrastructure should be included, and this has been taken up by the Commission. This combined definition is an explicit recognition of infrastructure's role beyond the economy and its support for social and environmental policy outcomes. This is further emphasised through the wide terms of reference for the Commission, including: traditional considerations such as international competitiveness; demographic and technological changes; infrastructure ownership and fair work; and newer objectives of inclusive economic growth (IEG) and low -now net zero- carbon economy (NZC)¹. To frame its work, the Commission made the early decision to focus on the role of infrastructure in achieving both of these objectives in tandem: an inclusive net zero carbon economy. This approach was tested throughout its stakeholder engagement and informed by desktop research.

¹ Where we state Net Zero Carbon (NZC) we are referring to the legislation and related actions to achieve net zero greenhouse gas emissions by 2045ix.





Part A:
Context & Key Drivers
(continued)

3. Approach

The Commission consulted widely, ensuring that all of Scotland had the opportunity to consider and inform the short and long-term vision for infrastructure. Alongside this we drew upon existing research and good practice, to understand the balance of opinion and evidence.

3.1 Stakeholder Engagement

We developed an engagement strategy which reflected this commitment. Further details of this strategy are included at Appendix B. The approaches, and segmentation, ensured engagement with a wide and varied range of stakeholders across civic Scotland. These included experts with a professional understanding of the infrastructure sectors, to individuals, and communities of interest affected by infrastructure decisions:-

- > As a first step, the Commission issued an Initial Call for Evidence in March 2019. The Call provided individuals, representative bodies, public bodies and organisations who use, plan, manage, maintain, finance and deliver infrastructure with the opportunity to contribute to Commission work by submitting written evidence. 147 responses were received; Appendix C provides a link to the Call for Evidence document issued by the Commission; Appendix D provides links to the individual submissions, where the respondents agreed these could be shared.
- > The Commission held a series of five Regional Forums in Aberdeen, Edinburgh, Glasgow, Inverness and Moffat. The forums were designed to capture regional distinctions, through dialogue with representatives from the public, private and third sectors. Appendix E provides a summary of the Forums, highlighting the key points and issues raised.
- > The analysis of the Call for Evidence and the responses from the Regional Forums were used to identify key sectors, emerging themes and gaps in evidence which the Commission investigated in more depth via nine Thematic Round Tables. These were attended by subject matter experts and enabled the Commission to interrogate further some headline issues raised in the Call for Evidence and Regional Forums. Appendix F provides a summary of main points from the Round Tables.
- > At key stages throughout this process, there were also a number of one-to-one and group meetings with representatives of specific sector interests. Appendix G details all stakeholder organisations the Commission

engaged with during Phase 1. This included engagement with Scottish Government policy leads and sectoral experts, and Appendix H contains a summary of the Scottish Government group meetings which had a similar form to the Thematic Round Tables.

- > Finally, a programme of social research was undertaken by Ipsos Mori, to understand the views and opinions of the wider public; as both users of Scotland's infrastructure and often also contributors to its funding, this included 4 deliberative workshops in Edinburgh, Glasgow, Moffat and Kinross and an online survey of over 1,000 people. Appendix I provides the report from this activity.

3.2 Desktop Research

In addition to capturing the views, opinions and priorities of stakeholders, desktop research was undertaken. The Commission undertook an internal review of research on the links between inclusive economic growth and infrastructure, which is included at Appendix J, following which the Fraser of Allander Institute was commissioned to undertake a deeper literature review. This is included as Appendix K.

Aventia Consulting was also commissioned to undertake a desktop review of literature on the relationship between net zero carbon (NZC) and infrastructure. This is included at Appendix L.

The key findings from these studies are highlighted below in Section 4.

The Commission also worked with the Scottish Government to understand the existing infrastructure asset base across Scotland. Appendix M provides the collated baseline and Part B of this main report provides commentary on individual sectors. All data is current to at least September 2019. In some instances, this has been updated subsequently.

Research and good practice were collated and analysed as identified in the Bibliography at Appendix N.

4. Key Policy Drivers

4.1 Introduction

The Scottish Government's policy has directed the Commission to the primary focus on infrastructure's role to achieve an inclusive net zero carbon economy. This supports the holistic goal of enhancing wellbeing over more narrowly defined measures of economic success such as GVA/GDP. The Scottish Government's 'Just Transition' process will be essential to achieve these objectives. Being clear on the role of infrastructure as a contributor to these

National Performance Framework

Our Purpose, Values and National Outcomes



Source:
https://nationalperformance.gov.scot/sites/default/files/documents/NPF_A2_Poster.pdf

goals is challenging, as the evidence is complex and conflicting. New forms of evidence are now needed to ensure that investment is fit for the purpose of an inclusive, net zero carbon economy.

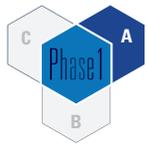
4.2 National Performance Framework

Scottish Government's National Performance Framework (NPF) sets an overall purpose and vision for Scotland. It includes 11 broad national outcomesⁱ that support the purpose and provides measures on how well Scotland is progressing towards them. Aligned with the UN Sustainable Development Goals it "...aims to reduce inequalities and gives equal importance to economic, environmental and social progress". The framework is represented as an integrated system, showing the interdependency of economic, environmental and social priorities. As such, success is currently equally measured across the 11-outcome areas, with no obvious weighting or prioritisation.

The NPF could be considered to encompass the breadth of measures essential for a wellbeing economy. Concepts of a wellbeing economy are not new; however, they are now gathering momentum

across the UK and beyond. The Office of National Statistics (ONS) has developed a number of datasetsⁱⁱ to measure well-being, since 2010, including their "beyond GDP" series. This year ONSⁱⁱⁱ acknowledged the limitations of GDP as a measure of welfare and living standards. They suggested instead that complementary measures of wellbeing are needed. Similarly, the UN Human Development Index^{iv} (HDI) takes a broader approach to understanding the development of a country and not only economic growth.

Infrastructure is not explicitly measured within the NPF, perhaps reflecting the understanding of it being either an enabling asset to achieve other priorities, e.g. schools provide the public environment to achieve educational outcomes; or an area which needs to be managed to minimise negative impacts e.g. within the Environment outcome it states "We promote high quality, sustainable planning, design and housing."^v One notable exception to this is blue-green or natural assets which are identified as outcomes in their own right, such as access to green and blue space; biodiversity; and clean seas. As indicated above, the Commission has included natural infrastructure within its scope of its work.



Part A:
Context & Key Drivers
(continued)

4.3 Programme for Government

The annual Programme for Government (PfG) lays out the key policy action plan and priorities for the coming year, including any legislative programme. The 2019-20 PfG^{vi} leads with addressing the climate emergency, while ensuring a just transition, through equitable share of opportunities as well as impacts. Through this prism, the programme explicitly identifies a range of infrastructure initiatives to support its economic, environmental and social priorities.

While seen to have a wider role within the PfG, infrastructure is most commonly framed to support the economy. Scotland's 2015 Economic Strategy states "Scotland's economic prosperity depends upon the strengths and talent of our people, our natural resources, our infrastructure and how we are governed."^{vii} In addition, the PfG^{vi} notes that "[investment commitments] are not possible without a strong economy that generates the jobs and wealth for us all to benefit from. We will continue our work to transform Scotland's infrastructure, support our innovators and expand our exports." A report by the Scottish Government's Office of the Chief Economic Advisor (OCEA)^{viii} in December 2018 identifies the ways in which infrastructure enables broader objectives, and in particular inclusive and sustainable growth. This report highlights the Scottish Government target to increase expenditure on infrastructure by 1% of current GDP by the end of 2025-26, in order to achieve the OECD average of 3.6%. The PfG notes this will take the annual infrastructure investment to £6.7 billion, from the 2019-20 figure of £5.2 billion. A number of benefits are indicated from this increase covering: market impacts; social and environmental impacts; demand and supply side economy impacts. It is also noted however that these impacts depend strongly on the degree of economic slack; the efficiency of the investment; the overarching system; and the method of financing. Trade-offs were also acknowledged as important: with a focus on economic growth also regarded as necessary to fund many of the social and environmental priorities.

4.4 Net Zero Carbon

Scotland has legislated for net-zero greenhouse gas emissions by 2045^{ix}. There are also ambitious interim targets which include achieving a 75% reduction of greenhouse gas emissions by 2030. This commitment puts Scotland as only one of six countries^x that has legislated for NZC by 2050. While this has set the policy direction, there is a recognition that the magnitude and pace of implementation will need to change to achieve this target; and

**First Minister quote from
2018-19 Programme for
Government announcement:**

"We will make it our mission to steadily increase annual infrastructure investment so it is £1.5 billion per year higher at the end of the next Parliament [2025-26] than in 2019-20.

This bold mission will increase Scottish Government capital investment by an additional 1% of current Scottish GDP and to achieve it we will need to continue to innovate in our models for investment and work across the public sector. On our current estimates that would mean around £7 billion of extra infrastructure investment by the end of the next Parliament."

Source:

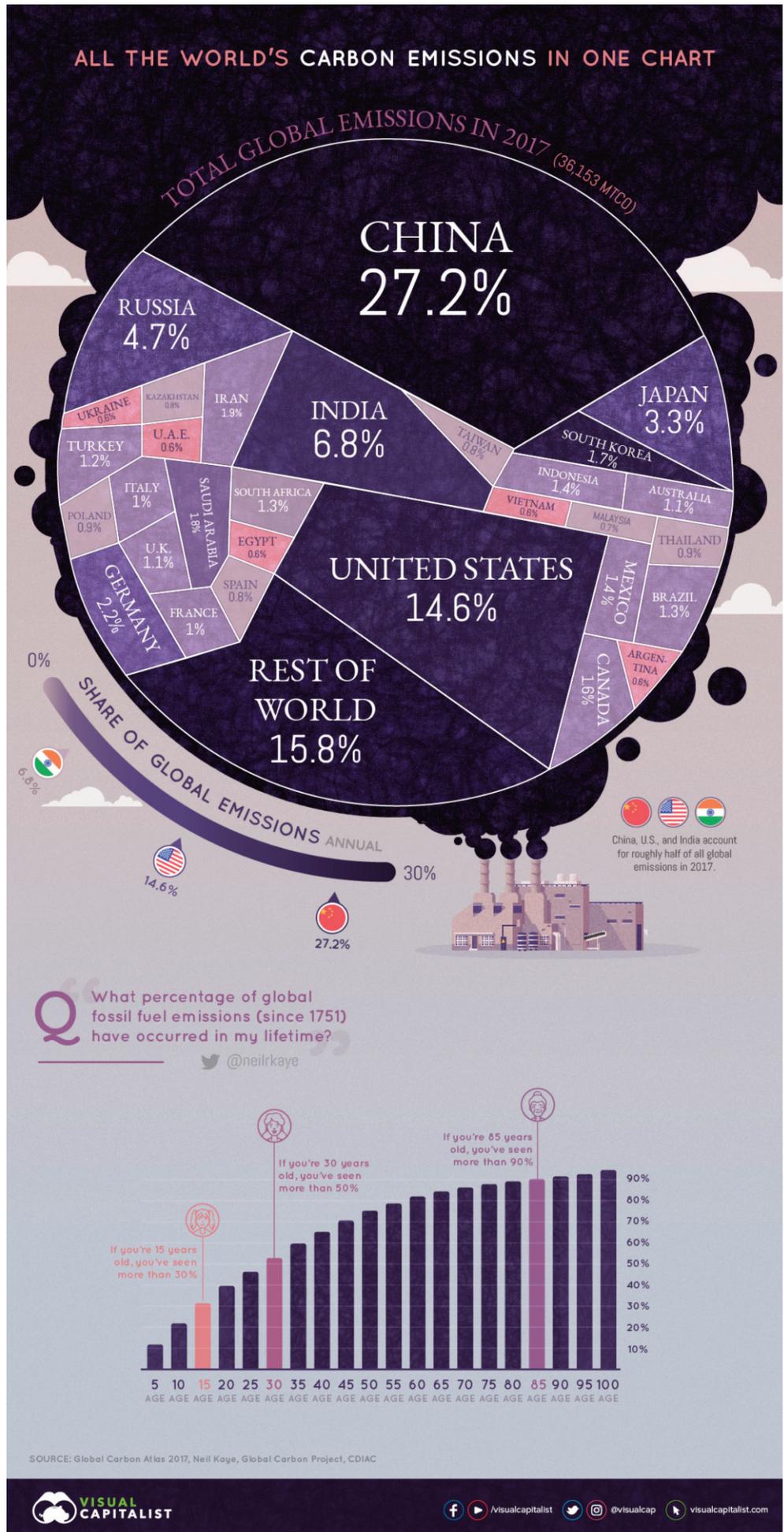
(Scottish Parliament, 2018) source: <https://sp-bpr-en-prod-cdnep.azureedge.net/published/2019/1/15/Scottish-Government-infrastructure-investment/SB%2019-02.pdf>

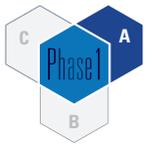
that progress is needed to address sectoral carbon reduction challenges, as well as structural and system barriers to change.

To provide a path to NZC, The Climate Change Plan 2018-32 (CCP) identifies key actions, currently for 2032 emission targets. The First Minister has committed to updating the CCP, to reflect the Climate Change Act, within six months of its Royal Assent. Much has already been achieved, with the recent Eighth Report^{xi} on progress, noting that in 2017 Scotland had reduced its emissions by 47% from the 1990 baseline. In addition, in 2017 Scotland generated 68% of its electricity requirements from renewables.

World's Carbon Emissions

Source: www.visualcapitalist.com/all-the-worlds-carbon-emissions-in-one-chart/





Part A:
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(continued)

Aventia Consulting undertook a desktop study into the relationship between infrastructure and carbon, considering both embodied and lifecycle/operational carbon. The full report is at Appendix L. Infrastructure was estimated to account for 53%^{xiii} of total UK emissions in 2013, putting it front and centre in the requirement for decarbonisation. Without significant action this is set to grow to 90% by 2050 as other sectors decarbonise, and asset construction in particular takes a greater share of remaining emissions. The current 53% includes the more narrowly defined economic infrastructure used by the UK National Infrastructure Commission (NIC), therefore it is likely to be higher in Scotland, with its wider infrastructure definition. In terms of investment requirements and life expectancy, infrastructure is a long-term intergenerational asset. For example, it is estimated^{xiii} that of the current 2.5 million homes in Scotland, 80% will still be in use in 2050. Moreover, 75% of the current housing stock was built before 1982, with 20% being built before 1920, making these properties at least 100 years old. In addition, infrastructure is interdependent e.g. homes and schools need roads and utilities. It is anticipated that this interdependency will continue to grow as we move through the transition to low and zero carbon solutions, as is playing out now for energy and transport.

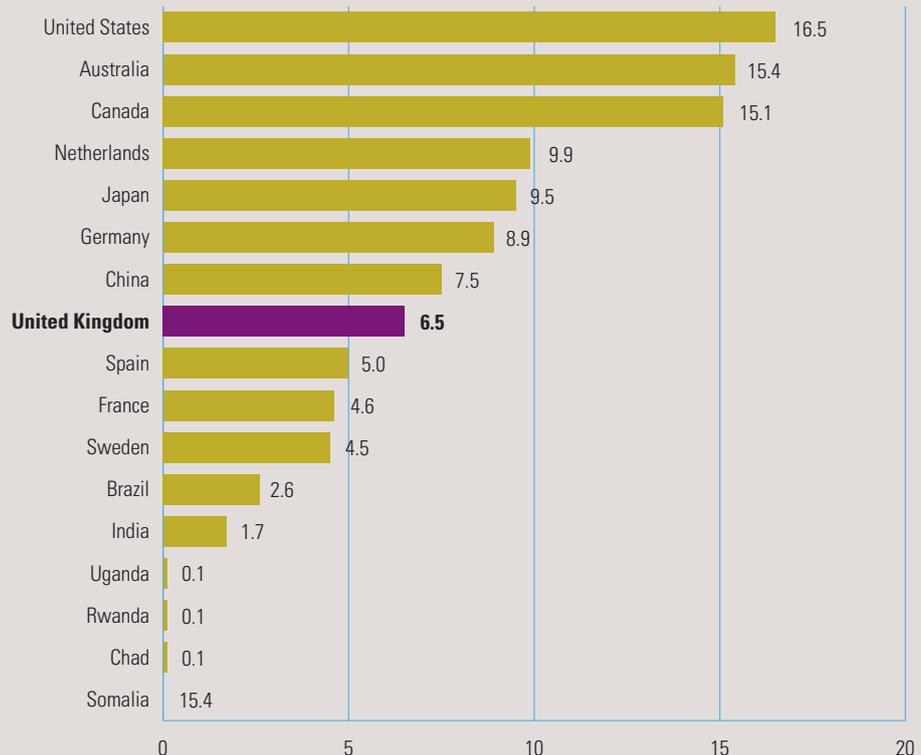
This means that no single area of infrastructure can be considered in isolation.

The scale of infrastructure’s role in emissions makes decarbonisation of infrastructure a priority, however the interdependency and long-term nature of much of our infrastructure also makes decarbonisation complex and often challenging.

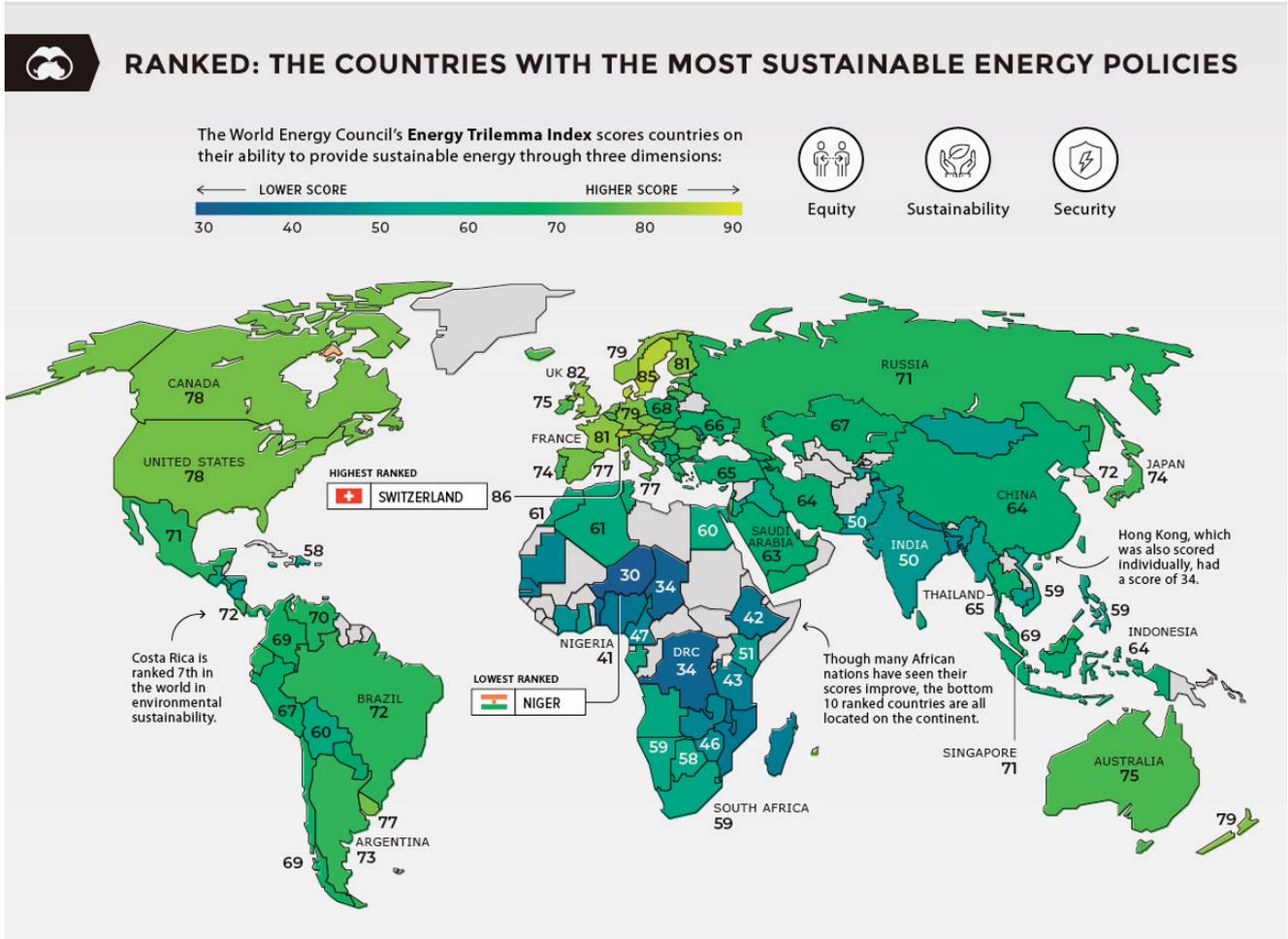
Aventia’s review suggests that new appraisal and financing models need developed to work with the interdependence of infrastructure classes, including the interface between old and new assets, as well as the interactions between sectors and across the economy. Aventia note that Scotland is in a good position, primarily due to electricity decarbonisation and good progress on raising awareness of adaptation, building capacity and long-term decision-making to respond to climate change challenges. However, areas noted as requiring more progress are: transport, agriculture and heat for buildings.

Domestic transport is the most carbon-intensive sector; it is as carbon intensive now as it was in 1990. Total vehicle kilometres on Scotland’s roads increased by 37% from 35bn in 1993 to 48bn in 2017, with the volume of traffic on major roads in Scotland more

CO2 emissions per capita
(Metric tonnes per capita)

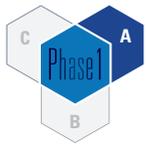


Source:
World Bank - EN.ATM.CO2E.PC
<https://www.economicshelp.org/blog/10296/economics/top-co2-polluters-highest-per-capita/>



than doubling since 1975. In the main, public transport use is moving in the wrong direction, with both bus travel and cycling decreasing as a proportion of trips made; with only train use increasing. In contrast, car and air travel are increasing. To illustrate, in 2017 journeys to work by car made up 63% of all journeys, while 10% were by bus and 5% by train. The rapid pace of change in transport and mobility is likely to bring significant developments in fleet electrification, connectivity, automation and shared mobility, to reduce the carbon impact of travel. These developments make transport planning for a NZC future extremely challenging. Part B goes into greater detail on some of these future scenarios, as well as the wider transport challenge. Overall, however, the message is clear: we need to use new and different scenario modelling techniques to better align strategy so that it delivers NZC. Within this there are key questions for policymakers about the roles of incentivisation, regulation, pricing and other tools to achieve the changes in behaviour that will be required to meet the NZC targets.

Turning to energy, Scotland has an integrated strategy underpinned by significant public investment, although as a reserved policy area, liaison with UK Government and regulators is clearly essential. This investment, alongside building standard changes, has been associated with increased energy efficiency, with energy consumption in 2015 down by 15.4% compared with the mid-2000s at 157 TWh. Despite this however, in 2016 heat was 54% of total final energy consumption, compared to 25% for transport. This is slightly skewed to industrial/commercial consumption at 59% versus 41% for domestic. These figures are higher than the rest of the UK. As with transport, there is change ahead and key decisions to be made around primarily electric or primarily hydrogen futures. The decarbonisation of heat is anticipated to rely on one or both of these developments, alongside district heating.



Part A:
Context & Key Drivers
(continued)



As a result of the scale of energy used for heat, housing and related space heating are the dominant building sector challenges. This is primarily an issue of retrofit, as building standards continue to have a key role in reducing new-build emissions that include targets to end gas-connection by 2024. Fuel poverty also continues to be a policy concern, with public programmes to remove poor efficiency of homes as a driver for fuel poverty. Aventia suggests that there is an economic stimulus argument to extend this support more widely.

There are also less obvious areas of emissions. For example it has been estimated that at a global level digital emissions are increasing fairly quickly and in 2018 were 3.7% of the annual total; and expected to rise to 4% by 2020. Contextualising this, the same source suggests that civil air transport accounted for was 2% and light vehicles 8% globally^{xiv}. The fact that the digital energy used is primarily within the devices themselves raises distinctive challenges for public policy.

The sectoral challenges are clear, however research suggests that actions for both NZC infrastructure and climate change are “piecemeal, unsystemic and of inadequate scale^{xiii} and the Committee for Climate Change has identified transport, heat, carbon capture and storage, housing, buildings, industry and afforestation^{xiv} as all having policy deficits. “Clear, stable and well-designed policies” are needed to reduce emissions further. While it is noted that Scotland has shown significant leadership – globally as well as nationally, the CCC concludes that more needs

to be done to ensure the appropriate governance and planning structures are in place. It is recognised however, that establishing this is not easy. In a recent report by the RSE on the challenges facing energy policy in Scotland, the authors summarised the “quadrilemma” of competing energy policies: addressing climate change; ensuring affordability; providing energy security; and developing energy policy which is acceptable to the public, economically sustainable and just^{xv}. This further emphasises the interlinked policy areas of inclusive economic growth and net zero carbon. The Scottish Government established the Just Transition Commission^{xvi} to guide and manage this relationship, ensuring that the opportunities of NZC are maximised, but equally to mitigate against any negative impacts. Their interim report is due to be published in early 2020.

4.5 Inclusive Economic Growth

IEG Concept

The concept of achieving Net Zero Carbon by a specific date in order to meet emissions and climate change obligations is extremely challenging, yet also clearly defined. In contrast, the concept of Inclusive Economic Growth is less definite given its complexity and implications across all aspects of the economy and society. IEG can therefore be expected to evolve over the period in which decarbonisation must be achieved.

The Scottish definition of IEG is:

Growth that combines increased prosperity with equity, that creates opportunities for all, and distributes dividends of increased prosperity fairly

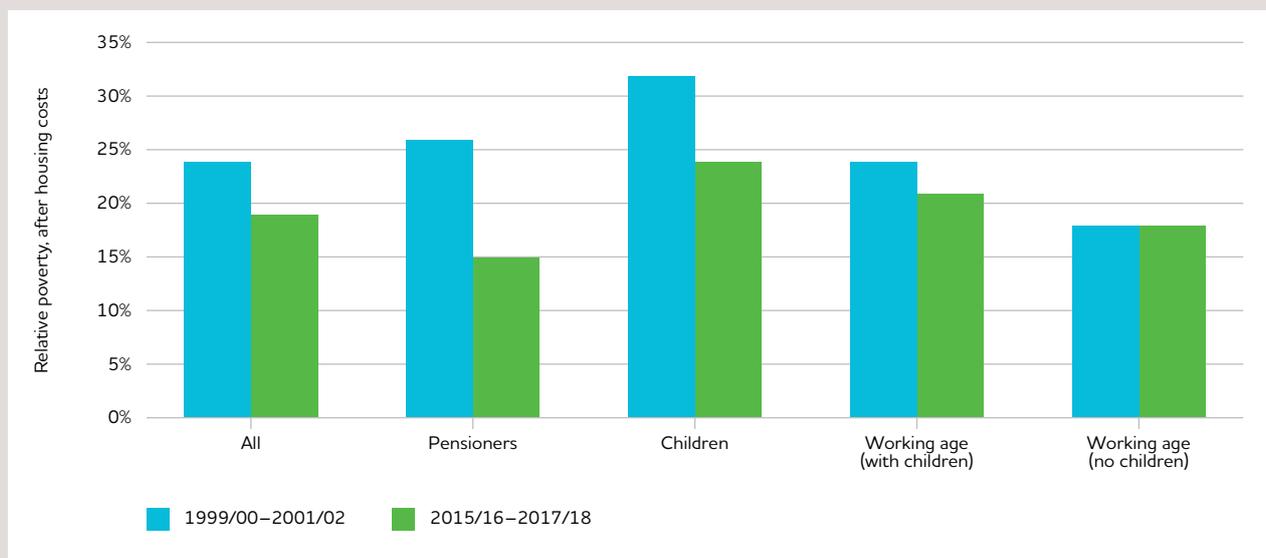
This definition could be interpreted as being interested in both pre-investment appraisal and post-investment review to influence inclusion i.e. creating opportunities through growth policies, but also with a redistributive element. The earliest reference to IEG was in Scotland’s 2015 Economic Strategy. The strategy summarised the approach through the two pillars of increasing competitiveness and tackling inequality. While no definition of IEG was provided in this document, aspects covered included fair work, access to the labour market and equity, including spatial equity. This is useful in identifying measures that help contextualise IEG, including poverty, advancing equality of opportunity, employment, and fair work. There are also spatial considerations of inclusion be that local, regional or national; urban, semi urban or rural.

The interlinked challenges of poverty, employment and fair work

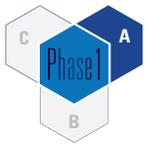
are also highlighted by the Joseph Rowntree Foundation (JRF) in their recently published Poverty in Scotland^{xvii} report. They encourage the Scottish Government to use all the tools at their disposal to ensure those on low earnings have sufficient financial gain from their work, while acknowledging that the reserved matter of employment law reduces some of the levers available to the Scottish Government in addressing poverty.

The Commission asked researchers at the University of Strathclyde’s The Fraser of Allander Institute (FAI) to review the evidence about the links between infrastructure and both traditional economic growth and IEG. Their literature review is at Appendix K. Their work shows that while theory supports a range of roles for infrastructure, the ex-post evaluation evidence is weak or unavailable. The recurring inability of analyses to clearly isolate the role of infrastructure from wider service and other system influences is a particularly important challenge. Possibly due to the emerging nature of the concept of IEG, FAI were also unable to find any study that demonstrated the link between IEG and infrastructure, including any evaluation by the Scottish Government. The available evidence in this area was seen to relate to developing nations and specifically inequalities and infrastructure.

The largest falls in poverty levels seen in the past 20 years have been among pensioners and children, but children remain the highest-risk group



Source: JRF analysis of the Households Below Average Income (HBAI) dataset. These figures may differ marginally from those that the Scottish Government publishes due to differences in the end-user licence data that is provided for public use through the UK Data Archive.



Part A:
Context & Key Drivers
(continued)

The challenges in conclusively linking economic growth and infrastructure included issues of causation and attribution. For example, the often-assumed role of infrastructure in stimulating economic growth is just as likely to be due to richer countries ability to invest more in higher quality infrastructure and public services. This means that it cannot be concluded that it is infrastructure investment alone that has achieved growth. Instead infrastructure is more appropriately seen as one part of a wider interconnected system, including the services that make use of it and the range of economic and social activities that the overall provision of infrastructure makes possible. In addition, the long-term nature of infrastructure can make short-term impacts and benefits difficult to identify.

FAI reviewed a number of individual sectors, to assess the evidence on the correlation between infrastructure and growth. Transport evidence was mixed and the FAI noted that economic displacement is a strong consideration for transport investment which could be the basis for a conscious policy to re-align regional development. In terms of digital, a 2012 OECD study related a 10% increase in

digital activity, to a 0.2-1.6% GDP growth. In terms of housing, it is noted there is an accepted link between housing and economic benefit where it is of the right standard and type. So again, it depends on context and efficiency of investment.

As a result of the weaknesses in available research, the review focused on the theory.

Theoretically, the ways in which infrastructure can support IEG are more indirect. They may include improving the supply side of an economy, better environmental outcomes, and correcting market failures, especially as these tend to impact the most disadvantaged in our communities.

The FAI summarise that sectorally housing, energy and transport infrastructure may have the strongest role to play in inequalities and IEG. The links to housing and energy, are due to their costs, while transport is key for providing access to employment. Overall however, the evidence establishes the need for a system-wide approach if the structural inequalities that exist in society are to be tackled. Many causes of poverty and exclusion in the UK have a limited connection to infrastructure provision directly: as the JRF



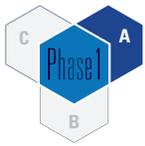


notes, unemployment and low paid jobs, low levels of skills, an ineffective benefit system, discrimination and relationship breakdown all play a large part.

Finally, there is also the possibility of significant trade-offs between pro-growth and pro-inequality infrastructure measures, at least in the short-run. Understanding and managing trade-offs was a persistent theme among stakeholders and in the FAI review. Given the limited extent of current evidence, important work remains to be done to fully establish how infrastructure investment should best be directed to support IEG priorities, within a wider well-functioning system.

This complex picture aligns with our stakeholder views. There was a strong commitment and agreement to prioritising IEG. However, it was recognised that implementing actual policy towards IEG outcomes would be challenging. While the Scottish Government's Scottish Centre for Regional Inclusive Growth^{xlviii} (SCRIG) has made significant progress in developing indicators^{xlviv} and measures for IEG, there was a desire expressed for more guidance, including better understanding of trade-offs and the application of available tools. This included the relationship between IEG and infrastructure.

Key issues summarised in this section are incorporated into a number of recommendations at Part C, most specifically those relating to Leadership, Place, and Heat and Transport.



Part A:
Context & Key Drivers
(continued)

5. Future Proofing

5.1 Introduction

In a world facing a climate emergency, global economic and technological disruption, future-proofing our infrastructure is a key requirement. Infrastructure is a long-term asset, with 80%^{xviii} of our current systems likely to still be in use in 2050, which makes the optimal management of those existing assets essential. Resilience to shocks was raised by our stakeholders as a key concern, with opinions that we must do things differently to manage these threats. Scotland has already made a firm commitment to achieving NZC in an ambitious, fixed time frame, and has established the Just Transition Commission to begin the task of planning to deliver the ambitious agenda in practice. However, stakeholders were clear in their responses to the Commission that there was a need to improve the alignment of policy measures to ensure clear actions are implemented.

5.2 Resilience & Adaptability

Infrastructure resilience and adaptability was a key area that many stakeholders raised in our consultation sessions. Comments ranged from specifics around climate resilience and how flood management is being co-ordinated to the wider issue of the extent to which infrastructure design and investment is planned to be resilient in the first place. Resilient and adaptable infrastructure systems are required to meet a diverse range of needs, including the ability to respond quickly to low probability high impact events, and have sufficient redundancy in the system to manage and mitigate the impact of disruption whilst it is happening. There are inevitable vulnerabilities across our infrastructure stock, and establishing a detailed understanding of these and their impacts is an important first step in developing a genuinely system-wide approach to infrastructure management that can achieve real resilience and adaptability.

“Infrastructure can facilitate business growth by improving productivity through enhanced digital connectivity; connecting employers to new markets, suppliers and partners; or increasing their access to talent and labour”

SCDI

Scottish Government’s 2nd Scottish Climate Change Adaptation Programme^{xvi} identifies 7 key outcomes, including infrastructure resilience. In addition, there is a statutory UK-wide requirement for the Committee on Climate Change to prepare Climate Change Risk Assessments^{xvii} every 5-years, again including the risks to infrastructure. A clear step in this process is to take action where straightforward interventions are evident to improve resilience, such as increasing prevention measures and providing back up support for key potential points of failure to minimise potential system breakdown. Indeed, ensuring a system-wide approach is critical if we are to move beyond asset specific risk management approaches to identifying the key interdependencies that underpin genuinely resilient design and planning of infrastructure.

5.3 Business Impact & Opportunity

While the challenges of identifying the impacts of infrastructure on the economy and IEG have already been detailed, theory suggests a range of business benefits. This includes providing international connectivity and access to markets and services, which are some of the drivers identified by the Scottish Government within the Commission’s remit. For business, appropriate and resilient infrastructure means ensuring our goods can get to market and people can get to work. This objective requires ongoing investment in existing infrastructure as a minimum. That this investment also needs to reflect NZC targets and the impact of climate change is an essential consideration which should be central to the decision-making process.

The FAI report on realising Scotland’s potential in 2050^{xix} identified the important role of international trade, whereby exporting firms are more productive, innovative and competitive over time; and countries with a stronger export base are often more resilient. For example, businesses that export account for 60% of UK annual productivity growth and are, on average, 70% more productive than businesses that do not export. Despite the noted benefits however, Scottish exports are low. Including UK exports, Scotland has a ratio of exports to GDP of c53%, the percentage of international exports is only 20% which is less than half of the EU average of 45% and also lower than the OECD average of 28%.

To contextualise some of the challenges, it is useful to reflect on the components of competitiveness and the UK’s standing internationally. The World Economic Forum defines competitiveness as “the set of institutions, policies and factors that determine the level of productivity of a country”^{xx}. Reflecting this broad definition, their Global Competitiveness Index covers 98% of the world’s



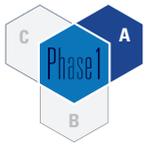
“Strengthening the resilience of our transport network and minimising the level of disruption during extreme weather is vital to all businesses, particularly those that rely on the ability to move people and goods across Scotland and further afield”

CBI Scotland



economies, allowing for an international comparator of the UK’s position. While this does not explicitly include Scotland, the UK ranking is a helpful indicator of some of the strengths and weaknesses in Scotland. Within this context, the UK Strengths are noted as: macroeconomic stability (maximum score), infrastructure (11th), and financial system development (7th). Areas for improvement are: the employability of graduates (11th), digital skills among the workforce (29th), ICT adoption (31st) and training and reskilling opportunities (29th). Notably, the infrastructure measure only covers the limited sectors of transport, electricity and telecoms. Within this group, some components of ICT adoption (a measure of ICT diffusion through broadband and mobile-telephony subscriptions and use) are highlighted as specific areas for development. Within this category, the UK is ranked 79th for fibre internet subscriptions and 70th for mobile-cellular subscriptions. However, the breadth of the Index signals that infrastructure’s role for competitiveness is only part of a much wider system.

Closer to home, a David Hume Institute review^{xxi} shows that Scotland’s productivity in 2018 was only behind London and the South East, however for Scotland to move into the top quartile of the OECD table, it would need to increase its productivity by approximately 20%. Challenges noted included: little employment growth in productive industries, low business investment and R&D spend, lower exports than the EU and OECD averages and from a narrower base. Insufficient use of the well-educated workforce, seen in low levels of management quality and small low-productivity firms, is also a cause for concern, as are declining survey scores for Scottish school education and reducing working age population. In the context of infrastructure, business investment weaknesses include a lack of investment in machinery, equipment and capital stock, with Scottish workers operating with less of these assets than their most productive OECD counterparts.



Part A:
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(continued)

Exports



The top 3 sectors make up 40% of all exports in 2017

The UK, followed by Europe remain Scotland's largest trade partners

Businesses that export account for 60% of UK annual productivity growth and are, on average, 70% more productive than businesses that do not export

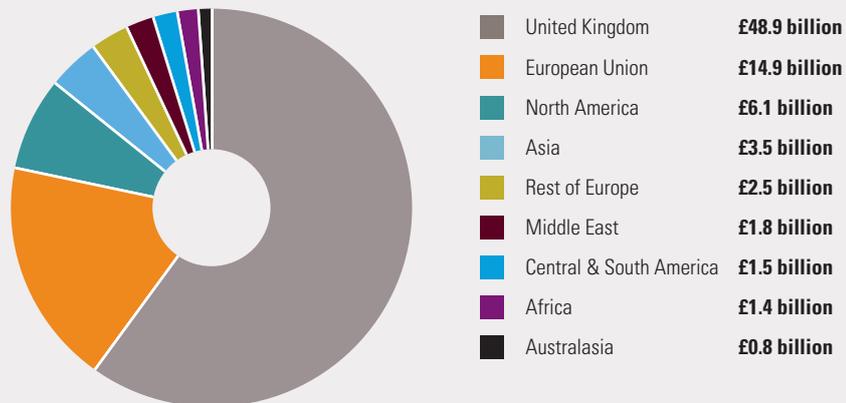


In 2017, Scotland showed an increase in international exports (excluding oil & gas) to

£32.4 billion

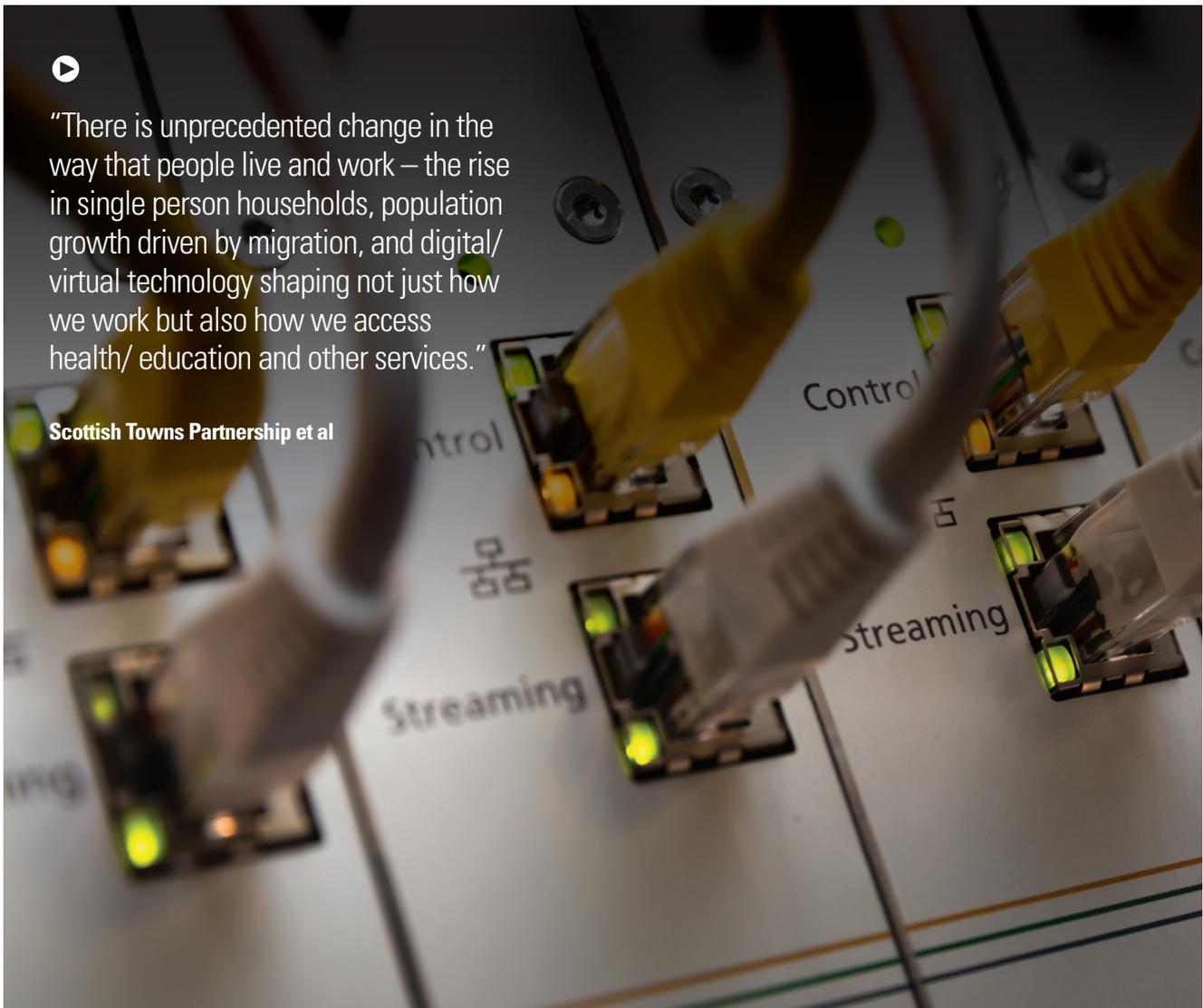
(an increase of £1.9 billion (6.3%))

Scotland's export partners by value



Top three exporting sectors





“There is unprecedented change in the way that people live and work – the rise in single person households, population growth driven by migration, and digital/virtual technology shaping not just how we work but also how we access health/ education and other services.”

Scottish Towns Partnership et al

5.4 Technology & Data

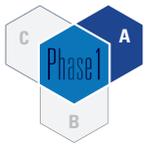
Future proofing for technological and data changes is also essential. As seen above, technology and ICT adoption are key components of competitiveness and ensuring both climate and economic resilience for these assets is essential. Stakeholders identified some key weaknesses in the fixed and mobile internet and data communications infrastructure, including subsea cabling and data centres. Perhaps unsurprisingly therefore the the UK’s adoption of ICT and in particular fibre internet is low. Yet, there are concerns around technology inequality affecting the most disadvantaged within our society. As with housing, it is important that investment in digital also improves access for those currently excluded, such as disabled people and those in our most deprived communities. While, as previously noted, digital technology is an increasing area of energy consumption, primarily within the charging for battery-supported devices, but also in areas such as data centres that have large energy needs.

The UK Industrial Strategy^{xxii} explains that the “fourth [industrial] revolution is characterised by a fusion of technologies that is blurring the lines between the physical, digital and biological worlds”. It is expected to disrupt every sector, creating both opportunities and challenges. Scottish Enterprise in its 2019-22

strategy, *Building Scotland’s Future Today*, also identify the opportunities and challenges of this revolution. Opportunities include low carbon innovation, taking advantage of Scotland’s rich natural environment, and existing strengths in data analysis and insight.

Scotland’s digital strategy, *Realising Scotland’s Full Potential in a Digital World*^{xxiii} notes that digital has the same importance of other utilities such as gas, electricity and water. It details an action plan which includes, amongst others, developing the resilience of the digital infrastructure. Part of that resilience will require better subsea connectivity as well as the expansion of the data centre sector within Scotland.

There are however concerns around the unequal impacts of the fourth industrial revolution. Reflecting this, in 2018 Scottish Government and the Scottish Trade Union Congress jointly produced a report on how changing technology may impact on the Scottish labour market^{xxiv}. While setting out in some detail the global debate and projections and how this may affect Scotland, this study notes there is little agreement on how technology will continue to develop and impact on our economy. Indeed, there is little evidence to date of significant technological disruption in Scotland, nor is there likely to be in the medium-term.



Part A: Context & Key Drivers (continued)

Irrespective of whether we will see significant disruption in the short to medium term, technology will have an increasing role in our society. There are some clearer weaknesses in our digital infrastructure, such as the provision of full fibre and mobile coverage, as well as issues of resilience around international connectivity, but there are economic opportunities, in areas of data and delivery of effective public services. Ensuring Scotland embraces and exploits the opportunities fairly must remain a key focus.

5.5 Accessibility & Mobility

The Scottish Government estimates that 32% of adults (and 10% of children) have long-term conditions that are limiting. The number of people with disabilities is growing as populations age and chronic health conditions increase globally^{xxv}. Infrastructure is critical to social functioning with impacts on earnings, wellbeing and education. Accessible infrastructure provides a barrier free environment, independence, convenience and safety for disabled people.

Disabled people's rights to independent living are enshrined in the UN Convention on the Rights of Persons with Disabilities. In Scotland 0.7% of local authority housing and 1.5% of housing managed by Registered Social Landlords is accessible for wheelchair users^{xxvi}. The demand for wheelchair-accessible housing is expected to increase significantly: a projected 80% increase in the population of wheelchair users by 2024, with an increase in unmet needs from 17,226 to 31,007 households^{xxvii}.

The Equality and Human Rights Commission noted in their 2018 report^{xxviii} that 'there was strong evidence to the inquiry that housing that meets disabled people's requirements will save on health and social care costs in the future, as well as considerably

lowering the cost of adaptations when they are needed. The Commission also noted that disabled people who were inappropriately housed were 4 times less likely to be in work.

At the Commission's thematic round table on accessibility and mobility, participants identified key infrastructure concerns in using public transport, housing, streetscapes and poor access to information and services. Despite the excellent work of the Access Panel Network^{xxix} across Scotland to address access issues in the built environment, as well as improving social inclusion for disabled people; the impression was that often disabled people and their representative organisations were not being involved in co-design. In addition, resources for both Access Panel Networks and public bodies was limited. The principle view expressed was that to enable disabled people to fully contribute to society requires accessible infrastructure being in place from 'door-to-door' and will require Scotland to look at working closely with disabled people to design built environments which works for them and society as a whole.

Key issues summarised in this section are incorporated into a number of recommendations at Part C, most specifically those relating to Leadership, Place, Making the most of existing assets, Heat and Transport and Digital & Technology.

6 Infrastructure Planning & Regulation Framework

6.1 Introduction

Scotland's planning landscape is comprehensive, incorporating guidance and decision-making at a national, regional and local spatial level. The successful delivery of policy priorities such as IEG and NZC require appropriate planning and regulation systems.



The 2019 NIC report, *Strategic Investment and Public Confidence*, notes some key regulatory changes to support the challenges of NZC, weather changes and increased digitalisation

Stakeholders were concerned that these systems do not currently address these dual priorities sufficiently, although it was recognised that change is underway, reflecting the changing policy emphasis. In addition, another consistent message from stakeholders was the desire to see these frameworks evolve to facilitate what is often termed an Infrastructure First approach.

6.2 National Planning Approach

National Planning Framework 4 (NPF4)^{xxx} is the long-term spatial plan for Scotland, which is currently in development and will supersede the current NPF3. This will include establishing where infrastructure is needed to support sustainable and inclusive growth. This next iteration to NPF4 is expected to see an evolution of priorities. This includes a longer-term timeframe and regional spatial strategies to reflect the evolution of decision making across spatial scales. NPF4 is also likely to incorporate the latest policy position for NZC and IEG more fully.

Research by Ironside Farrar^{xxxi}, on behalf of the Scottish Government, reviewed the role and use of Scottish Planning Policy, and how it could be developed in light of the Planning (Scotland) Act 2019 and thereby influence NPF4. Recommendations included a greater emphasis on placemaking at the forefront of development, and that NPF4 should be more directive in ensuring principles are implemented. This includes mitigating for conflicting priorities, such as housing targets, which are at times seen to undermine place principles. More broadly, an Infrastructure First approach should be encouraged, which facilitates longer term strategic planning and addresses future transportation, health, education and community facility requirements. The Infrastructure First principle also allows for improved infrastructure planning at a national and regional level, through greater co-ordination and involvement of all stakeholder in the planning process. This includes developing greater clarity of the infrastructure needs of an area, to reduce barriers to investment and development.

As well as the national spatial plan, all planning authorities have a duty to prepare local development plans, joining up land use and infrastructure, and improving place outcomes, supported by public engagement. The NPF4 is expected to be drafted for consultation in September 2020, with final version before Parliament in 2021.

6.3 Regulatory Framework

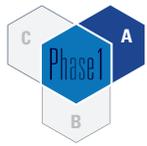
Just as NPF4 needs to further develop an Infrastructure First approach and a greater embedding of inclusive net zero carbon

“The emergence of new lifestyles with mobility, property and technology being provided as universal services rather than through individual acquisition needs to be part of our longer-term planning. Infrastructure planning needs to respond to the needs of an agile workforce contributing in different ways and in different places.”

Scottish Cities

economy priorities, the utilities regulatory regime for Scotland also needs to evolve. The need for a regulatory regime that is focused on future long-term investment requirements as well as appropriate oversight of standards of delivery was highlighted by a number of stakeholders, and reinforced during the roundtable engagement process. The views expressed were also reflected in the recently published report^{xxxii} by the UK National Infrastructure Commission (NIC) on the regulatory system for utilities infrastructure that incorporated water, energy and telecoms. Water regulation is a devolved matter while energy and telecoms regulation are reserved, therefore the recommendations of the NIC work are mainly relevant to energy and telecoms. The report identified some key regulatory changes to facilitate the three challenges that they highlighted in their 2018 National Infrastructure Assessment: NZC, weather changes and increased digitalisation. The assessment concludes that reform of the current regulatory system is necessary to address these challenges, and recommendations were based on (a) facilitating strategic investment and (b) building consumer confidence. Recommendations to facilitate strategic investment include: long-term investment planning; taking direction for strategic planning from devolved nations; updating regulation to include NZC obligations as well as the need for a long-term approach to resilience; and facilitating greater competition in delivery of infrastructure markets. Recommendations to build public confidence include: a better balance of risk and reward between consumers and investors; preventing price discrimination for the consumer; greater government guidance on priorities in terms of distributional impacts; and improved co-ordination of regulators. Both of these recommendation areas are relevant to addressing future requirements and outcomes aligned to IEG and NZC.

Key issues summarised in this section are incorporated into a number of recommendations at Part C, most specifically those relating to Leadership, Place, Heat and Transport and Regulation.



Part A:
Context & Key Drivers
(continued)

7 Decision-Making & Prioritisation

7.1 Decision-making

Scottish Government approach

For infrastructure investment the Infrastructure Investment Plan^{xxxiii} (IIP) is the key Scottish Government publication that sets out priority investments and longer term requirements. Refreshed at periodic intervals, the current plan was published in 2015 and a new plan is anticipated in 2020. The 2015 plan identified a number of guiding principles which focused on sustainability and low carbon; competitiveness and inequality; employment; and public services. It is anticipated that these guiding principles will evolve, to more fully reflect the inclusive net zero carbon economy priorities.

The implementation of the IIP is scrutinised by the Infrastructure Investment Board (IIB)^{xxxiv}. The IIB "aims to strengthen strategic direction, prioritisation and oversight to ensure coherent advice and successful delivery of an effective, fiscally sustainable programme which maximises Ministers' ambition for infrastructure investment^{xxxv}" Within their remit, the IIB highlight the important aligning of the IIP across government's reporting framework and annual timeline:

- > Infrastructure Investment Plan Annual Progress Report (April)
- > Medium Term Financial Strategy – Within four weeks of UK Spring Statement (May/June)
- > National Performance Framework and Scotland Performs published (June)
- > Major Projects Reports to Parliament, (October/March)
- > Programme for Government (September)
- > Scottish draft Budget (November/ December)
- > Scottish Futures Trust Corporate Plan, Business Plan and Annual Reports
- > Scottish National Investment Bank Implementation Plan and consultation exercises

The Commission remit did not include a consideration of the funding and financing of infrastructure, or include a funding envelope. As noted in the earlier OCEA paper, these are key components in ensuring that infrastructure investment is an efficient use of public money and therefore require careful consideration. It is worth noting that infrastructure investment is made by: the Scottish Government and its agencies, local authority-led investment, in areas such as housing; private sector-



The 2019-20 Budget defines the baseline

£5,195.8m

and sets out the ambition to increase annual infrastructure investment to

£6,750.8m

in 2025-26



Since 2007

£11.1bn

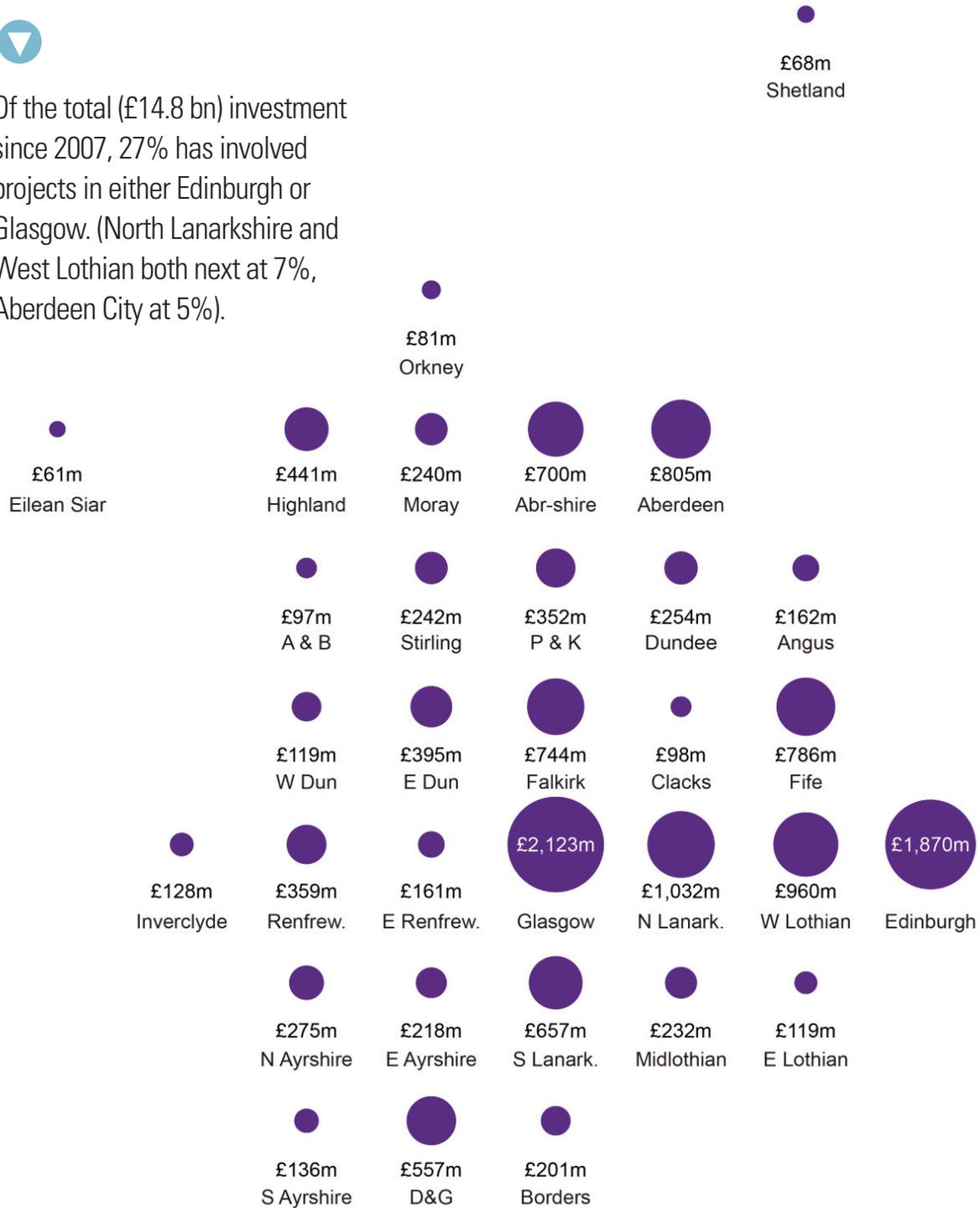
of Scottish Government led infrastructure projects have been completed with £3.7bn of capital projects currently under construction.

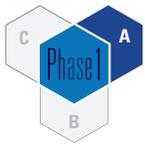
Around half of the pipeline projects are schools (34), schools account for less than 1/5 of the total capital value of projects.

In value terms 50% of the total pipeline is accounted for by road and rail projects



Of the total (£14.8 bn) investment since 2007, 27% has involved projects in either Edinburgh or Glasgow. (North Lanarkshire and West Lothian both next at 7%, Aberdeen City at 5%).





Part A:
Context & Key Drivers
(continued)

“A long-term approach to infrastructure policy making will help deliver sustainable investment, provide a clear long term outlook to potential investors, encourage industry to plan resources to deliver work and help reduce industry cyclicity.”

Ayrshire Councils

led investment, in areas such as digital infrastructure; and investment by Scottish Water, the cost of which is met by user charges. This is important in reflecting that decisions on investment are made not only by different stakeholders, but also at different spatial levels. The interaction in prioritising investment is therefore important to consider.

Place

The spatial levels for decision-making are clearly important and can be seen to have developed in recent years. Scottish Government policy has a focus on place-making, supported by a number of tools, such as the Place Principle^{xxxvi} and Place Standard^{xxxvii}. Effective integration of these standards within the decision-making process was highlighted by stakeholders; alongside managing the interaction of spatial decision-making more generally.

The Place Principle defines place as:

... where people, location and resources combine to create a sense of identity and purpose, and is at the heart of addressing the needs and realising the full potential of communities. Places are shaped by the way resources, services and assets are directed and used by the people who live in and invest in them

One size does not fit all. The Principle promotes a more joined-up and collaborative approach to services, land and buildings within a place; while the Place Standard is a tool designed to support assessment of places and what is needed. Assessment areas are again broad, including public transport, work and the economy, influence and sense of control, and feeling safe.

Place can also be considered at different spatial scales. While there is no statutory requirement to use the Place Principle and

Place Standard, the Scottish Government has legislated to embed local involvement in decision-making. This is both via Community Planning Partnerships^{xxxviii} as well as democratic structures such as Community Council schemes^{xxxix}. Local authorities are central to both of these frameworks with a range of resources and mechanisms at their disposal, including their role as the local planning authority. Spatial decision-making is further demonstrated through regionalisation developments. Following the establishment of City Regional Deals^{xl}, an increased regional focus has brought together groups of authorities and their partners to understand and plan regional priorities. These Regional Economic Partnerships are in their infancy for many, they are following a different strategic planning approach, that encompasses not only issues previously covered by strategic development plans but also wider economic, social and environmental shared priorities. Reflecting this increased focus on the region, the Planning (Scotland) Act 2019 has introduced a requirement for all authorities to develop regional spatial strategies.

Beyond this, there is a growing recognition of place in the work of national agencies, including Transport Scotland and Scottish Enterprise, that infrastructure investments significantly impact on the quality of places and need to reflect the priorities of local people.

Place therefore is an increasingly referenced policy area, with implications and decision-making structures at different interlinked spatial levels. Making better use of available tools for place-making, while establishing appropriate co-ordination of investments at different spatial levels were both consistent stakeholder themes. Understanding trade-offs and the best-fit of priorities across areas needs to be part of this decision-making.

“It is important to acknowledge that the creation of high quality places where people wish to live, requires upfront investment in ‘hard’ infrastructure such as transport, utilities, and educational facilities as well as ‘soft’ infrastructure such as recreational open space, blue and green networks as well as cultural facilities.”

Homes for Scotland



▶ Scotland's population has risen since 2000 and is projected to rise to 5.69m by 2041

Views of the Wider Public

Place highlights the importance of local influence of decision-making, to develop well-designed communities. The final area of research was undertaken by Ipsos Mori on behalf of the Commission. This sought to understand the opinion of the public, who are both users of infrastructure and often also contributors to its funding through taxation or user-charges.

Focusing on future priorities, users and participants prioritised infrastructure which impacted on their day-to day lives and their communities. A sense of fairness was often raised as a priority, with public infrastructure seen as having an universal level of importance, with the biggest impact on the greatest number of people. As such, healthcare facilities, education facilities, housing (in particular social housing) and emergency services were all seen to be important. Unsurprisingly therefore, thematic investment considerations highlighted a prioritisation of public services.

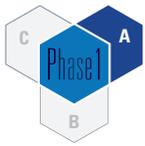
This research also confirmed public interest in making better use of our existing infrastructure assets. For example, conversations around existing assets emphasised the need for efficiency and

effective resource use, but also the negative impact of empty buildings on places.

Young participants gave a greater emphasis on support for solutions that will enable a zero-carbon future, although it was notable that this thread was not linked to support for the circular economy, perhaps suggesting a disconnect between the commitment to NZC and practice.

Reflecting the reality of budget decision-making, trade-offs were discussed. Public service provision tended to be prioritised over convenience, with increased travel acceptable, should the provision be of a higher quality than that available locally. Affordability of transport was considered more important than environmental considerations. Housing and access trade-offs were more mixed, with no clarity on the preference of affordability versus convenience of location.

Appendix I provides the full output from this research which took the form of 4 deliberative workshops, with 73 participants and an online survey, completed by 1,004 people. The deliberative engagement methodology is seen to be an informative and powerful approach, particularly when developing a long-term



Part A:
Context & Key Drivers
(continued)

view, with multiple potential trade-offs. More work is needed to engage our communities in what infrastructure within Scotland should comprise and where acceptable trade-offs may lie.

7.2 Prioritisation and Appraisal

Within this framework of prioritising infrastructure investment to drive an inclusive net zero carbon economy, a clear framework for investment decision-making and implementation is essential. In their report for the Commission, the FAI noted the need to improve the quality of data being fed into appraisal, to support investment decision-making. In parallel, the need to understand trade-offs, to manage the potentially competing priorities identified within the NPF has been highlighted. Developing a clearer route-map is essential.

HM Treasury's Green Book^{xli} continues to be the main public sector tool to appraise investment proposals. This system has continued to develop over time, with the most recent iteration seeking to provide greater clarity on how to effectively encompass carbon outcomes. Scottish sectoral appraisal systems based on the Green Book, include the Scottish Transport Appraisal Guidance (STAG) and the NHS Scottish Capital Investment Manual (SCIM).

The policy direction of travel within the context of the NPF, balances a diverse group of priorities. How potential trade-offs and conflicts across these policy areas are managed and subsequently prioritised is unclear. In addition, the extent to which our existing appraisal models sufficiently capture the pressing priorities of NZC and IEG was challenged by stakeholders. Aventia and others, for example, noted that the "hard-coding" of assumptions such as the primacy of drive-time as the key measure of accessibility appear to undermine STAG's flexibility to policy shifts.

On balance, to move towards NZC and IEG outcomes, what is needed, is a set of appraisal tools that are focused on these outcomes, in balance with other existing appraisal factors. This will in turn require better and different data, together with a greater element of cross-sectoral decision-making.

"...a greater focus on the measurement of wider economic benefit produced by projects... will allow far better prioritisation of investment to take place and better transparency of decision making."

NHS Lothian

"Economic outcomes and value for money alone can no longer be taken as the primary measure for decision making by the public sector. There is an opportunity for the Commission to instil a broader approach to infrastructure investment decision-making that incorporates social and environmental values alongside economic and financial criteria."

Scottish Towns Partnership

Understanding trade-offs and prioritising investment are the realities of policy and budgetary challenges. The Institution of Civil Engineers most recent publication^{xliii} on improving infrastructure decision-making, noted the importance of a clear framework, as well as considering affordability and undertaking ruthless prioritisation to allocate limited funds to those projects that bring the greatest development benefits over the long term.

A strategic approach is supported by international evidence. Australia^{xliii}, the International Monetary Fund^{xliiv} and National Audit Office^{xliv} amongst others, suggest that establishing an improved strategic approach to infrastructure decision-making is essential. They recommend that enhancements should focus on key areas such as: lead roles for a neutral assessor rather than a project promoter; real and active engagement of future users, customers and /or tax payers; careful consideration of investment priorities; requirements to publish evidence and assumptions; and proper evaluation of the projects post-opening to allow the actual outcomes to feedback into future decisions.

International evidence also tells us that best practice investment decision-making requires a clearly established framework that operates across sectors and portfolios, to enable these principles to be met.

Key issues summarised in this section are incorporated into a number of recommendations at Part C, most specifically those relating to Leadership, Place, and The role of the public.

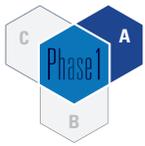
8 Summary

Scotland is a developed economy with a strong infrastructure base. As part of the UK, our economic infrastructure is ranked 11th out of 141 countries. However thinking of infrastructure in isolation does not help us to understand its role, current impact and wider benefits. Instead Scotland's policy direction of travel can be understood within the concept of an inclusive net zero carbon economy where infrastructure is one component of a wider and strongly interdependent system, equally concerned with social, economic and environmental outcomes to measure our success. This perhaps seems intuitive, however it does not immediately help decision-making, as very few of the appraisal techniques fully reflect these goals.

Our systems and structures have a number of areas that need attention to achieve an inclusive net zero carbon economy. Part of this, as highlighted by the FAI and others, is better evidence and data, within a more comprehensive and integrated decision-making system. Another part is immediate and clear action to address the role of infrastructure in carbon emissions. Taking all stakeholders on this journey is essential, whether it be those with specialist knowledge of infrastructure, or users and participants.

Part A has primarily sought to contextualise infrastructure and has only touched on the individual sectoral challenges where this illuminates an issue. This focused sectoral view is now picked up in Part B.



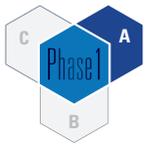


Part A:
Context & Key Drivers
(continued)

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Part A:
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(continued)

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