

A Low Carbon Economic Strategy for Scotland

Scotland – A Low Carbon Society

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Scottish Funding Council
Promoting further and higher education



SCOTTISH
DEVELOPMENT INTERNATIONAL



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The Scottish Government, Edinburgh, 2010

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A Low Carbon Economy

‘.. as the world moves shakily into the economic recovery phase, I see investment in the green economy as a key to that general world recovery... Current economic difficulties should be a spur and not a hindrance to that effort... I see the current economic difficulties as a spur to getting this green economic revolution right.’ (The Rt. Hon Alex Salmond MSP, First Minister addressing the Low Carbon Investment Conference 28 September.)

Contents

	Page
Ministerial Foreword	4
<u>Section 1 The Strategy</u>	
1.1 Towards a Low Carbon Economy	6
1.2 A Low Carbon Economic Strategy for Scotland	10
1.3 Strategic Objectives and Immediate Actions	20
<u>Section 2 – Sector Focus</u>	
2.1 Transformation across the whole Economy	30
2.2 Transforming the Energy Sector	43
2.3 Transforming the Built Environment	58
2.4 Decarbonising Transport	69
2.5 Scotland’s Resources	78
Low Carbon Economic Indicators for Scotland	89



Ministerial Foreword

On 22 March 2010, the Scottish Government published the discussion paper *Towards a Low Carbon Economy*, which outlined the Scottish Government's plans to move towards a low carbon economy in Scotland, as part of the overarching Government Economic Strategy. It identified the key dimensions of a transition strategy towards a low carbon economy, proposed an approach and timeframe and invited key stakeholders to engage in the development of the strategy. I am pleased that many partners took up that invitation and I am grateful for that input which has been invaluable in ensuring we set out on the right road to a low carbon future. The Strategy has been developed in partnership with the Joint Working Group of the Scottish Strategic Forum and SEPA and I will look to them to work with the Scottish Government to ensure the streamlined and coordinated delivery of public sector support, to aid the transition to a low carbon economy.

As I have stated previously, the transition of Scotland's industries and firms to low carbon processes, products and services is both an economic and environmental imperative, and offers the potential to stimulate and exploit rapidly expanding global markets. At the same time, over and above our world leading legislation in the field, Scotland must also adapt economically and socially to the uncertain, yet inevitable, consequences of climate change. Moving to a low carbon economy is essential to both capture the opportunities and mitigate the threats.

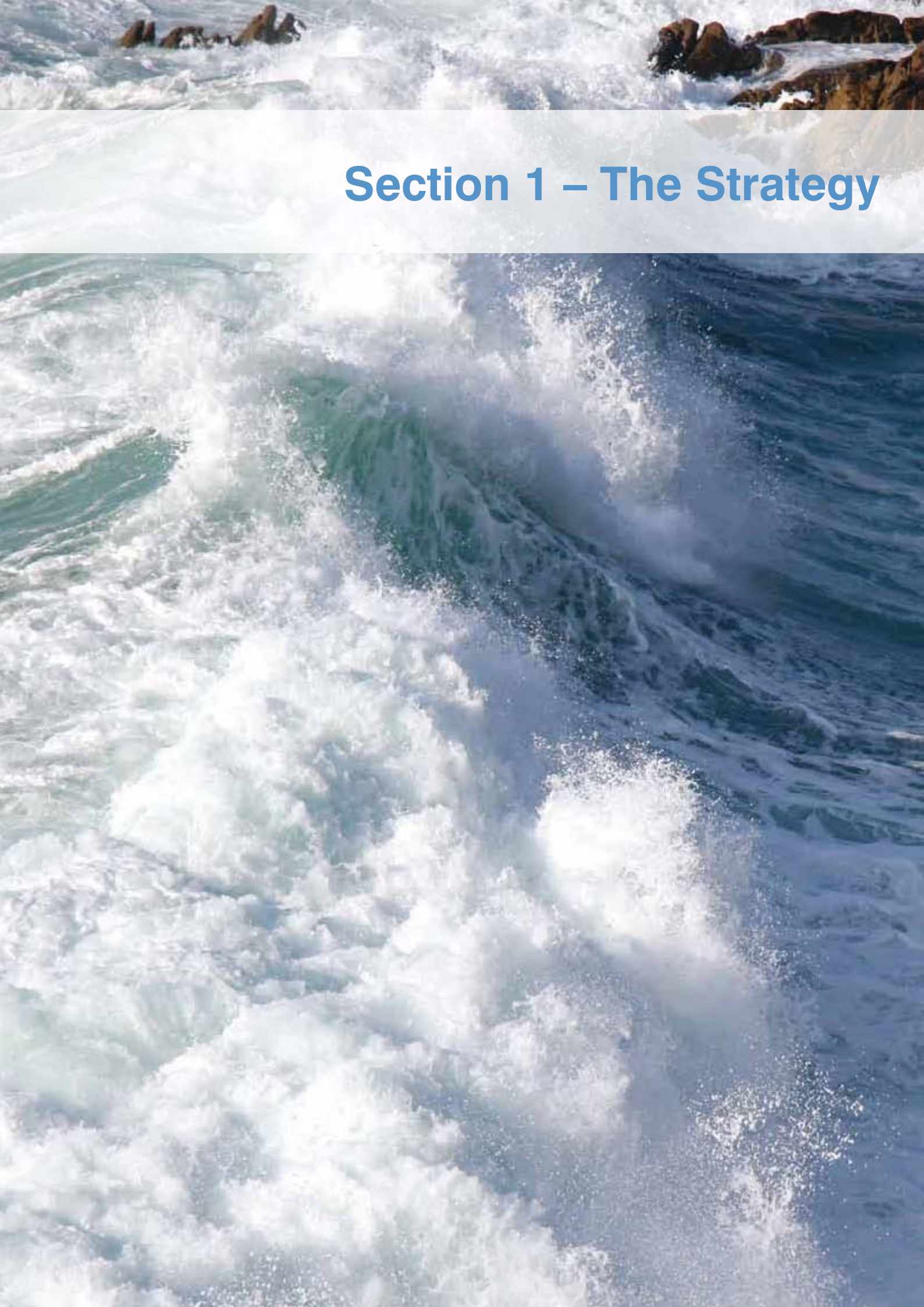
As Ian Marchant Chair of the 20:20 Climate Group said '*Low carbon is a way of thinking, behaving and operating that minimises carbon emissions while enabling sustainable use of resources, economic growth and quality of life improvements*'

We need to be sure that every opportunity is taken to place Scotland in the most advantageous position so that the benefits of the shift to low carbon are felt across the economy, at local and national level, in the private and public sector and in our communities. This is more important today than ever before as we face very challenging economic times in the coming years and I know this can only be achieved by building partnerships across all sectors.

This Low Carbon Economic Strategy builds on the responses from Scottish business, industry and research base, and in particular will provide a framework to complement the work of the 20:20 group. It provides a Scottish focus, alongside UK Government initiatives, on what action is required to transform Scotland's industries and infrastructure, into exemplars to the world of what can be achieved in the pursuit of a low carbon economy. I know that by working together we can make it happen.

A handwritten signature in black ink, appearing to read 'John Swinney', with a long horizontal stroke extending to the right.

John Swinney
MSP, Cabinet Secretary for Finance and Sustainable Growth



Section 1 – The Strategy

1.1 Towards a Low Carbon Economy

The Aspiration

The transition to a low carbon economy heralds an exciting but challenging economic and social transformation. By 2020, and certainly by 2050, Scotland will have a highly sustainable and prosperous economy where Scotland is a major player and beneficiary in the development of global low carbon markets.

The Scottish Government is committed to supporting the transition to a low carbon Scottish economy, necessary to meet our Climate Change Act¹ targets, to reduce emissions by 42% by 2020, and by 80% by 2050, and to seize business opportunities and a better quality of life. A low carbon economy will make us more resilient to unpredictable commodity and energy prices in an uncertain future world. People will have more sustainable travel choices and our children will be able to breathe clean air.

Within less than 10 years 80% of our electricity will be generated from renewables alongside a significant increase in recycling and reduction in waste to landfill. Our planning system will encourage active travel, our private transport will move away from dependency on oil, our homes will be insulated to a much higher standard and using low carbon heating systems. These changes will affect every individual and business, and internationally will help us to market Scotland as a low carbon destination of choice for tourists and business inward investment.

The move to our low carbon economy will be characterised on the one hand by high levels of resource efficiency and on the other, by the development of the low carbon goods, processes and services which can generate economic wealth and create jobs for Scotland. Everyone has a role to play in making the transition to a low carbon economy, from switching off a computer to the development of supply chains for the emerging offshore wind industry. While low carbon innovation and technology development are important, the application of technologies can only make a difference through changing the collective behaviour of business, individuals, communities and the public sector.

The Scottish Government has developed an ambitious set of targets to:

- decarbonise electricity generation by 2030, largely decarbonise heat sector by 2050;
- almost complete decarbonisation of road transport by 2050;
- significant decarbonisation of rail by 2050; and.
- establish a comprehensive approach to ensure that carbon is fully factored into strategic and local decisions about rural and urban land use.

¹ <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>

This will stimulate action, allowing us to track progress against low carbon economic aims to:

- increase the value of our low carbon goods and services sector to more than 10% of the Scottish economy by 2015 and continue to increase beyond and in doing so, create 60,000 green jobs;
- provide 80% of our electricity, 11% of our heat production and 10% of our transport use from renewable sources by 2020; and,
- reduce Scotland's final energy use by 12% through energy efficiency measures by 2020.

The Context

The Low Carbon Economic Strategy is an integral part of the Government's Economic Strategy² (GES) to secure sustainable economic growth, and is a key component of our broader approach to meeting Scotland's climate change targets and securing the transition to a low carbon economy in Scotland³, as illustrated below. It is closely linked to:

- the draft Climate Change Report on Proposals and Policies⁴, setting out actions to deliver emissions reductions to 2020 and beyond;
- the Public Engagement Strategy⁵, explaining our approach to engaging people about what they can do to help Scotland take action on climate change; and
- the Energy Efficiency Action Plan⁶, describing a programme of activity to improve energy efficiency in households, business and the public sector.

The Low Carbon Economic Strategy, (figure 1) seeks to establish strong policy direction around Scotland's key low carbon economic opportunities and strengthen business confidence in exploiting low carbon opportunities. In order to do this, it sets out:

- the global economic opportunities that will arise in making the transition to a low carbon economy;
- the drivers and barriers to the development of these opportunities and growth of the low carbon economy;
- the role of government, and wider public sector in supporting business to overcome the barriers.

² <http://www.scotland.gov.uk/Topics/Economy/Scotlands-Economy>

³ <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>

⁴ To be published shortly, www.scotland.gov.uk/rpp

⁵ To be published shortly, www.scotland.gov.uk/pes

⁶ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

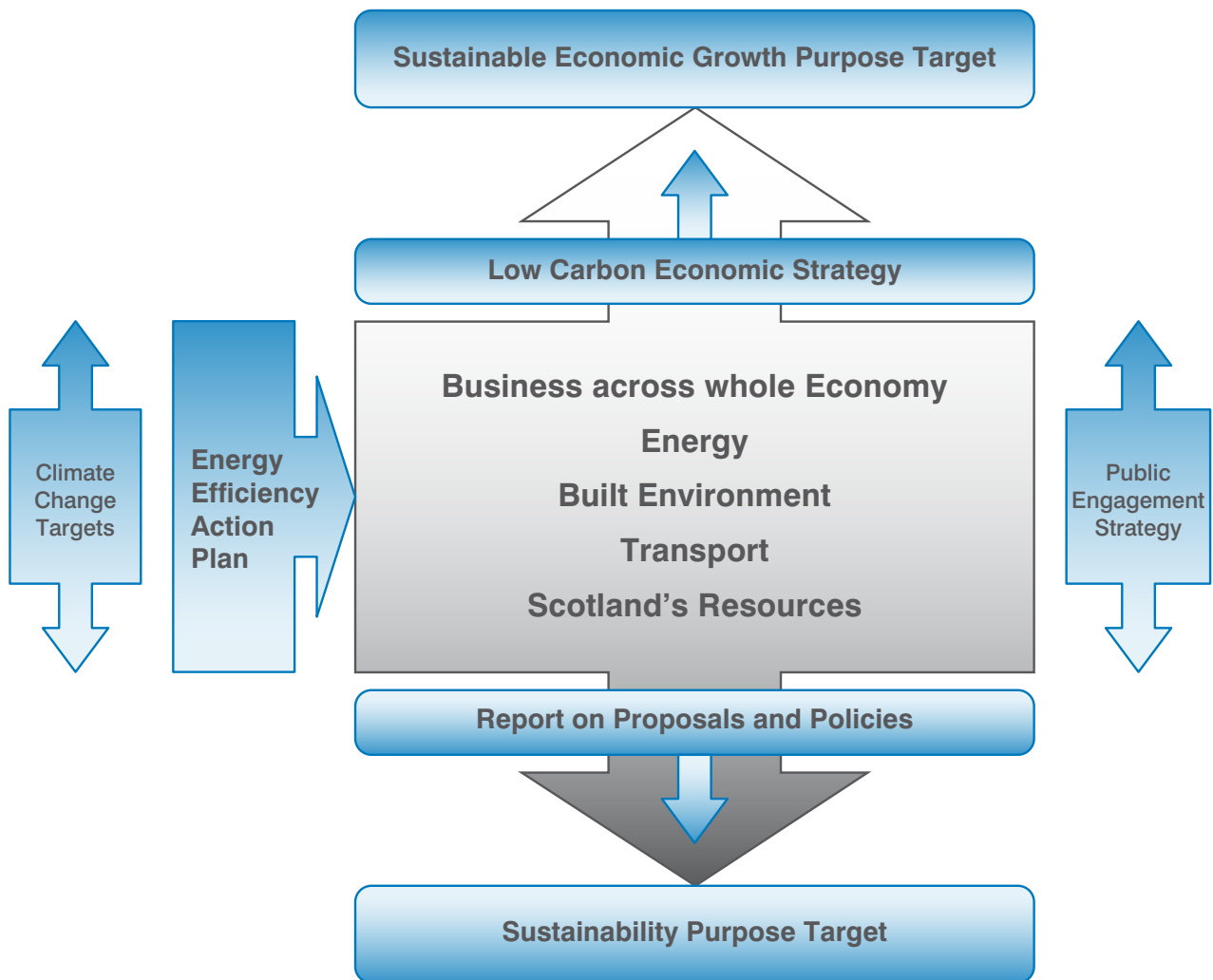


Figure 1: Low Carbon Economic Strategy

By exploiting commercial opportunities now, Scottish business and industry can maximise competitive advantage as the global economy moves to a low carbon basis. The focus of central and local government and wider public sector activity will be directed at areas where most added value can be achieved in meeting the strategic objectives set out in the Strategy. [The global economic transition is inevitable and is the growth story of the future.](#)

[Section 1](#) of this document presents the Low Carbon Economic Strategy for Scotland identifying aims and outlining strategic objectives and immediate actions that government and the wider public sector are undertaking to support business and support the transition to a low carbon economy. [Section 2](#) considers, in more detail, the specific challenges and opportunities for business and industry across the whole economy and the role of specific sectors.

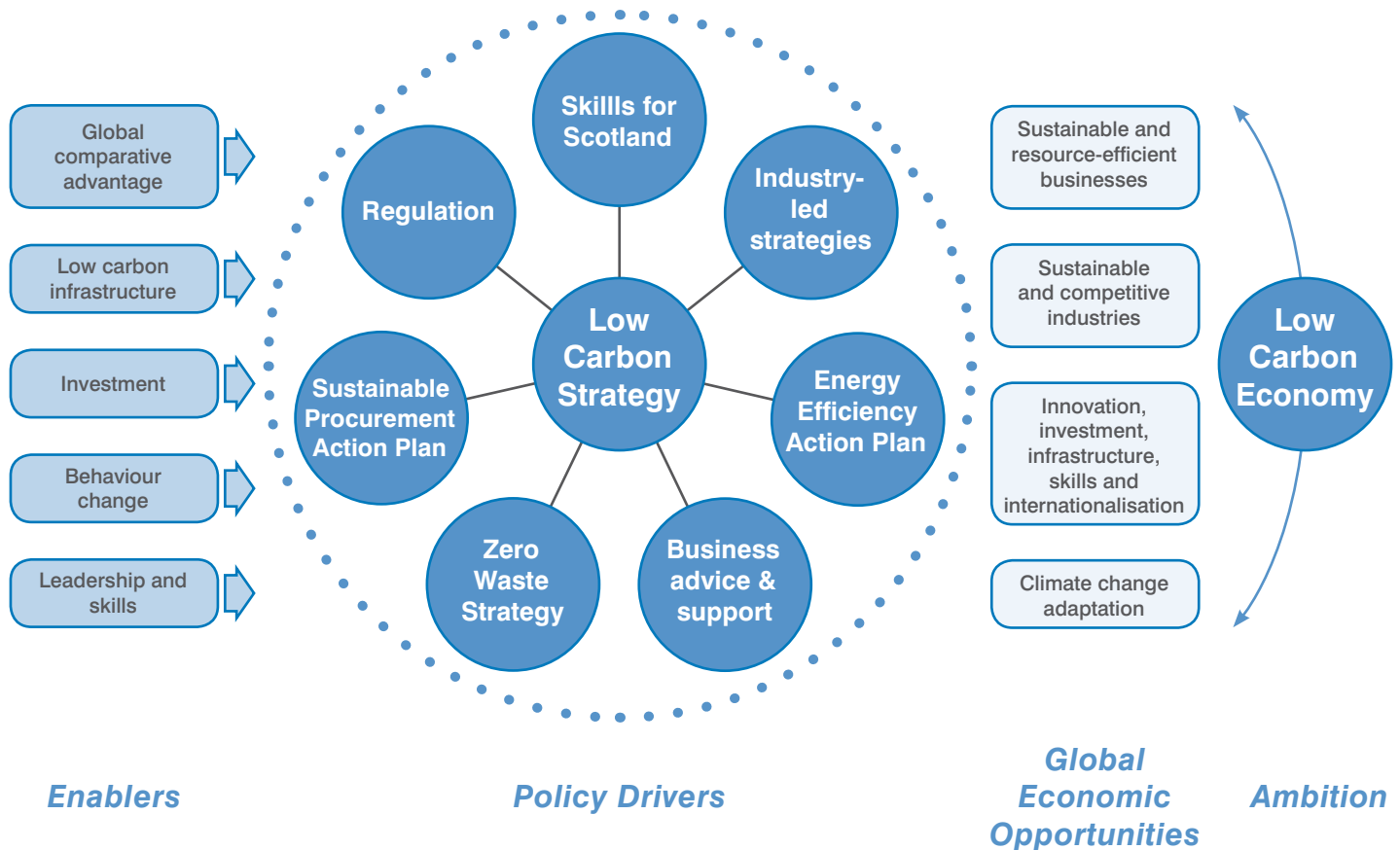


Figure 2: Success underpinned by: **Leadership – Ambition – Focus – Alignment**

Through the Strategic Forum and with SEPA, the Scottish Government will monitor progress against the aims and objectives of the strategy, and ensure the streamlined and co-ordinated delivery of the public sector support. It is anticipated that individual delivery partners will report on progress against actions in this document to support the transition to the Low Carbon Economy and future guidance letters will reflect these expectations.

Scotland's emissions have fallen by 21.2% from 1990, reaching the half way point in achieving our Climate Change Act target of reducing emissions by 42% by 2020. The Scottish Parliament passed an Order setting annual targets to 2022 on 7 October 2010, so as a Government, we can say, year-by-year, through very stretching annual targets, how we will drive emissions down to our overarching 2020 target of a 42% cut.

1.2 A Low Carbon Economic Strategy for Scotland

Scotland's Potential

Country	Market value, £bn	% Global Total
United States	629	20.6
China	411	13.5
Japan	191	6.3
India	191	6.3
Germany	128	4.2
United Kingdom	107	3.5
France	93	3.0

Figure 3: Market Value for Largest Green Economies⁷

With as much as a 25% of Europe's offshore wind and tidal potential, an estimated 10% of its capacity for wave power and its largest offshore CO₂ storage potential, Scotland has the natural resources to become the green energy powerhouse of Europe. We have a world class knowledge base in our academic and research institutions and the action of a highly skilled population. It is essential that Scotland retains this talent base whilst continuing to attract further talent from abroad. The Scottish Government is undertaking ground breaking initiatives focusing innovation to help maintain Scotland's position as a leader in low carbon technologies. Scotland is in a position to not only adapt to and mitigate the effects of climate change but also to optimise the economic opportunities that arise from those actions. In doing so, we will both secure a domestic economy underpinned by sustainable low carbon activity, and take the lead in the emerging global low carbon environmental goods and services market, positioning Scotland as the destination of choice for low carbon investment.

The potential scale of the economic opportunities for Scotland are vast:

- Scotland's low carbon market was worth around £8.5 billion in 2007-08 (within a GDP of around £100 billion), and is forecast to rise to around £12 billion by 2015-16;
- Scotland can secure a position as the international destination of choice for low carbon investment, and for the development of the financial architecture for a global low carbon economy;
- Jobs in the low carbon sector in Scotland could grow by 4% a year to 2020, rising from 70,000 to 130,000, over 5% of the Scottish workforce;
- Scotland is already an exporter of low carbon technologies, with £845m worth of low carbon technologies exported in 2009/10 mainly to China, Spain, Malaysia, India and Romania;

⁷ Innovas (2009) Low Carbon and Environmental Goods and Services: An industry analysis www.berr.gov.uk/files/file50523.pdf

- Scotland can be the green energy capital of Europe, and offshore wind alone could bring an estimated £30 billion of inward investment, and up to 20,000 jobs;
- Scotland now generates 22% of its final electricity demand from renewables and is comfortably on course to meet targets of 31% by 2011 and 80% by 2020;
- Sales of offshore electricity could value £14 billion by 2050, the equivalent of £2,700 for each person in Scotland;
- Household energy efficiency could save a cumulative £8.5bn by 2050, and provide thousands of jobs;
- Motorists could save £300m a year in reduced fuel costs by 'eco-driving';
- Farmers could save up to £464m by 2022 in business efficiencies.

According to the Stern Review the cost of doing nothing to address climate change is far greater than the cost of acting. The Review estimates that ***'if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1-2% of global GDP each year'***⁸, in other words we cannot afford not to take action. A more recent study by the ***Climate Change Committee identified that adapting businesses to climate change now may reduce the damage from future climate change by about 50%***⁹.

⁸ http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/sternreview_summary.htm

⁹ Adaptation Sub-Committee: How well prepared is the UK for climate change? (September 2010): <http://www.theccc.org.uk/reports/adaptation>

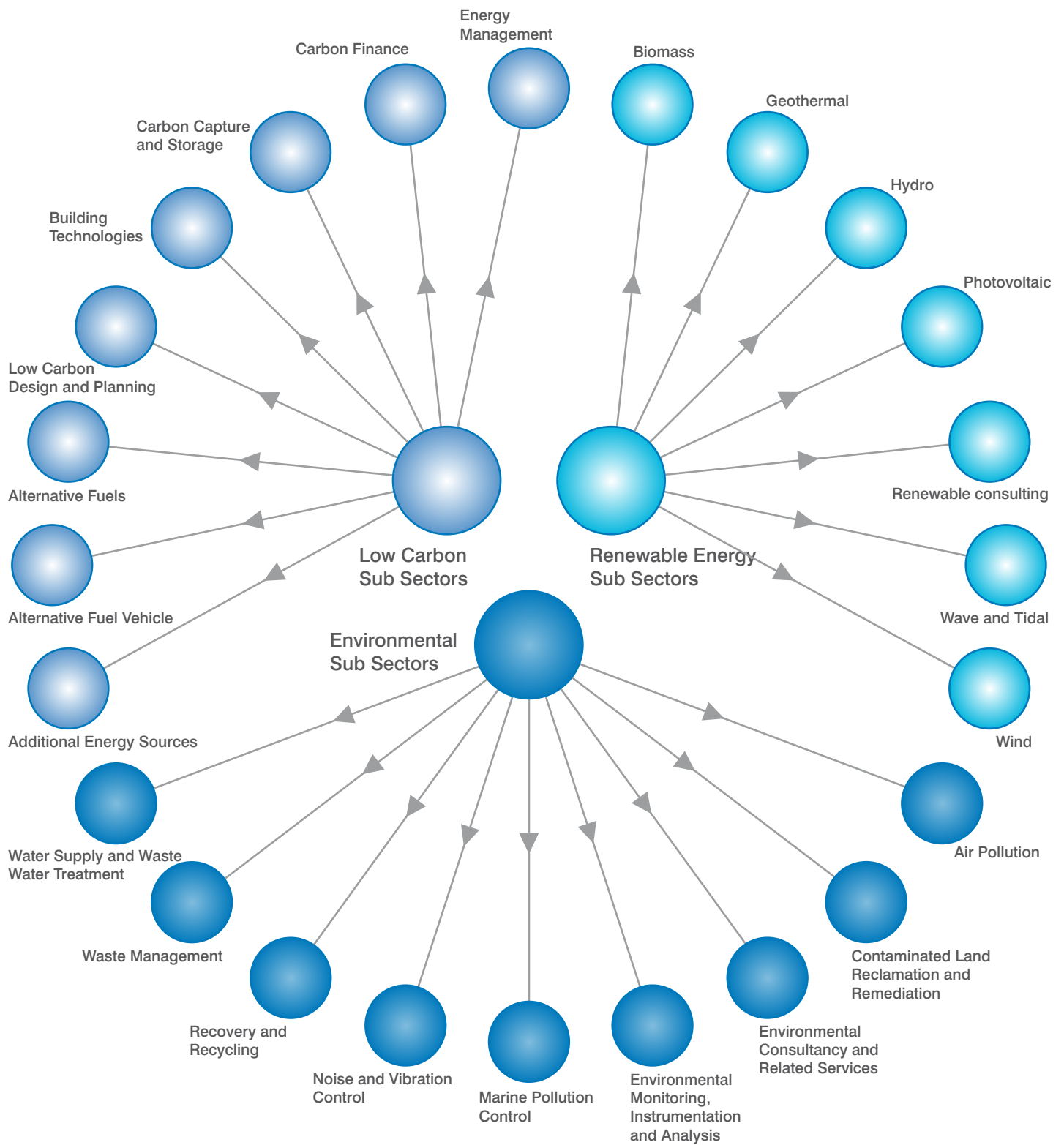


Figure 4: Low Carbon and Environmental Goods and Services (LCEGS) Sectors

What does this mean for Scotland – the Opportunities?

There are strong growth opportunities for Scotland across existing businesses and industries as well as in the emerging low carbon environmental goods and service sector (LCEGS). Low carbon employment in Scotland could increase by at least 60,000 by 2020, specifically:

- 26,000 jobs in **Renewable energy**, including wind, wave and tidal, biomass, geothermal, hydro and photovoltaic energy generation and the services that support them, including renewables consultancy;
- 26,000 jobs in **Low carbon technologies**, including alternative fuels for vehicles, carbon capture and storage, building technologies, energy management and carbon finance;
- 8,000 jobs in **Environmental management**, including energy, carbon and broader environmental consultancy, air pollution control, environmental monitoring, marine pollution control, waste management, recovery and recycling; as well as the service industries that support environmental management.

Globally, LCEGS markets, illustrated below, are forecast to increase in value from £3 trillion in 2008/09 to £4.3 trillion by 2014/15, making them three times the size of the aerospace sector and growing by 5.3% each year¹⁰. **Scotland has a GDP of around £100 billion with a LCEGS market of just around £8.8 billion which is predicted to grow to around £12 billion in 2015/16, 10% of the economy**¹¹.

‘We treat a new product, service or process as low-carbon if it leads to an absolute reduction in GHG emissions or improves the carbon intensity of an activity’. (The UK Climate Change Committee – in defining low Carbon).

In addition to opportunities in renewable energy around **50% of LCEGS sales are expected to occur in ‘emerging low carbon’ sub-sectors** including sustainable transport, sustainable buildings, energy management, carbon finance and carbon capture and storage. Furthermore **there are opportunities right across the whole economy**. The main ones likely to arise are:

- Resource efficiency – (energy, water, waste, materials) and sustainable business practices;
- Environmental and Clean Technologies – sustainable transport, building technologies, recovery and recycling, water and waste water treatment, environmental monitoring ;
- Food & Drink – waste management and re-use, local sourcing, reducing carbon in supply;
- Tourism – ‘green’ tourism products and services, promotion;
- Financial services – green financial products and carbon trading;
- Life sciences – sustainable health, telehealth and clean technologies;
- Chemical sciences – renewable fuels, bio-based feedstocks;
- Aerospace – lighter and more fuel-efficient materials/technologies;
- Textiles – functional textiles with higher tolerance/resistance to heat and water;
- Forest industries – wood fuel and biomass for renewable heat and power, locally-sourced timber for construction;
- ICT – data centres, energy management; and,
- Agriculture – grow wider range of crops, produce new plant/animal based products.

¹⁰ Innovas (2009) Low Carbon and Environmental Goods and Services: An industry analysis www.berr.gov.uk/files/file50523.pdf

¹¹ <http://www.theccc.org.uk/reports/low-carbon-innovation>

What are the Risks to the Economy of doing nothing?

Climate change brings with it high level risks that could impact across the Scottish economy including:

- Disruption to communications systems;
- Flooding leading to loss of, or damage to, premises, assets and stock;
- Disruption to energy sources, raw materials or other supplies;
- Inability to deliver services to customers as a result of extreme weather events and their aftermath, either through direct impacts or reduced transport links;
- Reduction or complete loss of water supply, either through drought or flooding of critical national infrastructure;
- Instability in the global financial markets as a result of climate change pressures;
- Increases in costs, or complete loss of supply, of principal imports as a result of climate change pressures elsewhere in the world.

Why is Action Necessary?

Global energy demand is expected to increase by more than 50% by 2030, with China and India alone accounting for 45 % of the increase. Global oil production may have already passed the point of maximum output ('peak oil'¹²) and entered a long period of slow decline. It is likely that oil prices will rise significantly in the next decade. There will be greater competition for a whole range of minerals and primary resources that are needed as part of developing and industrialised economies.

The transition to a low carbon economy must mitigate against these risks as set out in our Climate Change Adaptation Framework¹³. The transition must also include maintaining effective supply and affordability of energy and other key resources at the same time as migrating to low carbon fuels. The focus of central and local government, public and private sector, has to be on alignment of the regulatory framework setting clear ambition and focusing on interventions to incentivise low carbon investment and maximise competitive advantage. This will involve:

- leadership to drive the development of the low carbon economy;
- changing behaviours and adapting to climate change impacts;
- renewable electricity generation;
- developing clean and abated thermal base-load with carbon capture and storage;
- energy efficiency investments; electrification of transport infrastructure and greater use of sustainable bio-fuels;
- sustainable land use; sustainable cities/ neighbourhoods;
- extracting secondary resources from Scotland's waste stream to recycle into economic activity.

Climate change adaptation will come at a cost. But there is a bigger cost of not adapting. Ensuring that Scotland understands the risks and opportunities presented by a changing climate and is adapting sustainably will require the efficient and targeted use of existing and new sources of funding.

¹² <http://peakoiltaskforce.net/>

¹³ <http://www.scotland.gov.uk/Publications/2009/12/08130513/0>

What is Government doing to Support the Transition to a Low Carbon Economy?

Scotland, the UK, EU and countries around the world are taking serious action on low carbon because they see the economic opportunities outlined above. The UK has an ambition to reduce emissions by 80% by 2050, and as part of the EU also has a commitment to reduce emissions by 34% by 2020. Scotland is going beyond the UK in the most challenging climate change targets in Europe, to reduce emissions by [42% from 1990 levels by 2020](#), and 80% by 2050.

These targets are enshrined in *the Climate Change (Scotland) Act*¹⁴, forming the sustainability target within the GES and driving the overarching purpose of growing a sustainable economy.

Roles in Maximising the Opportunities

Over the next 10 to 20 years we will witness both the wholesale decarbonisation of existing businesses, supply chains and industries as well as the emergence of new sectors and sustainable business models. By exploiting these commercial opportunities now, Scottish business and industry can [maximise competitive advantage](#) as the global economy moves to a low carbon basis.

The [role of the private sector is to provide business and industry with the entrepreneurial mindset](#) and foresight to invest in exploiting low carbon opportunities. Business is already leading the way in embracing a low carbon economy, for instance through the work of the 20:20 Climate Group¹⁵. The private sector can not, however, deliver this transition alone. [Central and local government leadership and the activities of the](#)

[wider public sector and our academic institutions will act as a key enabler](#) of the low carbon transition, tackling market barriers, ensuring an appropriate legislative framework is in place and key policies for investment, infrastructure, international engagement, innovation, leadership, skills and education are aligned with the low carbon ambition.

Government and the wider public sector play a crucial role in:

- setting the long-term strategic direction;
- legal and regulatory framework;
- helping to reduce business risk and uncertainty;
- encouraging long-term investment;
- leading by example, seeking, where possible, to reduce the carbon impact of activities, and using low carbon technologies;
- helping to provide 'first mover advantage' to Scottish business and research and innovation communities in accessing new and expanding international markets in addition to commercial and reputational benefits.

The Scottish Government has also made a commitment to assess the carbon impact of its spending review from 2010/2011. As the country recovers from a harsh economic period and looks to the future, this sends a strong signal to business and industry, and consolidates the direction of travel to a Low Carbon Economy.

Legislation

The Climate Change (Scotland) Act 2009 has set the [legislative framework](#) to establish a favourable environment to support long-term investments to develop a low carbon economy and this will be underpinned with measures that will give businesses and consumers strong incentives and the confidence to invest in the technologies skills and behaviours that a transition to a low carbon economy requires. Under the Act, Scotland is

¹⁴ <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>

¹⁵ <http://2020climategroup.org.uk/>

obliged to develop a [Climate Change Adaptation Framework](#)¹⁶ which will both develop adaptive actions to the impacts of climate change and support the actions of the low carbon economy, in response to the UK Climate Change Risk Assessment (UKCCRA)¹⁷ which reports in early 2011.

Scottish Government has a significant role to play to influence those fiscal, legal and regulatory decisions taken at UK level and the regulatory regime imposed by the EU which impact significantly on Scotland. Building on the most challenging climate change targets, the Scottish Government is playing a pivotal role in evidencing and complementing the action of the UK Government as a leading proponent advocating the move from a 20% to a 30% reduction target in the EU.

Investment

The scale of funding required for developing low carbon technologies and investing in new infrastructure represents a significant challenge. Engaging directly with key financial institutions and regulators, the Scottish Government can influence the development of a new financial architecture to fund low carbon [investment](#) to ensure that new infrastructure, and the components that use it, are not prevented from developing. The Scottish Government has long argued the case to have the accumulated Fossil Fuel Levy surplus (standing at £191m in October 2010) to be released immediately to provide an urgent and much needed boost to key renewables industry developments in Scotland, and will continue to pursue this with the UK Government.

In addition the [Scottish Government is supporting specific activity](#) to develop innovative finance products, attract international financiers and position Scotland as a destination for low carbon investment, such as the Low Carbon Investment Project; a unique forum for Government, international finance, utilities and developers of low carbon projects to engage directly on investment opportunities, culminating this year in an international conference focused on energy generation and particularly renewable energy. Such was the success that a commitment has been made to [hold the conference annually, with next year's focus on finance for investment improving energy consumption and resource efficiency](#)¹⁸.

Central and local Government and the wider public sector are taking a proactive role in incentivising the development of and reducing uncertainty about new low carbon products, and in proving the reliability of new technology, thus [underpinning confidence in markets](#). Encouraging the uptake of the [Sustainable Procurement Action Plan](#) across the public sector will be key tool in this process.

Infrastructure

A critical role of the Scottish Government is to ensure that the necessary [infrastructure](#) is in place in Scotland to secure the transition to a low carbon economy and to support Scottish business and overseas investors to benefit fully from that transition in a way which is appropriate for the future climate.

Through the [National Planning Framework 2](#), the Government has set out a clear vision for developments of national significance necessary in energy, transport, built environment and land use sectors, to realise our ambition while

¹⁶ <http://www.scotland.gov.uk/Publications/2009/12/08130513/0>

¹⁷ UK Climate Change Act 2008, <http://www.legislation.gov.uk/ukpga/2008/27/contents>

¹⁸ <http://www.slcconference.com/>

protecting our environment¹⁹. This is implemented through the local planning system in the form of [Strategic Development Plans](#).

In relation to the sea, the Scottish Government is developing a National Marine Plan for Scotland which will provide the framework for marine development in Scottish waters, taking into account the needs of various marine users. This will include measures to deliver climate change objectives, such as possible locations for potential energy-related development.

The Scottish Government is making significant progress in delivering onshore and offshore reinforcements to Scotland's grid network – addressing barriers and pushing for change in energy regulation. For example, Ofgem is now listening to Scotland's calls for changes to the locational charging approach. At present this approach results in renewable generators, in the geographical areas of best renewable energy resource, paying the highest charges for use of the GB grid system.

International Engagement

Through [international engagement](#), the Scottish Government and Scottish Development International (SDI) can enhance Scotland's reputation and attract further direct foreign inward investment, by developing compelling tailored propositions which build on the natural assets, infrastructure, skills, research strengths and historic oil & gas capabilities of Scotland and ensure these propositions are targeted to where Scotland has the best opportunities to win the investment.

[Significant export opportunities exist for all sectors of the low carbon economy](#) and Government and SDI help businesses to take full advantage of

these by providing a range of support including: developing international strategies, providing detailed market intelligence, organising overseas missions and exhibitions, and providing an on the ground presence in the main overseas markets. The [Scottish European Green Energy Centre](#)²⁰ and [Scotland Europa](#)²¹ play a key role in fostering demonstration and deployment of energy technologies through collaboration between Scotland and other parts of the EU.

Innovation

Successful [research and innovation](#) will drive the transition towards the low carbon economy. If Scottish companies are to secure sustainable growth in existing markets and a significant share of new global markets in the Low Carbon and Environmental Goods and Services sector, then they need to be at the [forefront of innovative technologies, and their research, development, demonstration and deployment](#) (RDD&D). This will require not only maintaining existing collaborations but developing new ones with universities and leading researchers. It will also require the wider adoption of new behaviours and leadership styles across the economy in both the public and private sectors.

Leadership, Skills and Behaviours

There is a continuing role for central, local government and the public sector to lead by example through leadership and innovative behaviour change, for instance the [Public Sector Climate Action Group](#)²² and councils through the [Scottish Climate Change Declaration](#)²³. Government will build on this, working jointly across all sectors to establish a wider dialogue, resulting in an effective ongoing public engagement strategy²⁴

¹⁹ <http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/nfp2apsum>

²⁰ <http://www.segec.org.uk/>

²¹ <http://www.scotlandeuropa.com/about-us.aspx>

²² <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/Workingothers/pscag>

²³ <http://climatechange.sustainable-scotland.net/>

²⁴ To be published shortly www.scotland.gov.uk/rpp

Business and industry leaders will need new skills and training to support the sustainable development and growth of their business, reducing resource use and implementing energy efficiency measures, adopting innovative technologies, embracing new sustainable practices and processes, and identifying new market opportunities. This [starts with positioning sustainable business opportunities and practices as a key leadership issue](#), ensuring that business leaders are suitably equipped with the knowledge and capabilities to effect strategic, long-term business change. Innovative behaviours will require new ways of thinking, flexibility, adaptability and creativity to make decarbonisation everybody's business. Our colleges and universities have a key role in providing people with the leadership, behaviours and attitudes that are required in moving to a low carbon economy.

[Scotland has a highly qualified population](#) with expertise and skills in a range of industries and areas. We need to build on these established skills and make effective use of the existing work force. It is likely that many of the skills needs of the emerging economy will be addressed by using short flexible training modules that add to the experience and qualifications individuals already possess. This will allow workers to [enhance their existing profile with new sets of low carbon skills](#) whilst continuing in their existing jobs, for example the range of skilled individuals with experience in the north sea oil and gas sector can and will be able to turn their experience to good use in low carbon energy sectors, such as offshore renewables.

Education

Education has a major role to play in influencing attitudes and behaviour as well as developing the skills, knowledge and understanding to help Scotland make the most of the opportunities provided by a low carbon economy.

[Curriculum for Excellence²⁵](#) is now shaping practice across education, supporting the inspiring, relevant and deeper learning needed to prepare our children and young people for the challenges of life in the 21st century and raise standards for all. [Sustainable development and enterprise education are embedded across the curriculum](#), with particularly strong links to Sciences, Technologies and Social Studies, and resources have been provided to support learning and teaching. Partnership working is key, and the Determined to Succeed strategy has been instrumental in enabling employers to input more directly to the curriculum

The Scottish Government and local authorities are working, as part of Learning for Change: Scotland's Action Plan for the Second Half of the UN Decade of Education for Sustainable Development, with Skills Development Scotland, Scottish Renewables and others to create interest in low carbon industries and support young people to develop skills for jobs in renewables and sustainability.

Looking forward

The transition to low carbon economy is the biggest opportunity Scotland has had for decades. Scotland has the natural resources, legislative framework, the policies, the knowledge base, the skills and the people. [Scotland has the ambition](#).

²⁵ <http://www.scotland.gov.uk/Publications/2010/01/14141415/0>

The Scottish Government will play its full role in investment partnerships to ensure necessary infrastructure and frameworks are in place to identify the opportunities and attract international investment. However the challenge is beyond what government can achieve alone, the bulk of the investment required will inevitably come from the private sector.

Nothing less than a full commitment by all players across both the public and private sector will be necessary to ensure that the maximum benefits of a transition to a low carbon economy are realised. In doing so we can position Scotland as the destination of choice for low carbon investment and ensure that Scottish business and industry takes the lead in growing global low carbon markets.

Strategic objectives and immediate actions for government and the wider public sector to are summarised below. The following sections look more closely at the market opportunities in specific parts of the Scottish economy and specify what actions government and wider public sector are taking to support business to take advantage of the opportunities available and drive the development of a low carbon economy for Scotland.

1.3 Strategic Objectives and Immediate Actions.

The focus of central and local government and wider public sector activity will be directed at areas where most added value can be achieved. This is outlined in the strategic objectives and immediate actions for government and the wider public sector summarised below.

Transformation across the whole Economy

Opportunities exist for every business and industry to adapt to and exploit low carbon markets, and these should be reflected in business plans and industry-led strategies, focussing on two areas: saving money through efficiencies; and making money through new market opportunities.

Objective 1: Sustainable and resource-efficient businesses. *Helping all businesses in Scotland become more competitive by using resources more efficiently, proactively adapting to climate change impacts and generally adopting sustainable business practices.*

Immediate Actions:

- through the Strategic Forum and working with SEPA, the Scottish Government will ensure the [streamlined and coordinated delivery of public sector support](#), to aid the transition to a low carbon economy;
- Government, Enterprise Agencies and other agencies will take a [joined up, collaborative approach](#) with industry and business groups to maximise leverage on resource and will work with Industry Advisory Groups to help integrate sustainable, low carbon development into business plans, industry-led strategies and delivery plans;
- the Scottish Government's [Energy Efficiency Action Plan](#)²⁶ sets out a programme of

activity on energy efficiency including actively promoting the provision of energy efficiency advice to businesses in Scotland, through the establishment of a [single Energy and Resource Efficiency Service](#) similar to the [Scotland's Environmental and Rural Services](#)²⁷ (SEARS) model. This will streamline the support provided by the Energy Savings Trust, Carbon Trust, Enterprise Networks, Business Gateway and others;

- the Scottish Government and local authorities will work with company supply chains to support the planning, design and construction of long-life infrastructure and the retrofit of existing infrastructure;
- the Scottish Government, working jointly across the public sector will implement the [Scottish Sustainable Procurement Action Plan](#)²⁸ and promote its uptake by the wider public sector, generating business opportunities, recognising better low carbon solutions;
- the Scottish Climate Change Impacts Partnership (SCCIP)²⁹ will work with the enterprise, and other agencies, Business and Industry Advisory Groups to provide [tailored, sector-specific advice and intelligence](#) on key risks and market opportunities resulting from climate change; and
- the Enterprise Networks and Zero Waste Scotland will [promote the business benefits of sustainable business practices](#) including product lifecycle analysis, business model innovation and increasing the use of ICT to reduce travel.

²⁶ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

²⁷ <http://www.sears.scotland.gov.uk/>

²⁸ <http://www.scotland.gov.uk/Publications/2009/10/sspap>

²⁹ <http://www.sccip.org.uk/1/1/0/Home.aspx>

Objective 2: Sustainable and competitive industries. *Supporting Scotland's industries to exploit low carbon business opportunities to accelerate industry growth, build low carbon supply chains, diversify into new markets and technologies and promote long-term ambition and resilience.*

Immediate Actions:

- the Scottish Government and Enterprise Networks will work with the investment community to [stimulate greater investment](#) in low carbon opportunities and infrastructure;
- the Scottish Government, Local Authorities, Skills Development Scotland (SDS), the Scottish Funding Council (SFC) and the Enterprise Networks will ensure that the support they offer in relation to the Curriculum for Excellence, skills and learning and leadership development actively promote the issues and opportunities relating to the low carbon transition;
- the Enterprise Networks and Scottish Development International (SDI) will develop and disseminate further [market intelligence](#) on the scale and nature of global opportunities, and benchmark global best practice;
- SDI will promote Scotland's [low carbon 'brand' strengths](#) and investment propositions overseas, and support the development and [internationalisation of Scottish low carbon companies](#) and R+D expertise and, supported by the Scottish Funding Council, SDI will work with companies to [develop international market strategies](#) which include the marketing of low carbon credentials where appropriate. The [Low Carbon Skills Fund](#), aims to enable employers to upskill and reskill their employees and capitalise on the business and economic opportunities presented by developments in the renewables and low carbon fields. This new approach to the funding of employer training is to enable employers to access short, bite sized, flexible learning that will meet specific business needs;
- The Scottish Government will work with the SFC to ensure that our [investment in colleges and universities](#) fully integrate the needs of the low carbon economy into future spending priorities and we will also work with SDS to ensure that the skills demands for a low carbon economy are taken into account in the provision of National Training Programmes and flexible training opportunities. Future guidance letters to partners will reflect these expectations;
- The Scottish Government will work with SDS, the SFC, Sector Skills Councils, learning providers and employers to [analyse future skills demands, develop and refresh relevant qualifications, courses and vocational frameworks](#) that will ensure the supply of skills from Colleges, Universities and other providers meets current and anticipated future demands;
- The Scottish Government and SDS will [establish a group to develop and implement a skills framework](#) that will outline specific energy efficiency training interventions required and how these will be delivered. Specifically on renewables, the Renewables Action Plan Skills Framework, commits the Scottish Government to work with partners in education and industry to better understand future skills requirements and ensure adequate training provision to meet sector needs; and
- The work of the Scottish Energy Advisory Board highlights significant employment growth and skills requirements within the wider energy and low carbon economy. The Energy Advisory Board is working with partners to address the challenges of making sure we have the right skills, in the right place, at the right time.

The overall objective of low carbon innovation must be to maximise the long-term benefit to Scotland by securing our competitive advantage in the technologies where we can be global leaders, as well as leading to an absolute reduction in greenhouse gas emissions. It is about identifying the right innovative low carbon technologies, and ensuring that public sector support is aligned to realise the potential.

Objective 3: Supporting the right innovative low carbon technologies. *Ensuring Scotland capitalises on its natural advantages, natural environment and the expertise of our leading researchers, future support for low carbon innovation should be focused on areas where Scotland can secure maximum competitive advantage.*

Immediate Actions:

- the SFC will support Universities who to [respond to challenges of the energy technologies](#) identified by Scottish Government in this Strategy. The Energy Technology Partnership, MASTS and other research pools, working with innovative industry and the Enterprise Agencies, will be well placed to attract support for the translation of research excellence into economic advantage for a low carbon Scotland;
- the Scottish Government will work with the Energy Technology Partnership, the SFC, Enterprise Agencies, the Scottish European Green Energy Centre and European Structural Funds to [establish new technology hubs/alliances](#) to act as focal points for low carbon innovation in the Energy sector. These will Link to EU and UK funding programmes and attract overseas R&D investment;
- [the proposed Scottish Energy Lab](#) will also act as a demonstration hub, providing the test facilities for each of these key technologies to develop international collaborations;

- The Environmental Clean Technologies(ECT) Strategic Partnership (Enterprise Networks, SEPA, Scottish Funding Council supported by the Scottish Government) will deliver [coordinated support for businesses and academia](#) within the emerging Environmental and Clean Technologies sector. This will focus on the priority actions recently identified within the ECT strategy including industrial cohesion and awareness raising.

Objective 4: Funding technological innovation. *Developing the key technologies for demonstration by refocusing and reprioritising innovation support going forward. Given the difficult funding context for the public sector over the next decade, Scotland must maximise competitive advantage by focusing support on those technologies where there is greatest chance of success.*

Immediate Actions:

- the enterprise agencies and wider public sector should ensure, through [continuous development of funding metrics and assessment methodologies](#), that the appraisal of all projects receiving business or innovation support are considered specifically for climate change impact and low carbon economic benefit as part of the wider criteria for the assessment for funds, in order to facilitate the development of the low carbon economy and to ensure that support is available across the whole economy;
- to give initial support to this activity, and to the development of the technology hubs set out above, [the Scottish Government will reprioritise the £15m of innovation funding available in the Lowlands & Uplands European Structural Funds Programme towards the low carbon economy](#). This match-funding could create a potential £60m of support with contributions from the private sector and other public sector funders and is a significant commitment at a time of fiscal constraint; and

- the Scottish Government will work with UK and EU funding bodies such as the Technology Strategy Board, programmes and industry to bring world-leading university research in low carbon technologies to demonstration and deployment.

Transforming the Energy Sector

Transforming the energy sector in Scotland will play a pivotal role in the development of a low carbon economy, providing a unique combination of benefits, including reduced greenhouse gas emissions, energy efficiency, enhanced energy security, less volatility in the energy sector, and increased share in key global markets. Through timely and unprecedented levels of investment in the electricity, heat and energy efficiency sectors, the step change in activity will open up enormous opportunities for businesses across Scotland.

Objective 5: Securing funding and de-risking investment. *Attracting long-term finance and secure investment in the Scottish energy sector through understanding the issues, opportunities and global dynamics of finance, as well as the importance of creating an attractive landscape with adequate funding and support.*

Immediate Actions:

- the Scottish Government will continue to support the [Scottish Low Carbon Investment Project and annual Conference](#), a unique forum for Government, international finance, utilities and developers of low carbon projects to engage directly on investment opportunities and continue to develop a shop window of investible opportunity in Scotland through the project portal, identifying opportunities for collaboration and aggregation;
- the main actions from this years international conference included:
 - A commitment to hold a conference next year focusing on finance for investment in energy consumption and resource efficiency.
- Development of a 'Thought Leadership' circle and engagement around the immediate agenda e.g. CCS, Energy Efficiency, Offshore Wind Route Map and Supply Chain, infrastructure etc.
- Continued analysis of funding challenges and identification of solutions including public/private partnering for marine renewables infrastructure, quantification and analysis of elemental construction risk for offshore wind, debt solutions for marine technology commercialisation.
- Establishment of [CCS-Cluster Investment Plan](#) study, identifying how Scotland can provide Europe with a large scale carbon storage opportunity, starting by looking at how carbon capture from Scottish emitters can be transported and stored in the North Sea;
- the [Saltire Prize](#) which promotes transformational technologies that help unlock the marine renewable energy potential in Scotland and is helping to achieve Scotland's future renewable energy ambitions; and
- the Scottish Government announced on 6 July 2010 grants of £13m, awarded to five marine energy projects from the [WATERS fund](#) (Wave and Tidal Energy: Research, Development and Demonstration Support). This fund will help develop wave and tidal energy technologies, driving down costs and moving them closer to commercial operation.

Objective 6: Develop world leading policy frameworks and create a comprehensive infrastructure. *Ensuring delivery of the clean, affordable and secure electricity supply required to meet climate change targets and create a competitive position across low carbon energy sectors whilst delivering economic benefits for Scotland.*

Immediate Actions:

The Scottish Government will support a co-ordinated approach through:

- The [Scottish Energy Advisory Board \(EAB\)](#), a high-level, open and informed engagement between Ministers, the energy industry and other relevant bodies;
- [FREDS](#) will continue to build a partnership between industry, academia and Government which draws on their expertise and networks in order to most effectively develop Scotland's renewable energy industry;
- As a sub-group of the EAB, the role of the [Offshore Energy Programme Board](#) is to strategically drive and co-ordinate the public sector's collective contribution to the growing offshore energy opportunities, seeking maximum benefit for Scotland;
- A number of specific action plans are being taken forward across the energy sector:
 - Renewables Action Plan³⁰
 - Renewable Heat Action Plan³¹
 - Marine Energy Road Map³²
 - Offshore Wind Route Map³³
 - National Renewables Infrastructure Plan³⁴
 - Carbon Capture and Storage (CCS) Roadmap³⁵
 - Conserve and Save, the Scottish Government's Energy Efficiency Action Plan³⁶;

- [Marine Scotland](#) will introduce a one stop shop approach to licensing for marine renewables and integrated marine planning, underpinned by sound science; and
- SEPA will produce [an energy position paper](#), in recognition of the increasing importance of the energy sector to the Scottish economy.

Transforming the Built Environment

The built environment offers one of the most tangible expressions of low carbon opportunities and challenges to business, investors and householders. It offers two broad areas of opportunities for the construction industry and wider supply chains, reducing the current energy and carbon emissions associated with new and existing buildings and secondly, exploiting low carbon design of buildings and neighborhoods, as well as innovation in sustainable building technologies in both domestic and global markets.

Objective 7: Moving towards a low carbon built environment. Reducing carbon emission, through all phases of the building process, from design to construction, through operation and maintenance, within the new and existing building stock.

Immediate Actions:

- the Scottish Government is working jointly across the whole Scottish public sector to demand a [higher level of performance through procurement](#) by implementing the [Scottish Sustainable Procurement Action Plan](#)³⁷ and the [Scottish Government's Construction Works Procurement Guidance](#)³⁸;
- the Scottish Government will continue to [encourage local planning authorities to prepare heat maps](#) to inform strategic development plans and policies for renewable heat through local development plans; and

³⁰ <http://www.scotland.gov.uk/Publications/2009/07/06095830/0>

³¹ <http://www.scotland.gov.uk/Publications/2009/11/04154534/0>

³² <http://www.scotland.gov.uk/Publications/2009/08/14094700/0>

³³ <http://www.scotland.gov.uk/Resource/Doc/325568/0105002.pdf> – 28 Sep 2010 - 1756k

³⁴ <http://www.scottish-enterprise.com/your-sector/energy/energy-background/energy-reports/energy-renewable-energy-reports.aspx>

³⁵ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Thermal-Guidance/CCS-roadmap>

³⁶ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

³⁷ <http://www.scotland.gov.uk/Publications/2009/10/sspap>

³⁸ <http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building/procurement-manual>

- the [Scottish Government Energy Efficiency Action Plan](#)³⁹ sets out a number of actions on improving energy efficiency across the built environment including:
 - Within available resources, [continuing to provide ongoing support and financial assistance for energy efficiency in existing housing](#), leveraging investment from energy companies and private householders wherever appropriate;
 - [investigating options for financing mechanisms](#) for major energy efficiency measures in private sector housing;
 - proactively [developing district heating as a discrete policy area](#) within energy efficiency, including supporting a number of local heat mapping and feasibility projects over 2010/11;
 - [actively promote microgeneration](#), most notably by; seeking to maximise Feed in Tariff and proposed Renewable Heat Incentive investment in Scotland; and supporting the development of a Scottish Microgeneration Certification Scheme (MCS) certification body and exploring other barriers that hinder widespread participation in MCS;
- The Scottish Government are working with UK Government and the energy companies to ensure that a proportionate share of their supplier obligation is targeted in Scotland, for instance in relation to:
 - The [UK Carbon Emissions Reduction Target](#) (CERT), providing home energy efficiency improvements. This is expected to be worth over £300 million for the period 2008/11.
 - ‘[Better Billing ‘Smart’ meters](#)’ are to be installed in every home by 2020 encouraging better household energy management.
- The Scottish Government will work with the UK government to ensure that the ‘[UK Green Deal](#)’ financing initiative to maximise opportunities for Scottish businesses. The initiative is being developed for 2012 and will support fabric improvements in both domestic and non domestic buildings that will be paid for through savings in energy use.

Objective 8: Exploiting and integrating low carbon building technologies into the design and construction process. *Helping to develop, commercialise, test, demonstrate and market innovative new building technologies and materials and integrate these into the design process alongside passive technologies.*

Immediate Actions:

- the Scottish Government is currently [exploring opportunities with the European Investment Bank for a potential retrofit programme for Registered Social Landlords \(RSL\)](#). It is anticipated that this will provide loan funding for RSLs to install microgeneration and renewable technologies to improve the energy efficiency of their stock;
- the Scottish Government will [support the development and uptake of innovative energy efficient solutions and new building technologies and solutions](#) through:
 - supporting European funded projects for energy efficiency measure, in particular district heating projects, which will improve efficiency and cut emissions as well as delivering financial benefits to the occupiers of the homes and businesses;
 - investing £13.5 million per year for community renewables and microgeneration;

³⁹ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

- **Environmental Clean Technologies Partnership**⁴⁰ (Scottish Enterprise, Highlands and Islands Enterprise, SEPA and the Scottish Funding Council) will deliver coordinated support for businesses and academia within the emerging Environmental and Clean Technologies sector; including the priority actions recently identified within the ECT strategy including for sustainable building technologies.

Objective 9: Promoting low carbon building design at all scales from neighbourhood upwards, To encourage development of walkable, well-connected places.

Immediate Actions:

- Building on the **Scottish Sustainable Communities Initiative (SSCI)**, a report will be published next spring which will illustrate a wide variety of approaches to delivery of low carbon, sustainable communities and the industries which support them.
- The Scottish Government will evaluate, promote and disseminate the lessons learnt from **Scotland's Housing Expo** so that the skills and expertise available in Scotland in approaches to designing economic low carbon homes is more widely known about and understood. Many of these projects demonstrate the value of a 'passive energy' design approach which uses new technologies in their proper context and act as exemplars for new-build and the retrofitting of components to reduce energy use in existing housing.
- **Architecture and Design Scotland**⁴¹, the Scottish Government's champion for good design in the built environment, will provide advice and access to skills to assist designers, clients and constructors to realise low carbon

developments with the most sustainable layouts and in the most appropriate places.

Decarbonising Transport

Scotland needs to move towards a decarbonised transport sector by 2050. Global demand for low carbon vehicle technology is expected to grow exponentially over the next 20 years in response to demand for renewable energy, rising fossil fuel prices, the need for secure fuel supply, and new technology investment. With a global market of £345 billion for alternative fuel vehicles and £0.5 billion in Scotland, the sustainable transport sector presents a growing opportunity for the Scottish economy.

Objective 10: Reducing the need for travel. Promoting development which reduces the need to travel, facilitates travel by public transport and freight movement by rail or water, and provides safe and convenient opportunities for walking and cycling and securing the necessary infrastructure to do so.

Immediate Actions:

- Government is developing the infrastructure required to support electric vehicles. Providing viable alternatives to domestic air travel (high speed rail);
- Transport Scotland will continue to work with both Department of Transport and the High Speed Two company to **promote and develop the case for high speed lines to Scotland**;

Objective 11: Widening travel choices. Encouraging lower carbon options, like public transport, car clubs, car sharing and cycling and walking.

Immediate Actions:

- The Scottish Government, working jointly across the whole public sector to support public sector leadership in the use and promotion of Low Carbon Vehicles LCVs and

⁴⁰ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/lowcarbon/ECTActionPlan>

⁴¹ <http://www.ads.org.uk/>

associated infrastructure development. To meet the target of 100% of publicly procured vehicles to be LCV (except certain exempted 'specialist' vehicles) by 2020; and

- the Scottish Government aims to [meet the actions set out in Energy Efficiency Action Plan on energy efficiency across transport sector](#).

Objective 12: Encouraging both energy efficient driving and supply chains. Creating a demand at home and internationally for Scottish expertise in low carbon transport technologies.

Immediate Actions:

- the Scottish Government, and wider public sector, will [support the Low Carbon Vehicle Procurement Support Scheme to provide in the region of £4.3m to the public sector for the procurement of over 100 new low carbon vehicles LCVs and publicly available charging infrastructure](#);
- the Scottish Government, and wider public sector, [support the roll out a national network of fast charging points, smart grid and vehicle to grid technology](#); and will continue to support the unit costs making low carbon vehicles a more viable and appealing option to consumers;
- Scottish Government will continue to support investment in biofuel, and hydrogen research and development to make LCVs a more viable and appealing option to consumers; and
- [Environmental Clean Technologies Partnership⁴² will deliver coordinated support for businesses and academia](#) within the emerging Environmental and Clean Technologies sector; including the priority actions recently identified within the ECT strategy including for sustainable transport sector.

Scotland's Resources

Scotland's rich and diverse environment is a national asset and a source of competitive advantage for Scotland. As a nation we trade on its quality, so its continuing health and improvement are vital to sustainable economic growth, and the effective use of sustainable raw materials and natural resources all the more important. Many of Scotland's economic growth sectors such as tourism, agriculture and the food and drink sectors depending on our high quality air, land and water. It is important, therefore, that the Scottish Government and wider public sector take action to conserve and enhance Scotland's environment, supporting these critical sectors in the transition to a low carbon economy and ensuring sustainable economic growth.

Objective 13: the development and uptake of emerging technologies. *Encouraging industry to develop sustainable practices that support economic growth, and protect the environment through efficient resource use and minimising waste and pollution.*

Immediate Actions:

- the Scottish Government and wider public sector will work with the Technology Strategy Board in considering the feasibility of developing a [new innovation platform for water](#), which will focus efforts in two main areas: firstly the prevention and mitigation of flooding; and secondly the management of drought and water shortages;
- [Scottish Water will evolve from a successful utility into a dynamic water agency](#), becoming one of the largest generators of renewable electricity in Scotland. It will support the bid to hold the 2015 World Water Forum, as well as assisting in establishing a Scottish centre of excellence modelled on the Stockholm International Water Institute;

⁴² <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/lowcarbon/ECTActionPlan>

- [Centre of Expertise on Climate Change](#) is being established by Scottish Government to consider the impacts of climate change and reduction of green house gases on economic growth and sustainability across rural and environmental industries. This will include simplifying access to scientific expertise across Scotland; and enhancing synergy of effort and stimulate innovative, scientific thinking, in support of policy;
- Zero Waste Scotland is currently running a plastics capital grant of £5M to drive the [development of a plastic recycling facility in Scotland](#). Currently Scotland exports baled plastics for reprocessing elsewhere. Having the capacity to deal with this material here in Scotland would not only help drive recycling but it will also add value to this valuable resource here in Scotland;
- Scotland should consider the merits of becoming [a centre for processing and recovery of rare earth metals](#) for domestic and global technology markets, which could be built from the availability of these materials in waste electronic goods.
- [Scotland's Zero Waste Plan](#) sets out to create a stable regulatory framework providing confidence for investment and innovation and will see high levels of resource re-entering the economy, reducing Green House Gas emissions;
- the Scottish government and SEPA to work in partnership with industry and support agencies on a prioritised, sectoral approach to developing an [integrated and enabling framework for regulation and advice, supporting innovation](#) and enabling activities to reduce emissions whilst protecting the environment;
- the [Environmental Clean Technologies Partnership](#)⁴⁴ will deliver coordinated support for businesses and academia within the emerging Environmental and Clean Technologies sector. This will focus on the priority actions recently identified within the ECT strategy including for environmental monitoring and instrumentation sector and water supply and waste water recycling sector;
- SEPA have commissioned [research to identify raw materials](#) critical for the Scottish economy, and identify supply risks and opportunities for Scottish businesses. A key aim is to ensure that the resources required for the transition to the Low Carbon Economy are available for Scottish business; and
- SEPA will develop a clear position and reference appropriate methodologies for the [quantification of environmental improvements](#) as a result of the delivery of the low carbon economy. SEPA will also work with partners on an integrated approach to environmental monitoring and reporting.

Objective 14: Setting a policy and regulatory framework. Supporting the growth of industry and protecting the environment and available natural resources.

Immediate Actions:

- Scottish Government is developing a [Land Use Strategy for Scotland](#)⁴³ to be laid before Parliament March 2011;

⁴³ <http://www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy>

⁴⁴ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/lowcarbon/ECTActionPlan>

Section 2 – Sectoral Focus



2.1 Transformation Across the Whole Economy

Demonstrating leadership, through behaviour change, adopting new practices and supporting innovation and new technologies, will give [Scottish business and industry across the whole economy a significant role in shaping and delivering a low carbon future for Scotland](#). Building on natural advantages and academic strengths to focus innovation and development will offer the potential for new competitive advantage for Scottish firms and a means of increasing prosperity within environmental limits.

This section outlines the strategic objectives which relate specifically to [the development of sustainable businesses and industries, and to supporting low carbon innovation across the whole Scottish economy](#). Wider issues relating to energy, transport, the built environment and Scotland's resources are dealt with in other parts of section 2. Immediate actions for government and the wider public sector are outlined in section 1.3 of the strategy.

The Low Carbon Transformation

Countries such as Denmark, Germany and Sweden occupy leading positions in global low carbon markets, principally since they adopted emissions reduction targets coupled with a strong public policy framework that aggressively promotes investment in 'green' products and services. [The ambition of the Low Carbon Economic Strategy is similarly to help Scottish companies exploit 'first mover advantage'](#).

Figure 5: Global green technology strengths and job creation record, 2009⁴⁵

Rank	Country	LCEGS Strengths
1	Denmark	Wind, energy efficiency
2	Germany	Solar, green building, smart grid
3	Sweden	Energy efficiency
4	UK	Tidal/wave, vehicles, knowledge
5	Israel	Water, vehicles
6	Switzerland	Hydro, smart grid
7	US	Renewables, sustainable biofuels, green building, smart grid
8	UAE	Renewables, green building
9	China	Solar, wind, vehicles, green building
10	Canada	Hydro

Scotland is well-placed to benefit given the comparative advantages provided by its natural assets, research excellence and competitive strengths. ['Business as usual' is not a viable option in the future](#), given forecast global population growth and increasing consumption trends in addition to the impacts of climate change. [Market leaders are reducing emissions in their products, services and supply chains and already seizing low carbon opportunities](#) in response to a combination of drivers and barriers, outlined below, to better their competitors.

⁴⁵ <http://www.cleantech.com>

The potential scale of economic opportunity for Scotland is huge but it is not guaranteed, unless the market is competitive and ahead of developments elsewhere, particularly as it is reliant on international investment to ensure the long-term sustainability of existing business and to benefit fully from the new market growth, [the pace of the low carbon transition needs to significantly accelerate](#).

Barriers

- lack of awareness and understanding of business opportunities, benefits and financial returns;
- perception of bureaucracy/over-regulation;
- lack of knowledge around technologies, market intelligence and funding support;
- perceived risk and cost of investment;
- access to finance/investment;
- constraints on skills and leadership capacity to address opportunities;
- behaviour change (staff, customers, suppliers, leaders, shareholders); and
- unwillingness to invest owing to perceived poor payback from investment in R&D, innovation and workforce skills.

Drivers

- higher and more volatile energy prices;
- reduction in business costs from resource efficiency;
- depletion of fossil fuels, minerals and other resources;
- environmental benefits from using resources more sustainably;
- rapid growth of emerging markets;
- supply chain pressures to lower carbon emissions;
- growing customer demands;
- Government regulation and incentives;
- climate change impacts and international market opportunities; and
- moral imperative.

Dealing with uncertainties

[The transition to a low carbon economy heralds an exciting but challenging economic, social and environmental transformation](#). We know where we want to get to in terms of carbon reductions. We know that we want our businesses and communities to prosper and benefit on the way. However, there will be many uncertainties on this journey. Some technologies will prove less effective than expected, and other may be more so. Disruptive technologies may have unintended consequences.

[Communities and businesses may not behave in a way expected](#); habits often drive attitudes and behaviours in ways that are hard to anticipate. In many sectors we will have to consider how best to run two or maybe three 'systems' at once as we move from high carbon to low carbon energy sources and behaviours. This may mean accepting, but seeking to minimise as far as is practicable, redundant expenditure as we transition through different stages of the transition to a low carbon Scotland. It will also require individuals and businesses to make investment choices without knowing for example, which technology will eventually prevail.

There will be new pressures on hitherto underutilised resources. Low carbon materials such as rare minerals and metals may be controlled by countries in unstable parts of the world. Scotland takes seriously the protection of its precious natural biodiversity. Healthy biodiversity provides both essential eco-system services such as clean water for people and pollination for agriculture, as well as being an essential in limiting the impacts of climate change such as flooding, erosion and landslides. It will be necessary to continue to develop an understanding of the relationships between the natural world and use of its resources in the transition.

Long-term trends and unexpected external shocks will also impact on the transition. These include our aging population, demographic changes in both Scotland and globally, and the movement of both human, animal and plant diseases. Commodity prices, and droughts and floods in major food producing countries will have impacts on Scotland.

The indirect consequences of global impacts of climate change may have the greatest impact on Scottish businesses many of which rely heavily on extended global supply chains. Many of these supply chains extend into countries that may experience significantly more severe impacts of climate change than experienced in Scotland. Recent experience in the financial markets illustrate how globalisation has the capacity to rapidly transmit risk and threat across international borders and jurisdictions. Scotland's open economy and businesses large and small may be exposed to strategic risk from global climate change impacts disrupting global supply chains, eroding key markets or creating new scarcities of critical materials or components.

Dealing with uncertainty is challenging but it is not impossible. Scotland has expertise in a range of sectors that are already being drawn together to work through these issues and enhance our strategic preparedness. The Scottish Government will seek to raise awareness of the strategic challenges associated with the low carbon transition and work with key stakeholders to better understand the implications for energy, environment, health, food, transport, resilience, education, water-amongst others. Scotland has the capacity, skills and imagination to effectively take advantage of opportunities, mitigate threats and manage the consequences.

The emerging low carbon future requires our immediate attention, by building resilience into our systems, investments and objectives, using a 'no-regrets approach', we can capitalise the 'transition to a low carbon Scotland in a low carbon world.'

Economy-wide market opportunities

Opportunities exist across the whole Scottish economy for every business and industry to adapt to and exploit low carbon markets, and these should be reflected in strategic planning, business plans and industry-led strategies. The Scottish economy can benefit most by focusing its efforts on the *highest priority* opportunities, set out overleaf.

Business Opportunity	Action required by business
Information, awareness & knowledge sharing	Access information and advice on the business benefits of sustainable business practices. Share and adopt good practice to promote wider action.
Product design	Adopt a closed loop approach to reduce carbon and waste from the product lifecycle.
Resource efficiency	Embed resource efficiency into business culture to significantly reduce operating costs.
Sustainable procurement	Work with suppliers to encourage and adopt sustainable procurement practices.
Reputation and marketing	Reflect sustainability in business branding, marketing and customer/stakeholder relationships to help provide reputation advantages.
Sustainable business models	Undertake a strategic business review (including: R&D, design, lifecycle analysis, procurement, supply chains, brand identity, sales, risk management) to identify opportunities for business model innovation.
Adaptation to climate change impacts	Increase business resilience, seize opportunities and integrate climate change adaptation into existing business processes (eg strategic planning, business continuity and risk management).
Innovative behaviours	Adopt flexible, creative, adaptive approach embracing change and continuous improvement in sustainable business performance.

Figure 6

Reducing overall demand for energy, water and other materials should be the first priority for all businesses, followed by measures to use resources more efficiently. Using less energy has an immediate benefit in reducing business costs and boosting profitability and productivity. For example, it is estimated that [a £1,000 saving in energy bills is the equivalent of generating an additional £20,000 to £30,000 in sales⁴⁶](#). Reducing water use also provides tangible savings since businesses pay for water usage as well as using energy to heat water as well as enhancing business resilience.

Research by the Waste Resource Action Programme (WRAP) in 2009 highlighted that ‘quick wins’ in resource efficiency could deliver 10% of the carbon reductions needed by 2020. It is estimated that businesses collectively lose 2% of annual profits through the inefficient use of energy, water and waste. Over 90% of the materials used in production do not find their way into the final product and companies might spend up to 5% of their annual turnover on waste, including unused materials, defects, energy and water. Embedding resource efficiency into business culture can provide significant opportunities to reduce operating costs, gain access to new markets for resource-efficient products and services and to reduce environmental impact. Overall, the UK is missing out on potential savings of £6.4 billion a year from resource efficiency business benefits from sustainable resource management. www.eef.org.uk⁴⁷

⁴⁶ Evaluation of SEFV Environmental Services Programme, 2004 (Leclerc Associates)

⁴⁷ www.eef.org.uk

Every business can look to change its procurement approach, focusing on sustainable products and services. A thorough risk management approach will help companies scan ahead for future risks and opportunities, spotting potential emerging market trends and being prepared for potential difficulties in global supply chains and resource scarcity. This will improve the resilience of Scottish businesses in the face of the uncertainty of future climate change trends and enable them to adapt more creatively to the opportunities. Ultimately, embracing the low carbon opportunity in every business across all sectors will enhance the reputation of Scottish companies amongst their customers and establish Scotland's reputation globally as a leading player in the low carbon economy, as many Scandinavian counterparts have achieved successfully in the last two decades.

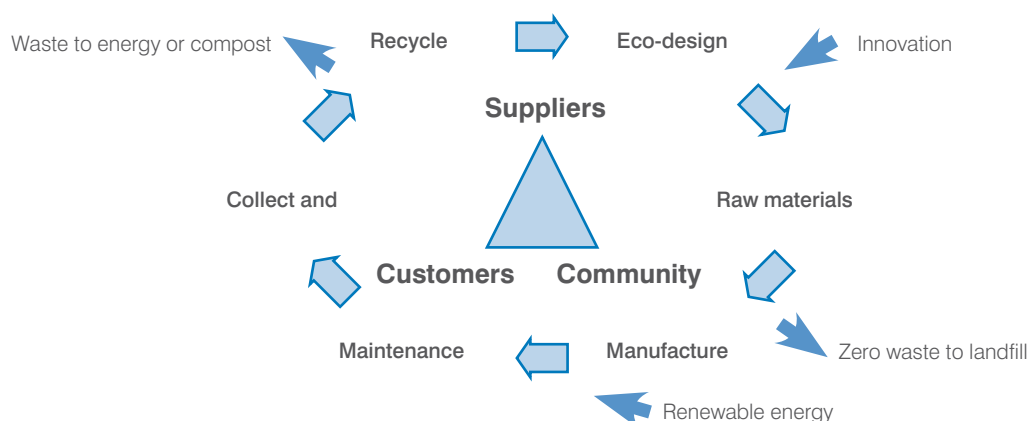
Rabbie's Trail Burners Ltd is Scotland's leading small group Highland tour company.

Sustainability is core to the ethos of the business and is central to its success. Rabbie's Trail Burners has developed Key Performance Indicators (KPIs) for measuring environmental performance, including energy consumption, waste production and fuel usage. These are monitored on a monthly and annual basis and where possible steps are taken to adjust performance. Rabbie's also reports on their carbon footprint to the Scottish Business in the Community May Day Network. Overall, significant environmental and economic improvements have been achieved including:

- 30% reduction in office carbon
- 21% reduction in customers carbon footprint
- 30% saving in electricity (£748) and virtually no waste sent to landfill
- Increased customer numbers by 20%, leading to a 50% increase in profitability
- Increased business to suppliers; an 18% increase in bednights in the Highlands and Islands region is estimated to be equivalent to 27 full time jobs of local residents.

Resource efficiency strategies also pose wider implications for businesses. Across the UK, for example, construction firms spend an estimated £1.5 billion on over-ordered materials. Eco-design, lean manufacturing, a 'closed-loop' approach and moving to service-based business models (including hire/lease markets) all represent ways in which materials consumption can be 'designed out' of business processes. The diagram below demonstrates how a closed-loop approach improves efficiency by minimising the extraction of virgin raw materials, reducing energy in product use and resulting in zero waste to landfill.

Figure 7: Closed loop approach



To deliver the low carbon economy, business and industry will require new and innovative technologies to help meet the Climate Change challenge, whilst maintaining and enhancing the quality of the environment. As mentioned previously, significant economic opportunities also lie within LCEGS, and specifically in the Environmental and Low Carbon technology sub-sectors. [Scotland's particular strengths are in the areas of: sustainable building technologies; sustainable transport technologies; environmental monitoring and instrumentation; water supply and waste water recycling; and recycling and recovery and waste management sub sectors.](#)

Working closely key stakeholders in particular with Local Authorities and Business Gateway, the Scottish Government, Enterprise Networks and SEPA, [The Environmental Clean and Technology Partnership⁴⁸](#), will provide targeted and co-ordinated support to those environmental and low carbon technologies where Scotland has international competitive advantage and that will help businesses: [save money](#) by adopting sustainable, resource efficient and environmentally compliant business practices; [make money](#) by exploiting opportunities in the development of new and innovative low carbon & environmental technology solutions; [manage risk](#) through the avoidance of future cost relating to non-compliance or failure to achieve future environmental standards; and establish Scotland as a [leader](#) in the global Low Carbon Environmental Goods and Services sector.

[Digital technologies are also playing a transformational role in our economy, widely recognised as an enabler of business productivity, a driver of innovation and international trade](#), they will allow our creative industries to prosper and provide a means to

minimising exclusion of geographically remote communities. Digital technology will also be an integral part of our transition to a low carbon economy. In many sectors, it will act as an enabler for carbon savings, for example, by facilitating the replacement of goods and services with virtual equivalents, by providing technology to enable energy efficiency, and by offering virtual technologies such as online shopping, teleworking and remote communication. The Scottish Government recently set out our ambition for Scotland's digital future and we will follow this up with a more detailed strategy and action plan before the end of 2010.

Ultimately, [all Scottish businesses will assume innovative behaviours, responding creatively to the challenges and opportunities of the low carbon economy](#), requiring strong leadership across all parts of the organisation, taking a 'can do' attitude towards adopting low carbon technologies to ensure low carbon becomes an integral part of business culture. [The 2020 Climate Group⁴⁹ is driving forward such an innovative approach](#), and is made up of around 20 leading figures from all walks of Scottish life, with expertise and influence, who have a strong contribution to make to delivering action on the climate change agenda. It is working to accelerate development, investment and action, and create the conditions under which Scotland's ambitious targets for climate change and the low carbon economy can be most effectively delivered.

⁴⁸ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/lowcarbon/ECTActionPlan>

⁴⁹ <http://2020climategroup.org.uk/>

Chemical Sciences Scotland

The 2020 Group recently explored the implications of the low carbon transition with Scotland's chemicals sector, identifying potential opportunities and risks. A strategic view was taken, using scenario planning as a tool for managing the global uncertainties and to identify ways to help sustain the industry's competitiveness, investment and employment in Scotland.

Key implications include the need to simultaneously increase manufacturing process efficiency for current fossil fuel-based products as well as investing to increase Scotland's strategic assets and capabilities in relation to 'bio-based' products. Chemical Sciences Scotland, the industry-led leadership group, will identify the specific responses needed as part of its industry-wide strategy refresh in late 2010.

Sector-specific opportunities

Clearly, there are huge opportunities for sectors such as Energy, Built Environment, Transport, and land and natural resource-based industries (dealt with in the following sections). [For the wider economy, there are also significant opportunities in all other sectors.](#) The main opportunities likely to arise are illustrated in Figure 8 below:

Industry	Priority market opportunities
Environmental and Clean Technologies (ECT)	Sustainable Transport, Building Technologies, Recovery and Recycling, Water and Waste Water Treatment, Environmental Monitoring and Instrumentation. Reprocessing of valuable resources as we move towards a zero waste society.
Food and Drink	Waste management & re-use (eg anaerobic digestion); sourcing for environmental benefit; reducing carbon in supply chains and logistics; promotion, branding and labelling; generating heat/electricity from distillery and manufacturing co-products, creating and matching consumer expectations for green products, reduced cost, increased competitiveness, marketing advantages.
Tourism	'Green' tourism products and services, tourism promotion.
Chemical Sciences	Renewable fuels and bio-based feedstock and clean technologies/processes.
Aerospace	Lighter and more fuel-efficient aircraft materials/technologies.
Textiles	Functional textiles with higher tolerance/resistance to heat and water; resource efficiency.
Forest Industries	Wood fuel and biomass for renewable heat and power; locally-sourced timber for construction; carbon sequestration.
ICT	Data centres, energy management, video conferencing, next generation broadband and adoption of Voice over Internet Protocol (VOIP) technologies.
Financial Services	Green financial products, risk management services and carbon trading.
Life sciences	Sustainable health, telehealth and clean technologies.
Construction	Planning, design and construction of long-life infrastructure and the retrofit of existing infrastructure.
Agriculture	grow wider range of crops, ability to produce new plant/ animal based products leading to greater income generation.
Technical/advisory services	Consultancy advice across all of these sectors.

Figure 8

Opportunities in the domestic market

Meeting the growing demands of domestic markets will provide environmental benefits and promote greater economic and structural resilience, particularly in a period of sluggish economic recovery. Improving the energy efficiency of homes and commercial property, for example, also provides job-rich investment in the construction sector.

Climate change adaptation for the Food and Drink industry

SE, SEPA and SNH facilitated a workshop to explore how climate change might potentially shape the future of the Scottish Food and Drink industry and to help inform industry and business responses. While climate change is initially expected to bring mixed effects (including some benefits such as reduced demand for heating, increased crop yields and increased forest growth), its negative impacts (such as more frequent winter floods, endangered ecosystems and increasing ground instability) are likely to increase over time. Key themes explored:

- the growing importance of food security;
- an increase in the proportion of food grown and processed locally;
- the likely increased intensification of agricultural production;
- global competition and climate change combining to urge Scotland to focus on product areas where it has genuine comparative advantage;
- pressures to reduce carbon emissions right across supply chains;
- the increasing importance of innovation and technological developments to industry competitiveness.

The industry is now addressing this issue through its refreshed strategy – *Fresh Thinking* – by promoting stronger sectoral collaboration, stimulating greater innovation and business adaptation to climate change impacts, reducing carbon impacts in logistics and distribution networks and prioritising resource efficiency and skills development in the short-term.

Opportunities in global markets

While every business will need to adapt to the low carbon economy, however, it is the sheer scale of global markets that are likely to yield the greatest economic returns to Scotland. As a small, open economy, Scotland's low carbon economic strategy must also focus on export-oriented markets that exist for each sector that will drive long-term sustainable growth. Scotland's whisky, green tourism and environmental consultancy sectors, for example, offer great potential for future growth.

Strategic objectives for government and the wider public sector

Section 2.1 sets out the four strategic objectives, previously outlined in section 1.3, for government, and the wider public sector. These are aimed at supporting businesses and directing the focus towards investing in innovative new technologies and behaviours. Immediate actions for government and the wider public sector are outlined in Section 1.3.

Objective 1: Sustainable and resource-efficient businesses. *Helping all businesses in Scotland become more competitive by using resources more efficiently, making proactive adaptations to climate change impacts and generally adopting sustainable business practices.*

Sustainable, low carbon thinking goes beyond resource efficiency and requires business leaders to consider every aspect of their operations including transport, buildings, supply chains and purchasing.

Increasingly procurement of products and services are demanding sustainable solutions, in the private sector large organisations are demanding 'green credentials' from their supply chains and financiers are looking for 'green investment opportunities'. In Scotland public sector procurement will become more and more driven by a focus on sustainability. The Climate Change (Scotland) Act 2009 allows Ministers, by order, to require public bodies to prepare reports on their compliance with the Public Sector Duties introduced by the Act. This will include information relating to how their procurement policies and procurement activity has contributed to compliance with climate change duties.

[The Scottish Sustainable Procurement Action Plan](#)⁵⁰ provides a 10 step methodology for making sustainability part of everyday procurement⁵¹ underpinning the focus on sustainability.

It is clear that proactive companies that position themselves to meet the public sector and broader, demand arising from a direction of travel to a low carbon economy are increasingly likely to become more competitive, particularly where they embrace sustainable, low carbon approaches. These companies are also inherently more resilient to the impacts of a changing climate. To accelerate

the low carbon transition, sustainable business practices need to become the norm, regardless of size or sector.

Objective 2: Sustainable and competitive industries. *Supporting Scotland's industries to exploit low carbon business opportunities to accelerate industry growth, build low carbon supply chains, diversify into new markets and technologies and promote long-term ambition and resilience.*

The scale of funding required for new infrastructure and technology development is very significant and in a period of economic austerity, the public sector share the risks with private investors to increase access to finance for long-term return.

Large-scale, emerging global opportunities provide real potential to drive long-term sustainable economic development. To benefit, Scotland is positioning itself as a low carbon leader, attracting global investment and talent by pursuing a strong, stable policy and regulatory approach. This will enable a growth in exports of Scottish knowledge, expertise, products and technologies from companies and the research base e.g. in the fields of waste, recycling, waste water treatment and recycling, and energy management and environmental monitoring, sustainable transport and sustainable buildings technologies and consultancy.

⁵⁰ <http://www.scotland.gov.uk/Publications/2009/10/sspap>

⁵¹ <http://www.scotland.gov.uk/Topics/Government/Procurement/policy/corporate-responsibility/sspap>

Not only is competitive advantage being gained by individual firms in exploiting emerging low carbon opportunities but Industry Advisory Groups, supported by other industry bodies, are providing leadership and direction to enable their supply chains to diversify and adapt.

The transition to a low carbon economy will also require a shift in emphasis in skills development across a whole range of skill sets, not least that of creativity, management and leadership in Scottish Businesses. Employment opportunities will be created at all levels. For instance the Government's Energy Efficiency Action Plan commits to assessing the skills needs required to make the necessary improvements in energy efficiency to the built environment that will help to meet our climate change targets, and to keep Scotland's workforce competitive in the low carbon economy.

Investment in leadership and skills development, together with broader education and awareness-raising, is required to encourage a step-change in behaviour among business leaders, employees and individuals.

The [Scottish Government's refreshed Skills Strategy](#), developed with COSLA, has a strong focus on the opportunities for Scottish business to develop new markets and grow existing ones, whether in key sectors such as energy or other areas with high levels of employment such as construction.

Low Carbon Skills Fund has been established to provide access to sector specific training to help improve business performance, efficiency, and the adoption of improvement processes around low carbon. In the first instance the fund will be restricted to employers with 250 employees or less, who are implementing processes around low carbon. In order to structure this pilot phase of skills funding, SDS is drawing on the Renewables Action Plan, and the Energy Efficiency Action Plan in order to prioritise skills and training interventions. The initial focus will therefore be on Energy Efficiency and Built Environment skill needs.

The type of training/qualifications that are eligible for support include:

- Construction and eco-materials, in relation to energy and water efficient buildings and infrastructure, renovations and retrofits, and the installation and maintenance of efficient appliances and machinery, including insulation and building treatments;
- Microgeneration, including Solar Water and Heating, Ground Source Heat Pumps, and energy saving technologies and management;
- Materials to improve product performance;
- Environmental and Technology Services;
- Offshore/onshore wind technician training;
- Business Improvement Techniques in waste stream reduction/treatment/management;
- Effective use of sustainable raw material.

Delivering learning in a workplace setting will also become increasingly important as much of the skills requirement will be met by adaptation of the existing workforce, requiring private sector skills investment. In response, the Scottish Government will continue to direct public funds, to incentivise, encourage and pump prime training in key areas.

Local Authorities, SDS and the SFC, along with colleges and universities and schools make sure that learning which is offered is consistent with current and future employer needs.

The strategy outlines that a renewed focus on improving Scotland's leadership and management skills is a priority to increase productivity and growth in Scotland. Progressive and innovative leadership and management and employee trust and motivation are the key factors that enable the introduction of meaningful and sustainable workplace practices that enable people to perform at their best. Scottish Enterprise is developing with key agencies and stakeholders a framework for action for leadership, management and ambition to provide a clear strategic direction and a coherent approach across Scotland, which will recognise the leadership challenge Scotland's faces in its transition to a low carbon economy.

Objective 3: Supporting the right innovative low carbon technologies. *Ensuring Scotland capitalises on its natural advantages, the natural environment and the expertise of leading researchers, future support for low carbon innovation should be focused on areas where Scotland can secure maximum competitive advantage.*

Research, development, demonstration, and delivery (RDD&D) and innovation are essential in developing lower-carbon products and technologies and Scotland's research and innovation support needs to reflect our ambition.

The **overall objective of low carbon innovation** must be to maximise the long-term benefit to Scotland by securing competitive advantage in the technologies where Scotland can be global leaders, as well as leading to an absolute reduction in greenhouse gas emissions from, or improving the carbon intensity of, an activity. It is about identifying the right innovative low carbon technologies, and ensuring that public sector support is aligned to realise the potential.

The Committee on Climate Change (CCC)⁵² recently reviewed the UK's current innovation arrangements for low carbon technologies and concluded that support needs to be focused on those technologies where the UK can genuinely lead globally across the whole RDD&D chain:

- Offshore Wind; Marine; Carbon Capture and Storage (CCS) on power generation; Smart Meters/Smart Grids; Electric Vehicles; Aviation Technologies.

These are the technologies which are necessary to ensure that Scotland and the UK meets the 2050 climate change targets, and have to be developed during the next decade to be ready for deployment post-2020.

Scotland has particular research strengths and is already a leader in Offshore Wind, CCS, Marine and Smart Grids across universities. CCS, Wind and Smart Grids are already technologies which are at the heart of the EU's Strategic Energy Technology Plan⁵³ for demonstration via European Industrial Initiatives⁵⁴. The Scottish Government and UK Government are also lobbying, with support from the Scottish European Green Energy Centre, for an additional European Industrial Initiative for the Marine sector. Scotland also has essential underpinning science and our

⁵² <http://www.theccc.org.uk/reports/low-carbon-innovation>

⁵³ http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm

⁵⁴ http://ec.europa.eu/energy/technology/initiatives/initiatives_en.htm

engineering excellence needs to drive continued innovation.

These technologies will be crucial for achieving our commitment to decarbonise the power generation sector by 2030, and we need to focus on [demonstration and deployment of these technologies](#) during the 2010s, to realise their potential for deployment in the 2020s. The Energy Technology Partnership and the Scottish European Green Energy Centre are already focussing support in these areas.

The Scottish Carbon Capture & Storage Centre (SCCS) is the largest CCS research grouping in the UK and is an example of an effective academic-industry-government partnership, funded by the University of Edinburgh, Herriot Watt University, the British Geological Survey, the Scottish Funding Council, Research Councils UK, the Scottish Government, SEPA and Scottish Power.

SCCS is a world-class centre of expertise in CO₂ storage evaluation and injection, using petroleum and hydrocarbon geoscience, and augmented by industrial scale chemical engineering, next-generation carbon capture and innovative CO₂ use, combined with rare expertise in power plant design and operation. The centre has the capacity for a full evaluation of business concepts and technology innovation appraisal.

SCCS comprises experimental and analytical facilities; expertise in field studies and modelling; key academic and research personnel, to stimulate the development of innovative solutions to carbon capture and subsurface storage. It also undertakes strategic fundamental research, and are also available for tactical consultancy. In addition, it performs a key role in providing impartial advice to help industry, the public sector and policy makers.

The CCC innovation review⁵⁵ argues that by supporting their research and development now, [the UK has the potential to take a leading role in development of '3rd generation technologies'](#). These are technologies that are further from the market and where no country has yet taken the market advantage, including: 3rd generation Solar Technologies, new Electricity Storage Technologies (e.g. advanced batteries, super-capacitors, superconducting magnetic energy storage), Hydrogen Fuel Cell Vehicles, Advanced Sustainable Bio-energy, Agricultural Technologies and Industrial and Building Technologies (low carbon cements, biogas, anaerobic digestion, marine bio-energy). The public sector will work with UK and EU funding programmes and industry to bring world-leading university research in areas such as hydrogen fuel cells to demonstration and deployment.

[We must identify, develop and nurture the areas where Scotland shows emerging strength and ensure innovation, research and development support is appropriately targeted.](#)

Objective 4: Funding technological innovation. *Developing the key technologies for demonstration by refocusing and reprioritising innovation support going forward. Given the difficult funding context for the public sector over the next decade, it is essential that Scotland maximises competitive advantage by focusing support on those technologies where there is greatest chance of success.*

This means [finding new ways to assess the low carbon impact of projects across the whole economy that receive innovation support](#) via the Enterprise networks, and the research activities that are supported by the Scottish Funding Council. It also requires maximum leverage of external funding from the UK (the Technology

⁵⁵ www.iea.org/papers/2009/CCS_Roadmap.pdf

Strategy Board and Energy Technology Institute) and the EU (Framework Programmes, European Industrial Initiatives & New Entrants Reserve).

The CCC review of innovation support concluded that there remains a key role for public funding for low carbon innovation, given the market failure to incentivise the development of low carbon technologies. It argued that greater support should be given for low carbon innovation through reprioritisation, with current levels of support maintained as an absolute minimum. By focusing on the areas where Scotland has particular strengths, we will ensure we have the greatest potential to secure long-term advantage in global markets.

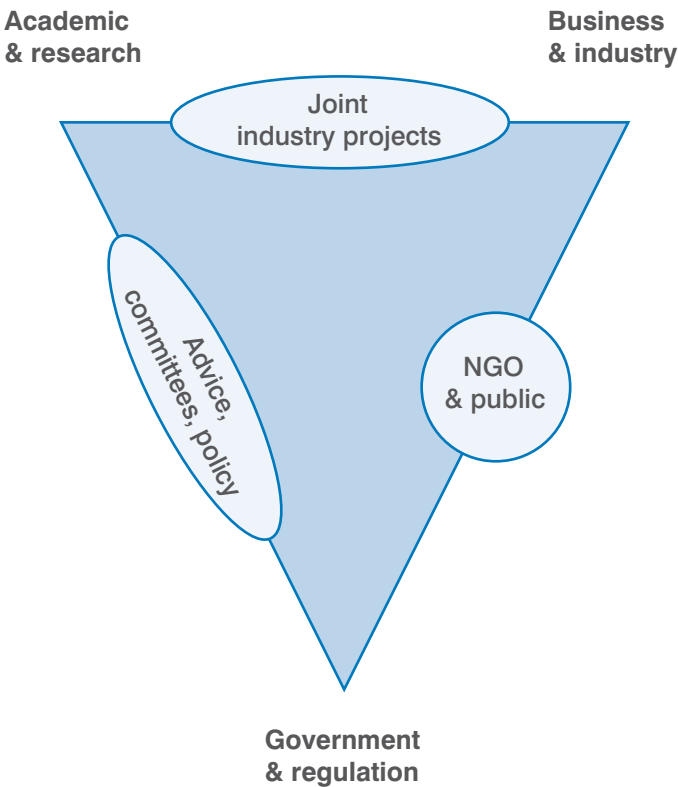


Figure 9

The Scottish Government wants to underpin this activity through the establishment of industry-academic-government hubs for the key energy technologies, coordinated by the Energy Technology Partnership (ETP)⁵⁶. The ETP already provides the research pooling in Energy across Scotland’s universities, giving the critical mass to Scotland’s researchers necessary to engage in industry and international collaboration and to compete effectively on an international stage.

The Scottish Government is supporting the ETP in its bid to secure support from the Lowlands & Uplands Scotland European Structural Funds Programme to establish these new hubs, which will focus on knowledge exchange, commercialisation, business support and SME engagement across the supply chain. They will help position Scotland’s companies and universities to work more effectively together to realise the benefits of collaboration and secure additional investment from European Framework programmes and UK funders such as the Technology Strategy Board and the Energy Technologies Institute. The ETP will also work with the Energy Research Affiliate Forum to maximise interdisciplinary opportunities with other Scottish Research Pools.

⁵⁶ <http://www.etp-scotland.ac.uk/>

2.2 Transforming the Energy Sector

Section 2.2 outlines the challenges involved in decarbonising the energy sector in Scotland and the resulting economic opportunities that will arise. It demonstrates the range of benefits for both businesses and communities and sets out the role of Government in supporting the transition. It also outlines the corresponding Strategic Objectives with associated actions as detailed previously in Section 1. Wider issues relating to business and industry, the built environment, transport and natural resource-based industries are dealt with under other sections.

Low Carbon Transformation

Transforming the energy sector in Scotland will play a pivotal role in the development of a low carbon economy. The transition can provide a unique combination of benefits, including reduced greenhouse gas emissions and enhanced energy security and less volatility in the energy sector. Through timely and unprecedented levels of investment in the electricity, heat and energy efficiency sectors, the step change in activity will open up enormous opportunities for businesses across Scotland. [Scotland stands on the verge of another energy revolution](#). Just as the discovery of North Sea oil and gas provided a basis to develop international expertise in the sector, Scotland's abundant renewable resources offer opportunities which could be the source of international competitive advantage in the decades ahead. This will help us to meet our climate change and renewable energy targets and generate substantial new economic activity, jobs and prosperity and give Scotland a leading position in emerging global markets.

Scotland's main sources of competitive advantage in the field of renewable energy and low carbon potential include:

- as much as 25% of Europe's offshore wind and tidal energy potential;

- an estimated 10% of Europe's capacity for wave power; and
- the EU's largest offshore storage capacity for carbon emissions – greater than the Netherlands, Denmark and Germany combined.

[Electricity generation](#) currently contributes around 30% of all emissions in Scotland annually. Meeting our Climate Change targets will consequently require very large investments by industry over the next twenty years. [By 2030 almost all of our electricity will have to come from low carbon technologies such as renewables and fossil fuelled plants fitted with carbon capture and storage technology](#), a marked transformation from today's mix which provides half our electricity from unabated, or semi-abated, fossil fuelled plants. To facilitate this the Scottish Government recently increased the target for renewable electricity, by 2020 renewable electricity generation must account for at least 80% of gross electricity consumption. As electrification of the transport and heat sectors gathers pace in the 2020s we will also need to generate significantly more electricity than today. Following a recent change of legislation many Local Authorities are now working with private sector companies to generate renewable energy. To support this, investment will be required in a larger, smarter transmission grid to ensure that electricity can be transported from more remote and offshore locations where the natural resources are most plentiful.

[Heat production from renewable sources will need to increase significantly by 2030, placing Scotland on the path to a complete decarbonisation of its heat supply by 2050](#). This too will require mechanisms to stimulate investment in the sector, both to develop technologies and to support their roll out in the domestic and commercial sectors.

Energy efficiency improvements will be a central step towards a low carbon economy. Whilst primarily reducing demand, enhanced energy efficiency is also considered the fastest and most cost effective way of meeting Climate Change targets and offers a way to resolve the tension between the objectives of economic growth and environmental sustainability. Conserve and Save, the Scottish Government's Energy Efficiency Action Plan describes a wide ranging programme of activity to improve energy efficiency in households, business and the public sector. The business opportunities and policies aimed at driving improvements in this area are set out in detail in other Sections.

Secure, resilient and affordable energy supplies in the future represent a further challenge but also a key benefit from the transition to efficient, diverse and low carbon energy systems.

Barriers

- Investment
- Infrastructure
- Skills
- Technology
- Costs
- Market Intelligence

Drivers

- Legislation and Policy
- Energy Security
- Market Opportunities
- Climate Change (committed and future)
- Social and Community Benefits
- Skills Base

Market Opportunities

Ofgem estimates that £200 billion needs to be invested in the next 10 years to secure sustainable energy supplies at an affordable price for consumers. Clearly this represents an enormous challenge for Government and the private sector, however, the economic opportunities arising from the transformation of the energy sector are enormous. And the costs if implemented retrospectively to 'catch up' with leading nations if traditional energy supply is pursued, could be equally enormous.

In Scotland, the primary economic development opportunities will be aligned to our unique advantages in terms of renewable energy resource, research expertise in key areas and experience in offshore engineering. In addition, Scotland is strategically positioned on carbon capture and storage and on collaboration to develop UK and European energy grid networks.

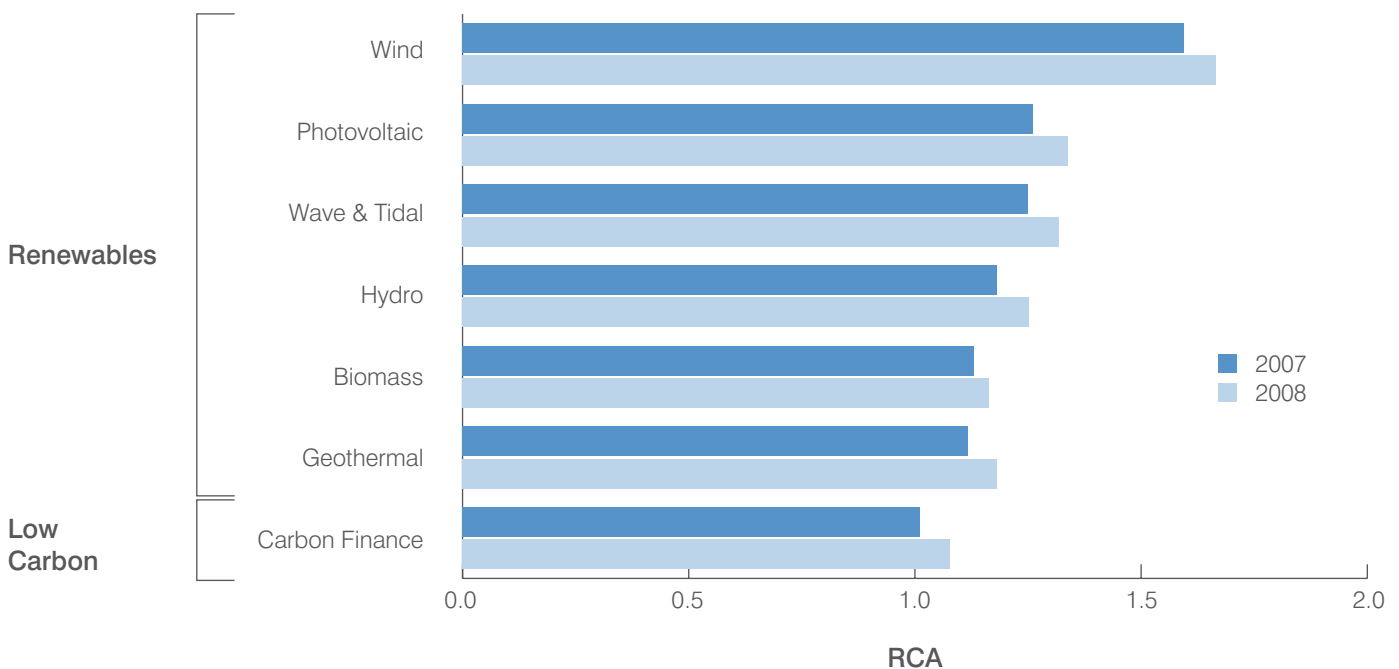
The renewable energy sector represents a significant part of the Low Carbon Environmental Goods and Services sector, however to maximise both the economic and employment opportunities from the transformation of the energy sector it is essential to raise awareness and develop the skills required to service this potential future demand.

The Energy Advisory Board has developed a ***Skills Investment Plan for the Energy Sector***, which estimates the scale of this future opportunity and the interventions required to maximise the benefit. The main areas of future opportunities in Scotland's energy sector include Oil and Gas, Thermal Generation/Carbon Capture and Storage and Renewables. This investment plan reviews a wide range of literature on the energy sector in Scotland and concludes that between 52,000 to 95,000 job opportunities could be supported by activity in the energy sectors by 2020. A significant proportion of this employment will not be directly related to low carbon activity, but the skills and infrastructure required to support this activity will be important to a range of emerging low carbon sectors.

Low Carbon and Environmental Goods and Services Sector – Energy Sub-sectors

Scotland's revealed comparative advantage (RCA)⁵⁷ for energy sub-sectors is shown in the figure below (an RCA value above 1 indicates that Scotland's exports/imports ratio for a particular item is greater than Scotland's ratio of exports/imports for all goods). It shows that Scotland has an RCA in all energy sub-sectors and that this increased across all from 2007 to 2008⁵⁸.

Figure 10: RCA Energy Sub Sectors



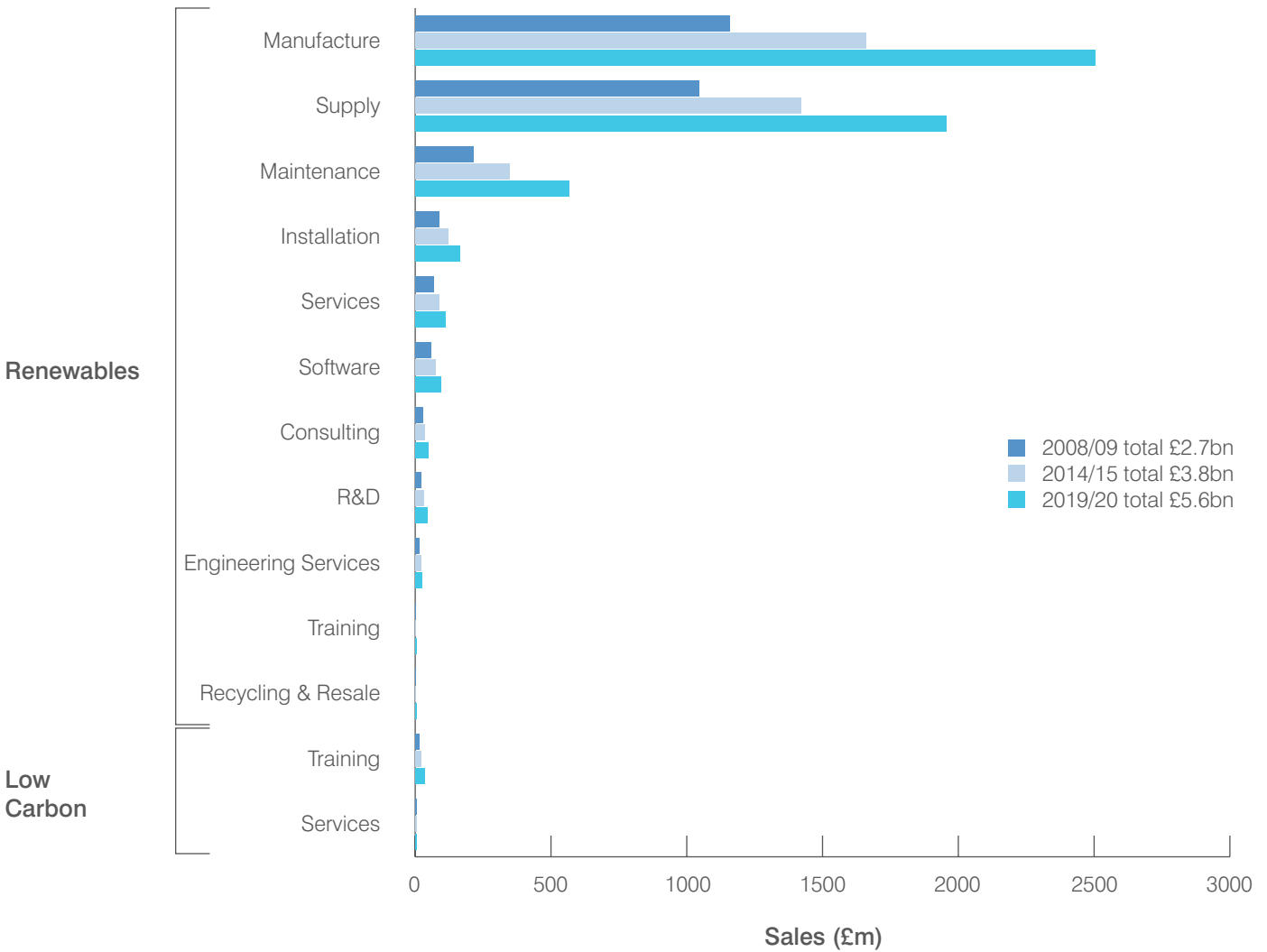
Source: Scottish Government and Inovas.

⁵⁷ Scottish Government, based on BIS methodology, Economics Paper 1: Towards a Low Carbon Economy, Available at: www.berr.gov.uk/files/file52165.pdf

⁵⁸ Scotland's Low Carbon and Environmental Goods and Services Sector Study, Inovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>
Scotland's total imports and exports are taken from the HMRC UK Regional Trade Statistics.

Sales in energy sub sectors totalled £2.7bn in 2008/9, and are forecast to increase to £3.8bn in 2014/15 and £5.6bn in 2019/20⁵⁹. The breakdown is shown in Figure below, with the majority of sales in manufacture and supply in renewables sub sectors.

Figure 11: Sales projections for Energy Sub Sectors

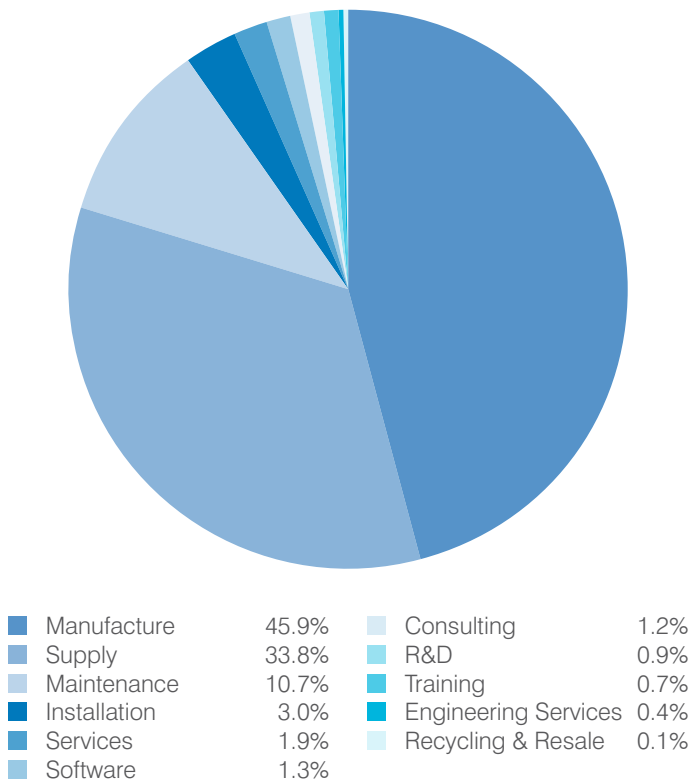


Source: Scottish Government and Innovas

This is also the case for the employment figures for energy sub sectors, shown in Figure 12. Employment is forecast to increase from the 2008/9 figure of 22,000 to 32,000 in 2014/15 and 48,000 in 2019/20.

⁵⁹ Scotland's Low Carbon and Environmental Goods and Services Sector Study, Innovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

Figure 12: Employment in Energy Sub Sectors 2019/20⁶⁰



Source: Source Scottish Government and Inovas

Offshore Wind

The large scale development of offshore wind represents the biggest opportunity for sustainable economic growth in Scotland for a generation. It is critical that Scotland exploits the opportunities being made available by the offshore wind industry. *Harnessing just one third of our offshore renewable energy potential could meet Scotland's electricity needs seven times over by 2050.* The projections of market share and employment reported above are not the upper bound of what is achievable. With the right support and infrastructure, the successful delivery of the offshore wind industry and development of the full extent of the identified offshore wind leasing

zones, this sector alone offers the potential for 28,000 direct jobs and a further 20,000 jobs in related industries and £7.1 billion investment in Scotland by 2020. The opportunities for inward investment associated with our offshore wind resource are enormous and this is a priority for Scottish Development International.

Scotland is already active in the offshore renewable energy market and is home to the world's first deepwater offshore wind turbine deployment at the Beatrice Platform in the Moray Firth. Companies including Burntisland Fabrications (BiFab) are also leading suppliers to existing offshore wind projects.

Renewable Energy is recognised as one the key business sectors within the Fife Economic Strategy – 'Growing Fife's Future 2009/2020'. It is one of the strategy's key objectives to become 'a Centre for Excellence for Renewable Energy' in Fife. Key outcomes are the creation of 2,000 new green jobs and a 500m+ investment in renewable energy.

In partnership with Scottish Enterprise, Fife Council has led the development of the Energy Park Fife which is identified as a key asset in the Scottish Renewables Infrastructure Plan and accommodates **Burntisland Fabrications (BiFab)**; BiFab, an established fabrications company based in Fife, has in recent years expanded to become one of Europe's leading suppliers of support structures for offshore wind turbines. Traditionally involved in the supply of steel to the oil and gas industry, BiFab has successfully diversified into the offshore wind, wave and tidal power industry – a move which has seen its annual turnover grow from £20 million to £90 million in just four years. It is now a market leader in the manufacture of Jacket substructures for offshore wind turbines.

⁶⁰ Scotland's Low Carbon and Environmental Goods and Services Sector Study, Inovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

Wave and Tidal Energy

Scotland's extraordinary natural marine energy resources and leading position in the development of wave and tidal energy technologies provide a unique platform to establish a world leading position in this vitally important sector. While it is acknowledged that the timeframe for commercial scale deployment is likely to extend beyond that for offshore wind, the industry is making good progress through initiatives like the [European Marine Energy Centre in Orkney and the world's first commercial leasing round for wave and tidal energy in the Pentland Firth and Orkney Waters announced by The Crown Estate in March 2010. The leases awarded highlight potential for 1.6 GW of deployed wave and tidal energy technology by 2020.](#) The Scottish Government through Marine Scotland is working closely with local authorities and key stakeholders to support early, sustainable deployment of these new technologies, taking into account environmental issues and the needs of other marine users.

A centre of excellence for marine renewables: The European Marine Energy Centre (EMEC) is the world's first grid-connected, independent, UKAS accredited test facility for wave and tidal power generation. Located in Orkney, the Centre is the result of investment from several public sector partners, including the Scottish and UK Governments, the Scottish enterprise networks and Orkney Island Council. EMEC provides grid connected berths and a range of services for device developers, including independent assessment of devices' energy conversion capabilities, structural performance and survivability, as well as monitoring and assistance with consent and regulatory issues. Its role extends beyond the provision of real-life testing conditions, and is leading the development of industry-wide standards for the marine energy sector. EMEC is building up important skills and knowledge as it supports developers deploy and test their devices. This knowledge and skills base will be vital to the sector as developers now look to deploy their devices in the sea on a pre-commercial scale.

Carbon Capture and Storage (CCS)

The economic opportunities for the development of a CCS based industry are considerable. There is the potential for a whole new industry to emerge in Scotland, which could support up to an estimated 10,000 new jobs in the next 15–20 years. In the longer term, CCS is expected to develop into a multi-billion pound market with some 23,000 thermal generation plants globally, potentially requiring replacement or retrofit with CCS.

As stated previously, Scotland has real potential to see the development of CCS as a key economic sector. We have many of the skills and engineering experience gained from the oil and gas and power industries which are transferable to this sector. Given the global potential for CCS development, there is significant export potential for Scotland in areas such as power plant construction and components, engineering consultancy services as well as geological and academic expertise.

While we consider that Scotland has already made significant progress in a number of aspects, the challenge will be to build upon this work as we start to move into the demonstration phase of CCS over the next few years.

Onshore Wind

Onshore Wind has developed rapidly over the last decade and in 2008 contributed around 37% of all renewable electricity generated in Scotland. Since May 2007, Scottish Ministers have given consent to 24 wind farm applications totalling well over 2 GW in capacity. In addition Local Authorities play a significant role in approving smaller applications and setting development planning context through Spatial and Local Development plans.

It is important to recognise that onshore wind is still the technology that can make the most immediate positive impact on our low carbon economy, and therefore the Scottish Government will continue to encourage large, medium and small scale developments that are sited appropriately.

Whitelee Windfarm: Europe's largest wind farm – located on Eaglesham Moor, 20 minutes from central Glasgow. It is owned and operated by ScottishPower Renewables. The wind farm site spans 55 square kilometres and has 140 turbines which can generate 322MW of electricity, enough to power 180,000 homes.

In addition to a secure, green energy supply, Community groups across East Renfrewshire will also benefit from a new fund set up from the development of Europe's largest onshore wind farm.

The fund, which will last for the lifetime of the windfarm, will deliver £140,000 for community groups, activities and initiatives in its first year. There will be similar sums each year over the next 25 years.

Renewable Heat

The Scottish Government recognises the importance of developing renewable heat and the need for transformational change in this area. We have an ambition to create a completely decarbonised heat sector by 2050, with an interim target of 11% of heat to be derived from renewable sources by 2020.

Given the scale of the challenge we face in reaching our renewable heat target, the Scottish Government and local authorities must work with partners, to put in place the necessary support to help develop the sector. In the short to medium term the biggest impact can be made on an industrial and commercial scale, while the domestic sector is more likely to see major changes towards the end of the decade and beyond.

Aviemore North Biomass District Heating Scheme: Albion Housing Society last year completed the installation of a woodfuel district heating scheme which will provide heating and hot water for 130 homes in Aviemore:

- £1 million project
- 3 boilers with a combined power of 1060 kW will heat 130 homes in the scheme.
- It is estimated that 700 tonnes of CO₂ will be saved per annum through the use of biomass.
- The Aviemore area has significant amounts of forest locally as well as large sawmills producing huge quantities of wood co-product. Being able to source the fuel locally can make the plant more sustainable and reduce emissions further.

A Renewable Heat Incentive (RHI) would be a key driver for development of the renewable heat market. Scottish Ministers acknowledge that DECC's Annual Energy Statement published on 27 July, included a positive statement on heat. The UK Government have confirmed that it will fund a Renewable Heat Incentive to be implemented in 2011. This is welcome but we await further details and reassurance that the scheme will be sufficient to overcome the current hiatus in the market and stimulate growth. The [Renewable Heat Action Plan⁶¹](#) sets out a route map for the sector and will adapt to exploit the potential opportunities of alternative sources of heat as they are identified.

Oil and Gas

The Oil and Gas industry is already playing a major role in developing renewable energy in Scotland. [By using the engineering experience, skills and knowledge of the sector it is helping to develop the new sources of energy where the challenges are often very similar to those faced by the industry.](#) Offshore expertise in pipelines, drilling and reservoirs and aquifers are also very relevant to the development of CCS, which in itself offers real opportunities to continue exploitation of the resource without creating emissions.

Composite Energy Limited

Significant amounts of unconventional gas are now being found all over the world and untapped energy sources such as coal bed methane offer huge potential, so long as development and use is sustainable and consistent with environmental objectives. There are great opportunities if investment is made and Scotland is well placed to develop these technologies utilising the wealth of skills and experience in drilling techniques gained from oil and gas exploration.

Composite Energy Limited is a Scottish-based company specialising in the extraction of natural gas from coal seams. They have committed to a coal bed methane production site in the Central Belt and are pursuing market opportunities in well drilling for gas storage and shale gas in both the UK and across Europe.

A further, and major, opportunity lies in anticipating the changes that the low carbon transition will bring for the downstream petrochemical industry and related chemical and pharmaceutical sectors and their supply chains. Finding new ways to ensure that value can continue to be captured from remaining oil and gas reserves without creating emissions may seem a major challenge but it can develop into a major economic opportunity. A [scenario planning exercise carried out for the 2020 Climate Group in conjunction with Scottish Enterprise](#) identified the following emerging strategic insights:

- flexibility and adaptability: adaptiveness to change is essential. The industry needs to ensure that it is sufficiently nimble to respond quickly but also to pursue a strategic plan for gradual diversification into 'bio-based' products;
- market foresighting: we need strong market awareness and knowledge coupled with a global perspective and mindset to ensure our thinking stays as far ahead of the curve as possible. New markets are likely to be niche opportunities; global, highly specific and potentially fast-moving;

⁶¹ <http://www.scotland.gov.uk/Publications/2009/11/04154534/0>

- innovation will be a significant element of any future strategy and is key to capturing higher margins and economic value within the Scottish economy. Not only is this likely to include the firm-level innovation and the commercialisation of academic research but also the building of skills, services and know-how around products to increase value;
- supply chains: a strong understanding of the linkages across supply chains and with complementary industries is needed to assess the nature and scale of new diversification opportunities;
- industry 'branding': there is an opportunity to align the industry's positioning with Scotland's 'clean, green' brand and to make products that will improve the reputation of the chemicals industry among the public; and
- collaboration across the industry is likely to be a hallmark of future success, whether it be with firms, with academia, other stakeholders or a combination across all three.

This work is being [taken forward across other sectors and provides real opportunities to help Scottish industry develop a competitive advantage in international markets](#) as the markets for environmental goods and services increase.

Community Energy

Maximising benefits from renewables for the people of Scotland is a key aspiration of this Government. Our vision is that the development of renewables should raise the quality of life for the Scottish people, through increasing economic opportunities for all, on a socially and environmentally sustainable basis. Such benefits can be put towards a number of sources from securing those communities' long-term economic health to off-setting the disruption of existing industries or existing ways of life.

The Scottish Government recognises various models for community renewables and for the past two years has provided financial assistance to over 600 projects, as well as help and advice through the Community and Renewable Energy Scheme (CARES).

Isle of Gigha: Gigha Renewable Energy Limited, a trading subsidiary of the Isle of Gigha Heritage Trust, established the UK's first grid-connected local community-owned wind farm in December 2004, installing 3 second hand wind turbines. Total capital expenditure was £440K – this included a Scottish Government grant from the SCHRI scheme of £82K, Lottery funding £50K, Commercial loan £148K, Equity £120K.

- Gross annual income of £150K is anticipated.
- By generating their own electricity and selling their Renewable Obligation Certificates through their electricity supplier, Gigha residents will generate a new source of revenue for the island, whilst providing funds for the replacement of the turbines at the end of their working life.
- The residents are using the net profit from the project to fund energy efficiency improvements (opportunities for local businesses and skills development), which should in time allow the community to reduce their energy consumption and achieve an even higher contribution from renewable energy without any expansion in generating capacity.

Building on CARES success, [the Scottish Government commissioned an initial business case to consider the need for a loan fund to help de-risk early stage financing development of community renewables projects](#). The study was published on 28 September 2010 and will help inform future policy development.

Hydrogen and Fuel Cells

Hydrogen and fuel cells can play an important role in the development of Scotland's low carbon economy, with applications in heat and power, energy storage, and sustainable transport. Scotland is home to a number of demonstration projects, as well as companies operating in the commercial market, and a significant level of university-based R&D activity.

The **Hydrogen Office Demonstration Centre** has been set up to support the accelerated development of the renewable, energy storage (with a focus on Hydrogen), and fuel cell sectors in Scotland. The project is intended to improve awareness of these technologies, and promote the importance of energy storage and fuel cell technologies in enabling the transition towards a low carbon and secure energy future. The Hydrogen Office project will also actively undertake education, skills development, and research and development initiatives to ensure Scotland can fully benefit from the employment opportunities that will arise from this sector.

Strategic objectives for government and the wider public sector

This Section sets out strategic objectives for the energy sector, associated immediate actions are described previously in Section 1.3.

Objective 5: Securing funding and de-risking investment. *Attracting long-term finance and secure investment in the Scottish energy sector through understanding the issues, opportunities and global dynamics of finance, as well as the importance of creating an attractive landscape with adequate funding and support.*

The Scottish Government and partner organisations are leading work on the Scottish Low Carbon Investment Project to attract international investment to low carbon projects across Scotland. Scottish Development International is also active in working with potential partners to secure inward investment. [The key outcomes of the Low Carbon Investment Conference](#) held in Edinburgh on 28/29 September 2010 identified that:

- the main barriers to investment in large offshore projects are linked to risk and time. All the risks are not bridgeable by private finance, so Government has to consider getting involved, especially at the early stages. There is money out there if risks can be reduced. Pension funds are 'warm' to the idea of renewables, but need more guidance;
- there is a possible role for Government to act as a guarantor to underpin early-stage investment in high-risk areas like offshore wind and renewables where the private sector is not prepared to gamble;
- a modern grid is crucial to provide power that can get to the market. Scotland understands the strategic role of the North Sea in the European grid and will continue to engage in Europe-wide discussions on grid upgrades;
- Ofgem's review of transmission charges is welcome and Scotland will continue to lobby for a fairer system that reflects where power is generated;
- Renewable Obligation Certificates (ROCs) are not perfect but work relatively well and we shouldn't keep tinkering;
- Scotland will continue lobbying for the release of the Fossil Fuel Levy money. This could make a huge difference to Scotland's port infrastructure by leveraging private cash and stimulating the offshore supply chain. In the short-term, consideration should be given to public-private collaboration to ensure investment is made in ports now;

- The key players – utilities, port operators and supply chain companies – are ready to start making deals but consideration needs to be given to developing a hub port very soon;
- The supply chain is crucial to maximising the economic impact of renewables. We must move quickly but cannot follow the normal sequence; we need to invest in projects, supply chain and infrastructure at the same time; and
- there is a need to start transferring skills from the oil and gas sector to renewables now as well as developing new skills. There is a lack of key posts including project managers, electrical engineers and turbine technicians.

Subsequent to the Low Carbon Investment Conference and in recognition of the pressing need to invest in infrastructure the Scottish Government, Scottish Enterprise and Highland and Islands Enterprise have launched a £70m Renewable Infrastructure Fund.

In the June 2010 Emergency Budget, the Chancellor confirmed the creation of a 'Green Investment Bank', to handle Government funding and leverage private investment in the low carbon economy. In taking steps to support private sector investment in infrastructure, the [Chancellor confirmed in the recent Comprehensive Spending Review an investment of £1 billion funding and additional significant proceeds from asset sales for a UK-wide Green Investment Bank.](#)

However, the Scottish Government also recognises that it must also provide support to the sector. The Scottish Government continues to be innovative in a period of stretched finances, and works to ensure that funding provides a legacy for the industry and for the Scottish people. Current examples of this are the [£10 million Saltire Prize for technological](#)

[advances in wave and tidal energy⁶²](#) – and the [£13 million WATERS \(Wave and Tidal Energy: Research, Development and Demonstration Support\) fund⁶³.](#)

[There is also an attractive marketplace for renewables developers to come to Scotland.](#) Introduced in 2002, the Renewable Obligation (RO) is the main mechanism across the UK for supporting renewable electricity generation. Renewable power generally costs more to produce than conventional forms of generation. The RO creates a market for renewable power by placing an obligation on all licensed electricity suppliers to source a specific and annually increasing percentage of their sales from the various eligible technologies. [The Renewables Obligation \(Scotland\), or ROS, is fundamental to increasing renewables capacity across Scotland,](#) achieving our target that 80% of Scottish electricity demand should be met from renewable sources by 2020 and has led to significant increases in renewable output across Scotland since its introduction in 2002.

The Scottish Government has led the way with increased support to emerging technologies through the RO, including wave, tidal and offshore wind. Giving these technologies a kick start can mean that Scotland can attract early investment and build a secure infrastructure.

Objective 6: Develop world leading policy frameworks and create a comprehensive infrastructure. *Ensuring delivery of the clean, affordable and secure electricity supply required to meet climate change targets and create a secure and competitive position across low carbon energy sectors whilst delivering economic benefits for Scotland.*

⁶² <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/leading/saltire-prize>

⁶³ <http://www.scottish-enterprise.com/your-sector/energy/energy-support/energy-funding/energy-grants/Wave-and-Tidal-Energy-Fund.aspx>

Along with renewables projects, developing a comprehensive infrastructure will allow Scotland to create a secure and competitive position in the renewables industry, particularly in offshore wind.

National Renewables Infrastructure Plan (NRIP) – Strategic action to ensure Scotland gains a competitive position for the growth of offshore renewables industry in the global Low Carbon Economy

The National Renewables Infrastructure Plan (N-RIP) led by Scottish Enterprise (SE) and Highlands and Islands Enterprise (HIE) and with the active engagement of councils, has focussed on a particular infrastructure needed to catalyse growth of the offshore renewables industry – manufacturing, installation, operation and management locations that are fit for industry use in key locations. The delivery of investment at these sites will enable Scotland to be a key player in this industry.

Offshore renewables sites identified can support up to 5,180 manufacturing jobs with an annual GVA of £294.5m, if Scotland becomes a home to manufacturing. To achieve this, investment needs to be made by asset owners with public sector investment support.

SE and HIE are continuing to work with asset owners to secure the provision of industry ready sites. There is ongoing and intense dialogue between industry and port asset owners to make sure that there is strong awareness of what is needed and the timescales. In time the job of Government in this sector will be done and business to business relationships will drive progress.

While the NRIP has focussed on offshore renewables, similar processes looking at industry infrastructure needs for renewable heat, CCS industry development and waste are a priority for the enterprise agencies to ensure that a competitive position is secured for Scotland. In supporting the transition to a low carbon economy, [SE and HIE will develop a dialogue and an approach to industry around these issues in order to carry out low carbon business infrastructure reviews which will assist in identifying key investment needs.](#)

[Also fundamental to successful projects, ideally situated to take full advantage of Scotland's resources, is the development of a comprehensive grid and fair access regime.](#) The Scottish Government is keen that renewable and small generators should not face significant connection delays, unnecessarily high costs or administrative burdens in applying for, or obtaining, connection to distribution networks. The Government is also keen that the thresholds determining whether or not applicants in particular areas face higher costs or delays relating to transmission access or upgrades is set sensibly and with a policy of support for Scottish and small generators firmly in mind.

The UK Government have announced a welcome review of transmission charging. The Scottish Government will be pressing for an end to the unfair locational charging system which effectively penalises Scottish generators and does not reflect the need for a greater generational mix (i.e. higher proportion of renewable energy, a great deal of which – wind, wave and tidal – is located in Scotland) in the UK energy supply.

Despite the obvious potential for the development and deployment of renewable and low carbon technologies, [there remain significant barriers to be overcome to ensure a clean, affordable and secure electricity supply](#) that is required to meet climate change targets whilst delivering economic benefits for Scotland.

In addition to addressing the root causes of the challenges facing industry, there are other strong arguments for governments intervening in the energy markets, such as maintaining secure energy supplies, reducing exposure to high and volatile fossil fuel prices and creating new jobs and businesses. It is also important that energy decisions made today are environmentally sustainable and resilient to the future changes in climate, and these are considered in partnership with, and through the work of, the Scottish Environment Protection Agency (SEPA).

The Scottish Government understands that setting out appropriate actions does not always generate tangible results. That is why we have established a comprehensive framework of groups to assist us in reaching our targets, putting us in the position to begin to deliver.

Irish-Scottish Links on Energy Study (ISLES): ISLES is a collaborative project between the Scottish Government, the Northern Ireland Executive and the Government of Ireland. Funded mainly by the EU's INTERREG IVA Programme and managed by the Special EU Programmes Body (SEUPB), it is assessing the feasibility of creating an offshore interconnected transmission network and subsea electricity grid based on renewable energy sources off the coast of western Scotland and the Irish Sea. A robust business case for accelerating the development of renewables across jurisdictions will be presented to the partner governments.

The target area has huge potential for capturing wind, wave and tidal energy. However, each region's electricity network has not been developed as an offshore grid to exploit this major marine renewable resource and grid infrastructure is poor. As a result, the capacity to generate electricity is not matched by the ability to collect and transport that energy to market. As well as identifying the challenges in creating, storing and transporting the electricity created from these renewable sources, ISLES can help pave the way for renewable energy and carbon reduction targets to be met and assist in the economic development of the relatively peripheral coastal areas in each of the three partner countries.

The results of the feasibility study, being carried out by RPS Group, will be known by the end of 2011.

Scotland's Energy Advisory Board

The Scottish Energy Advisory Board (EAB), chaired by the First Minister, [creates effective, high-level, open and informed engagement](#) between Ministers, local government, the energy industry and other relevant bodies, addressing the key issues facing the energy sector in Scotland. Four, Ministerial led, energy theme groups have been established in conjunction with the overarching EAB. These focus on:

- Oil and Gas;
- Thermal Generation and Carbon Capture and Storage (TG and CCS);
- Renewables (FREDS); and
- Offshore Renewables (Offshore Energy Programme Board).

Oil and Gas Advisory Group

This group aims to [further better integration of Government policy in the oil and gas sector and to influence investment](#) as a contribution to sustainable economic growth. Its focus is to nurture and grow the Scottish oil and gas supply chain capability, to maximise the recovery and value of remaining North Sea reserves and to access current and future business opportunities in oil and gas and the growing alternative energy market domestically and overseas.

Thermal Generation (TG) and Carbon Capture and Storage (CCS) Advisory Group

This group looks to [articulate the needs of industry in regard to TG and CCS, coal-bed methane and underground coal](#) gasification in line with Scottish Government policies. There is cross membership from the other theme groups which facilitates knowledge exchange and constructive input.

Forum for Renewable Energy Development Scotland (FREDS)

FREDS builds a partnership between industry, academia and Government which draws on their expertise, networks, and the numerous strands of activity in which they are engaged in order to [most effectively develop Scotland's renewable energy industry](#). FREDS has a commitment to oversee and update the Renewables Action Plan every 6 months. It is informed by and contributes to the work of a number of sub-groups (bringing together over 170 members from the renewables industry) which work for the development of the renewables industry in a specific technological or cross cutting area – they include:

- Marine Energy;
- Offshore Wind;
- Pentland Firth and Orkney Waters;
- Renewable Heat;
- Skills;
- Micro Hydro;
- Hydrogen and Fuel Cells; and
- Communities.

Offshore Energy Programme Board

Established in early 2010, the role of the Offshore Energy Programme Board (OEPB) is to strategically drive and co-ordinate the public sector's collective contribution to the growing offshore energy opportunities, seeking maximum benefit for Scotland. Overseeing the newly emerging offshore energy sectors will allow for strategic linkages and priorities to be drawn out within the existing work of the public sector authorities, influencing the direction of future work. The OEPB's scope will cover the key areas of offshore energy – wind, marine renewables and grid infrastructure.

The Scottish Government actively work to remove barriers to the deployment of renewables, and to improve the quality of energy applications and the process by which Scottish Ministers assess them.

In determining 45 energy applications since 2007, with 40 consented and 5 refused, working closely with local authorities, Scottish Ministers have struck a balance between developing and delivering Scotland's energy future and protecting environmental, cultural heritage, economic and community issues. The Beaully to Denny upgrade, for example, is Scotland's most significant and important electricity infrastructure reinforcement project in a generation, and is the key to unlocking the massive renewable energy potential in the North. Scotland's commitment to further improve its planning processes and establish best practice is demonstrated by its leadership of the European Commission-funded Good Practice Wind project, <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/leading/Good-Practice-Wind> set up to examine and disseminate best practice across Europe in balancing objectives on renewable energy with wider environmental and community objectives.

The British Wind Energy Association (now RenewableUK) commented: 'In 2007 the incoming Scottish Government promised to improve the system in order to maintain investor confidence in what is effectively the renewable powerhouse of the UK. These promises were kept, with a flurry of decisions coming after Government took office and a further voluntary pledge to make decisions on section 36 projects within 9 months of submission.'

2.3 Transforming the Built Environment

Section 2.3 focuses on the economic opportunities across the built environment as a consequence of the moving to a low carbon economy.

It also outlines the corresponding Strategic Objectives with associated actions previously detailed in Section 1.3 of the strategy. Wider issues relating to business and industry, transport, energy, and natural resource-based industries are dealt with in other parts of section 2.

Transforming the Built Environment

Building standards have been substantially reformed over the last two decades. However, the built environment still accounts for more than 40% of our CO₂ emissions, generated through the heating, lighting and running of buildings. Clearly it represents a major focus for efforts to reduce emissions and change behaviours and an area where there are both low carbon opportunities and challenges for businesses, investors and householders.

Legislation has provided an efficient and effective means of driving down energy use and carbon emissions in new buildings, challenging a mainly traditional industry sector and providing a clear pathway for both improving building performance and driving innovation and new skills.

EU/UK and Scottish low carbon regulations (ETS, CRC energy efficiency scheme, Climate Change targets, new building standards) are already obliging the construction sector to address the growing imperative to invest in research and development and implement the use of innovative products and methods. Future building standards, for example, will deliver further improvements in the environmental performance of new buildings in Scotland.

New housing for which a warrant is applied for from 1 October 2010 onwards will emit 70% less CO₂ than equivalent new buildings in 1990. And we are working towards an overall ambition that all new buildings in Scotland will be zero carbon by 2016/17⁶⁴ if practicable. Energy efficient and sustainable building design delivers immediate cost benefits with respect to operational costs, and ensures that the building is fully resilient to future climate conditions.

Improvements in the performance of existing buildings through upgrading and retrofitting as well as improved performance of new build will be essential to meet emissions reduction targets.

The Scottish Government estimates that billions of pounds of investment is required to increase energy efficiency across the built environment to a sufficient standard to meet climate change targets. This is a significant task given the current economic climate. However, as a small and responsive economy with a skilled workforce, Scotland is well placed to drive forward and attract that level of investment.

Local Development Plans are already introducing policies in line with Section 72 of the Climate Change Act⁶⁵ to avoid a specified and rising proportion of greenhouse gas emissions from use of new buildings. The Scottish Government's approach to improving the energy efficiency across the built environment is set out in the Energy Efficiency Action Plan⁶⁶ and the broader strategy for reducing emission in the Report on Proposals and Policies⁶⁷.

⁶⁴ A Low Carbon Building Standards Strategy for Scotland – Report of a panel appointed by Scottish Ministers (chaired by Lynne Sullivan, 2007)

⁶⁵ <http://www.legislation.gov.uk/asp/2009/12/section/72>

⁶⁶ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

⁶⁷ To be published shortly, www.scotland.gov.uk/rpp

Sustainable schools – Inverclyde Academy opened in January 2009, with an Energy Performance Certificate 'A' rating – a significant achievement for a secondary school building. The Council were committed to producing a landmark campus that would also act as an exemplar to inform the design of subsequent schools.

The design of the new Academy makes use of natural daylight and ventilation providing high quality learning and teaching facility for the children and wider community. High efficiency condensing gas boilers and heating and water services systems are. Sustainably sourced materials, such as Forestry Stewardship (FSC) sourced timber, were specified where practical and affordable. A 50kW wind turbine will provide 15-20% of the power to the school reducing ongoing energy costs and CO₂ emissions.

The Council has incorporated the lessons learned from the Academy project into their PPP Schools programme, which will deliver two new primaries and two new secondaries by 2011. In the first tie-up of its kind in Scotland, the Carbon Trust worked alongside the Council and the building consortium E4i through the procurement process, providing a range of technical advice. The Carbon Trust is now working with other authorities on a similar basis.

More broadly, sustainability is a key theme for the Scottish Construction industry and central to [Scottish Construction Forum's](#)⁶⁸ industry plan: ***'This theme will be a key driver for change in the construction industry, affecting planning, design, procurement and working practices in order to reduce the overall carbon footprint of a built structure over its entire lifetime. The construction industry must be encouraged to design for whole-life sustainability, build with minimum waste, dispose of waste responsibly, use sustainable resources, reduce energy consumption, recycle and reuse materials, create minimum pollution and cause the least possible environmental impact'***.

⁶⁸ <http://www.scotland.gov.uk/Topics/Education/skills-strategy/making-skills-work/utilisation/SCF>

There are a range of drivers and barriers shaping the low carbon built environment:

Barriers

- Investment cost;
- poor information, lack of awareness;
- Commercial buildings owners not always the user benefiting from improvements;
- The gap in energy consumption that can exist between buildings as designed and their actual performance on completion;
- Focus on the initial capital cost rather than 'whole life' costs;
- Multiple building ownership delays agreement to retrofit; and
- Inertia to new investment and change.

Drivers

- Value of energy savings;
- Higher comfort levels;
- Health benefits;
- Co-benefits and intangible benefits;
- Awareness and motivation;
- Public sector as exemplar tenant in commercial sector;
- Public sector procurement of green buildings;
- Scottish planning policy;
- Improved energy standards in building regulations;
- Energy efficient low carbon design;
- Carbon trading schemes;
- Demand for 'green credentials' in supply chains;
- Increasing energy prices;
- Reducing dependence on imported energy sources; and
- Enhanced resilience to future climate.

Market Opportunities

Two broad market opportunities exist in relation to the built environment:

- reducing the current energy and carbon emissions associated with new and existing buildings through energy efficient, low carbon design and specification; and
- exploiting innovation in sustainable building technologies in both domestic and global markets.

Reducing the emissions of new and existing buildings

A range of current and near-term market opportunities exist in helping reduce the emissions of the current building stock including:

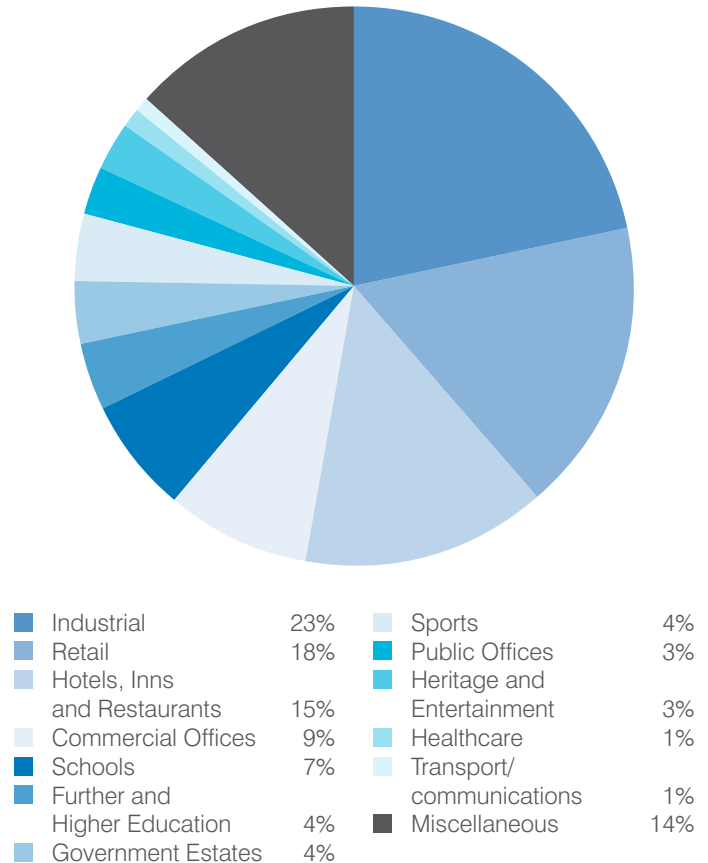
- passive 'low carbon' design of sustainable buildings and places; as advocated in [Designing Streets: A Policy Statement for Scotland](#)⁶⁹.
- insulation for domestic and non-domestic properties (but avoiding additional cooling loads in the case of the latter);
- installation of energy efficient boilers and other building services and controls;
- installation of energy efficient lighting and controls;
- micro-generation;
- smart meters; and
- renewable heating;

These will be implemented via:

- energy advice services;
- upgrading existing skills and developing, delivering and accreditation of new skills; and
- financial products.

Better energy efficiency in buildings and communities offers savings with respect to operational costs for owner and tenants, and additional benefits for owners from long-term more efficient capital stock of the buildings.

Figure 13: Emissions (%) by sector (2005)



Source: Carbon Trust 2009: Building stock emissions by sector⁷⁰

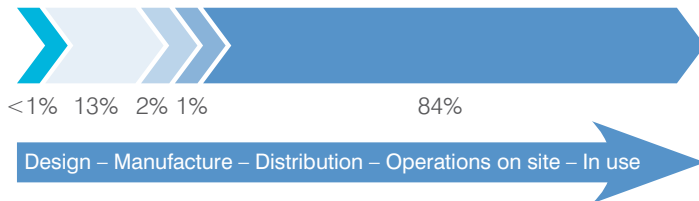
Currently approximately, 45% of the UK's carbon emissions are generated by energy consumption within the building stock: 25% within domestic buildings with a further 18% within non-domestic buildings. In addition it is estimated⁷¹ that around 16% of the entire carbon footprint of the UK construction industry is related to design, manufacture, distribution and on-site operations activities, with 84% accounted for by energy use for electricity, water and space heating within homes and businesses. On top of this the construction process itself is a carbon intensive activity.

⁷⁰ <http://www.bis.gov.uk/assets/biscore/business-sectors/docs/10-671-construction-igt-emerging-findings.pdf> p37)

⁷¹ Low Carbon Construction Innovation and Growth Team – Emerging Findings (BIS, Spring 2010)

⁶⁹ <http://www.scotland.gov.uk/Publications/2010/03/22120652/0>

Figure 14: Estimate of the carbon footprint of UK construction, 2007⁷²



While the ambition is that all new buildings in Scotland will be zero carbon by 2017, where practicable, it is also estimated that the market opportunity for retrofitting the existing building stock is huge and will be driven particularly by the value of energy savings, given that 73% of UK domestic emissions arise from space and water heating. In addition, significant opportunities also exist in improving the energy performance of the 200,000 or so non-domestic buildings in Scotland.

Case Study: Aberdeen Heat and Power

Aberdeen Heat and Power is an independent not-for-profit company set up by Aberdeen Council to develop and manage combined heat and power district heating schemes. Over the past 10 years they have implemented several phases of their District Heating project. It is currently seeking funding to extend the infrastructure of the district heating network in Aberdeen. The funding would pay for highly insulated district heating pipes to be laid in the ground, plus additional generating capacity. The extension of the network would also make the connection by a number of other buildings on the route which may present additional carbon savings as well as being a good economic proposal for the relevant building users. These include: Transition Extreme (a leisure facility with climbing walls), a hotel, and Satrosphere (a science centre run by a local voluntary organisation).

There are clear environmental and economic benefits from increasing the use of timber as a construction material and in supporting innovation within the Forest Industries sector more advanced engineered timber-based products. Whereas the total value of the new-build sector in Scotland is currently worth over £3 billion annually (where 80% of all new homes are timber-frame construction), the US market is worth £300 billion (where 90% of homes are timber-framed). [The potential for exporting innovative timber-based products is significant. This is a key objective of the Scottish Forest Industries cluster⁷³ in addition to meeting the Scottish Government's target to grow forest cover to 25% by 2050.](#)

Given the significance of heating in contributing to carbon emissions, [large and growing opportunities also exist in implementing alternative forms of heating](#) such as district heating, industrial waste heat, and combined heat and power, including heat generated from biomass and waste. These various forms of lower carbon heat present a range of infrastructural issues and costs in relation to the built environment, requiring the close involvement of planning authorities in the design of residential or commercial developments.

There are also environmental and economic benefits relating to low carbon design and planning, through the development, implementation and articulation of passive design techniques as a means to delivery low carbon buildings and neighborhoods. In addition to new build, the adaptation of the existing building stock presents a big challenge and is important in terms of carbon reduction. It brings significant opportunities for innovation and skills development in the upgrading and retrofit of existing buildings, in particular housing.

⁷² Low Carbon Construction Innovation and Growth Team – Emerging Findings (BIS, Spring 2010)

⁷³ <http://www.forestryscotland.com/>

Roof Truss Company (RTC), Elgin

The Passive Wall is a pre-insulated closed panel wall system which can reduce building energy consumption significantly. RTC have developed the product using materials sourced locally to minimise carbon emissions. The Passive Wall has been used in passive certified houses in Scotland, most recently at [Scotland's Housing Expo in Inverness](#).

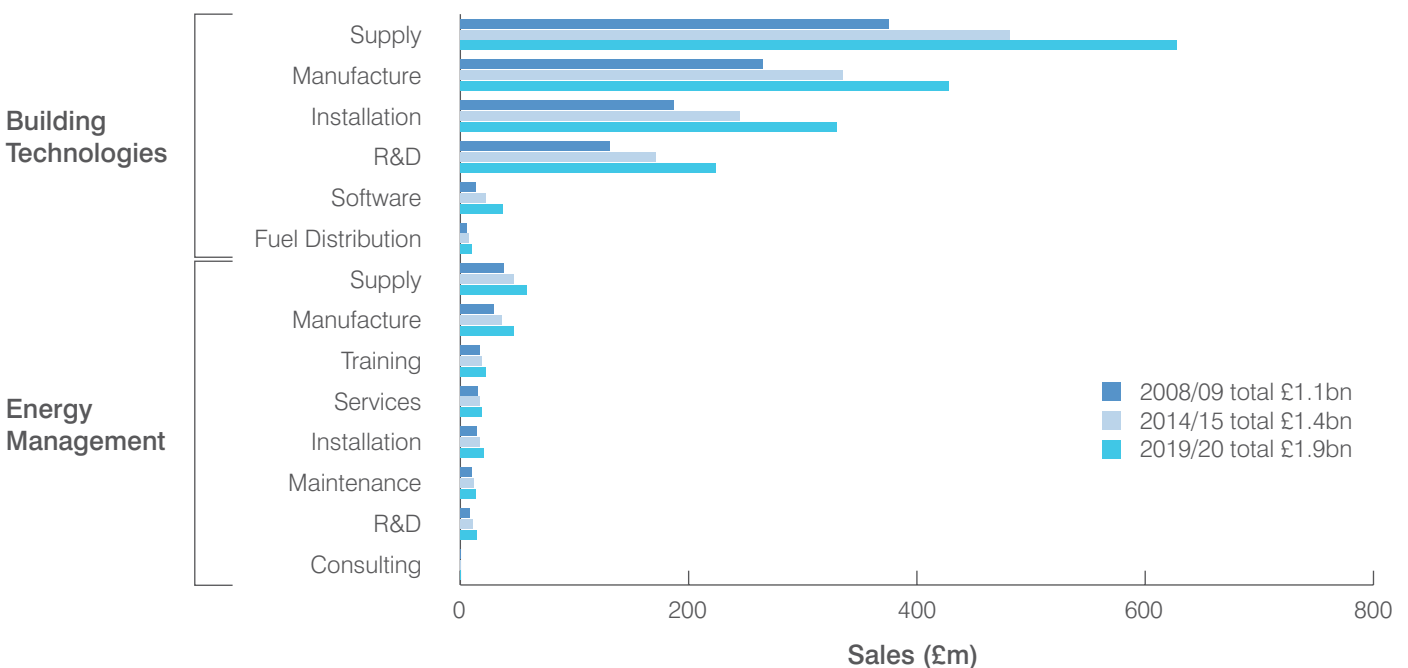
RTC's range of innovative products is helping to significantly boost the company's growth, taking them from a £3.1 million to a £5.5 million business in only three years. This will be achieved by sustaining their current market position; expanding their current premises to accommodate their expected growth; developing new technologies to improve efficiencies and support modern construction methods; and developing new products for the low carbon housing market.

Permitted development rights have been extended for domestic microgeneration⁷⁴. Consultations are underway on extending permitted development rights still further for domestic microgeneration and also for non-domestic microgeneration⁷⁵.

Exploiting new sustainable building technologies

The main sub-sectors relating to the built environment are; building technologies and energy management. It is estimated that these sectors alone will support 15,000 low carbon jobs by 2019/20 in Scotland. Overall sales are projected to increase from £1.1 bn in 2008/9 to £1.4 bn to around £1.9 bn in 2019/20, with the breakdown shown in Figure 15⁷⁶

Figure 15: Sales projections for Built Environment Sub Sectors



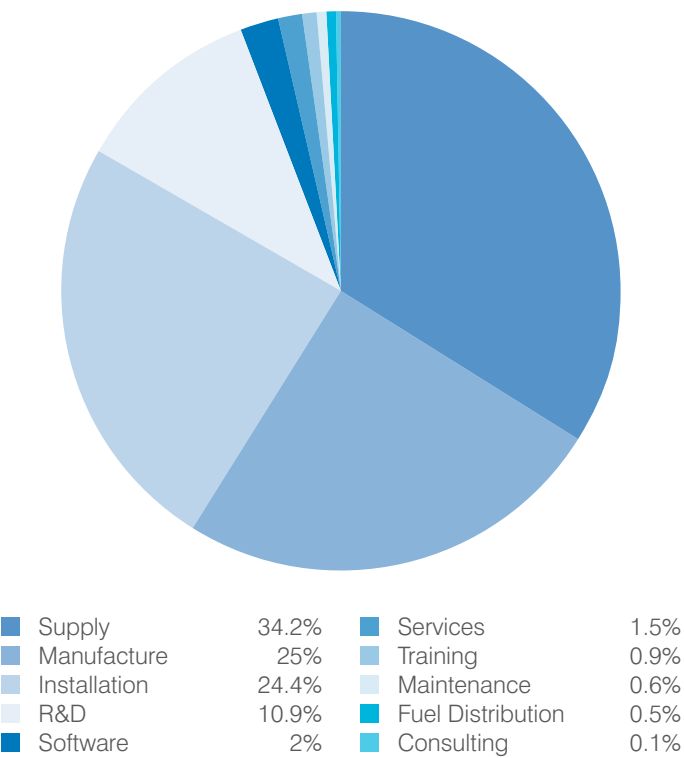
⁷⁴ <http://www.scotland.gov.uk/Publications/2010/03/05114236/0>

⁷⁵ <http://www.scotland.gov.uk/Topics/Built-Environment/planning/publications/consult>

⁷⁶ *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

The majority (approximately 84%) of employment in this sector within Scotland will be in supply, installation and manufacture of the low carbon technologies with around 16% of employment in consulting, R&D or training.

Figure 16: Employment in Built Environment Sub Sectors 2019/20



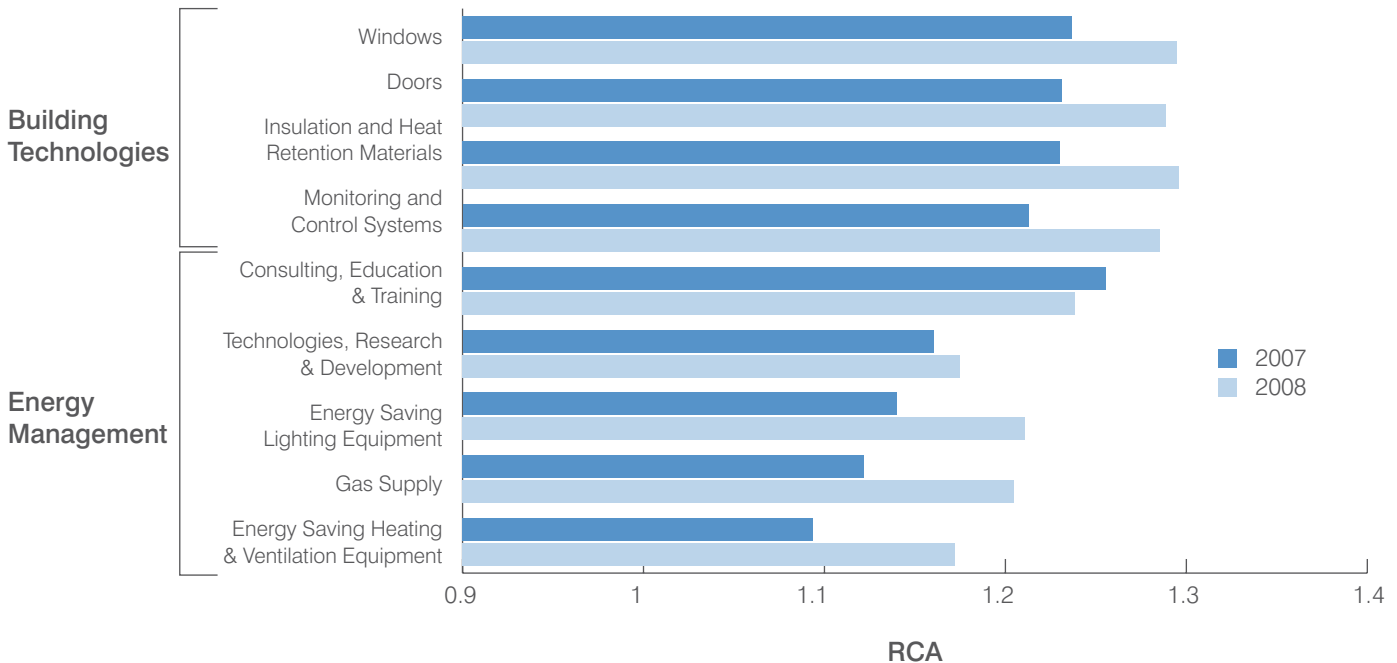
Source: *Scotland’s Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010.

Scotland has the opportunity at an early stage to develop comparative advantages in these low carbon sub-sectors and foster companies that can provide market leading solutions not only to a Scottish market but to a growing global low carbon market.

Analysis on potential for comparative advantage (RCA) in the built environment sectors (An RCA above 1 indicates that Scotland’s exports/imports ratio for a particular item is greater than Scotland’s ratio of exports/imports for all goods). It shows that Scotland has advantage across all sub-sectors and that this increased across all bar one from 2007 to 2008⁷⁷. There are potential opportunities for this sector to develop and not only service the Scottish supply chain, but become globally competitive companies and supply the low carbon global export market.

⁷⁷ *Scotland’s Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent> (LCEGS) dataset; Scotland’s total imports and exports are taken from the HMRC UK Regional Trade Statistics.

Figure 17: RCA Built Environment Sub Sectors



Source: *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010.

Potential for growth lies in the high demand for retrofit technologies utilising new technology and new construction ideas e.g. new material development and smart sensors. The Building Technologies and Energy Management areas of Environmental & Clean Technology (ECT), being supported by the ECT Partnership, will play a crucial role in the development and deployment of these technologies. Scotland has over 500 companies (many in the construction industry) who can address the UK market opportunity which is expected to be £21bn by 2014/15.

In spite of the strong regulatory drivers, a range of barriers exist that inhibit the development and widespread adoption of low carbon building technologies including:

- industry fragmentation: across the built environment sector there are disconnects between the sources of technology development and supply chain capability;
- access to testing and demonstration facilities: new technologies need to be validated and demonstrated to potential customers and investors in a safe, independent environment; and
- commercialising new technologies: a significant gap often exists between the development and market exploitation of new innovations and this is particularly acute in a traditional and risk-averse sector such as the construction industry.

The Low Carbon Building Technologies Gateway will for the first time establish a Scottish low carbon building technologies innovation pathway by enabling the development and integration of two initiatives and allowing for a clearly articulated support system from concept through to market demonstration within Scotland. Led by Edinburgh Napier University's (ENU) Building Performance Centre and supported by Scottish Enterprise, ERDF and SPIRIT funding, it combines with the ongoing development of the Building Performance Centre in Glenrothes (aka Hangar 17) which provides discrete test facilities which also protect commercial sensitivity, with an Innovation Park intended to provide a showcase for Low Carbon Building Technologies.

The project will provide continuous support for innovation and enterprise in relation to Building Technologies from concept through to market outreach. This will provide faster, better, more efficient processes to support innovation by SMEs in order to meet the future market demand for low carbon construction products. Additionally, the project will link to wider centre of excellence work being undertaken across Scotland via the Scottish Energy Laboratory and the CIC-Start online academic consortium. Specialist technical work that cannot be delivered by ENU/ BPAC or will be procured by ENU from wider project partners in Scotland. There are also important synergies with SE's recently LCBE Supply Chain Innovation Support project through provision of the physical resource to support the innovation process.

The Project will remove barriers and de-risk commercialisation of low carbon innovation while retaining the process within Scotland. Over a ten year period following intervention, the Project is forecast to contribute a total cumulative net gross value added of £182m. This unique approach has the potential to attract considerable interest from non-UK firms.

Strategic Objectives for government and the wider public sector

This section sets out strategic objectives for the built environment, previously described with associated immediate actions in Section 1.3 of the strategy.

Objective 7: Moving towards a low carbon built environment. *Reducing carbon emission, from all phases of the building process, from design to construction, through operation and maintenance, within the new and existing building stock.*

In the new build sector, we can expect that better performing construction materials and a change in methods of construction as staged improvements in energy standards within building regulations in 2010, 2013 and 2016 require, for example, much improved thermal performance.

Scottish Government has worked closely with industry in developing sustainability labelling for new buildings through building regulations. Proposals would recognise the achievement of reaching the demanding mandatory regulations from October 2010, as well as providing optional upper levels for those who wish to demonstrate their green credentials. The aspirational levels reflect a broad range of aspects of sustainability for domestic buildings and include challenging enhanced targets for carbon emissions reductions for all new buildings. Ministers have approved for proposals to go to public consultation in 2010. The system's intended introduction would follow during 2011.

A significant programme of refurbishment of Scotland's existing building stock will be needed to accompany the ambition of net zero carbon new buildings from 2016/17. This will build on existing Scottish Government programmes such as the Home Insulation Scheme and Energy Assistance Package. Local Authorities have a

significant role to play, in particular, through Local Housing Strategies, influencing and identifying area planning initiatives and/or regeneration projects in statutory local development plans.

For the existing housing stock, improvements are driven by householder action to reduce fuel bills through energy efficiency measures, supported by Government action on fuel poverty and promoting insulation, including through obligations on the energy companies. *Significant opportunities exist for company expansion to meet the scale of activity that will be required, accompanied by new recruitment into the industry and skills upgrading among existing employees.*

While demand for retrofitting homes and premises is increasing it is still not at the levels required by our emission reduction targets, and the current range of market drivers and incentives need to be strengthened. Anticipated rising energy costs and greater affordability of retrofit technologies over the next decade should provide strong levers to create market demand. Support from energy companies and UK Government programmes in addition to the Scottish Government's own incentives will also be important in optimising uptake, particularly in the current economic climate. Other drivers and incentives include:

- UK Green Deal (domestic and non domestic), whereby the initial capital outlay may be funded by a mix of third-party finance, public subsidy and savings on future energy bills. The Scottish Government is engaging with the UK Government to try and ensure these schemes are appropriate for Scottish conditions and levels of need. It is anticipated that the market will need to adapt to provide energy assessors, businesses that can deliver the installations of the measures funded by Green Deal, and financial institutions that can provide the finance.
- energy-related incentives such as feed-in tariffs or the renewable heat incentive that encourage owners and developers to invest;

- effective public information campaigns to encourage uptake;
- The need to adapt new and existing building stock to the impacts of climate change through decreasing reliance on energy and water, as well as increased thermal insulation reducing the future need for cooling.

The Scottish Government is also considering its position in respect of the powers available to enforce energy efficiency standards in private sector housing and existing non-domestic buildings contained in the Climate Change (Scotland) Act. We will also consider whether appropriate standards should be developed for the social rented sector.

Objective 8: Exploiting and integrating low carbon building technologies into the design and construction process. *Helping to develop, commercialise, test, demonstrate and market innovative new building technologies and materials and integrate these into the design process alongside passive technologies.*

It is clear that continued joint working across the public sector is needed to address the market barriers that currently exist in relation to low carbon building technologies. This will help close the gap between the development and market exploitation of new technologies and products, together with their mainstream adoption across the construction industry.

The Scottish Government's Construction Works Procurement Guidance⁷⁸ contains best practice, policy and procedures for public works procurement. For example, Section 3 contains advice on complying with EU procurement regulations in selection and award procedures and Section 7 acts as a signpost to policy

⁷⁸ <http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building/procurement-manual>

and best practice endorsed by the Scottish Government to help embed sustainability into public works procurement.

The Planning Application Notification on Renewable Energy Technologies is being updated and will be web-based, allowing for further more regular updates than in the past. It will seek to maximise opportunities for renewables, whilst managing environmental impacts, through the new planning processes. Scottish Government has also commissioned research on the use of quantitative greenhouse gas impact assessment to inform future strategic planning policy development.

Planning authorities are encouraged to prepare heat maps to inform spatial plans and policies for renewable heat with development plans. Such heat maps are based on a range of data, such as sources of raw materials, areas of high heat load, grid availability, fuel poverty hotspots, and designated sites and can be used to identify opportunities and areas of greatest benefit.

The Scottish Government is funding a heat mapping pilot project in the Highland Council area, with the results to be disseminated to Councils across Scotland. The Scottish Government is currently undertaking a Waste Heat Study that will investigate the potential for the provision through waste heat and its economic impacts. This applies to low carbon district heating and renewable heat.

Scottish Government has commissioned research, which is currently underway, to assess overall financial capacity of the social rented sector, to establish potential for significant new investment in quality measures as well as provision of new housing. Where financial capacity exists it is dependent on circumstances of individual local authorities and housing association and may not match investment requirements in housing stock.

Once the most cost-effective product and process solutions are validated there are likely to be considerable benefits as scale increases. This will be facilitated by the effective sharing of best practice solutions as they emerge.

The use of off-site production and other modern construction methods is growing, often offering advantages in terms of energy efficiency and improved product quality.

Objective 9: Promoting low carbon building design at all scales from neighbourhood upwards. – Encouraging the development of walkable, well-connected places.

We need to encourage wider understanding of the critical importance of the design of units larger than the individual building to the development of an effective low carbon economy and sustainable places and communities. Examples of these larger scale approaches include the layout of neighbourhoods and larger urban units, including design approaches which encourage easy pedestrian and cycle access (as advocated by Designing Streets: A Policy Statement for Scotland.) We also need to take account of the fact that some low carbon technologies (such as district heating or combined heat and power) will often operate most successfully and efficiently at the scale of community rather than at the level of individual buildings.

The Scottish Government is already working with a range of other public and private sector organisations to promote projects which demonstrate integrated approaches to low carbon design. There is scope for the wider promotion, evaluation and dissemination of the achievements of these projects and for the consideration of how the scope of other projects may be developed to demonstrate important aspects of low carbon design. An example of the later is the recent design ideas competition for architect and developer teams at the Scottish Sustainable Communities Initiative (SSCI) project at Whitecross near Linlithgow.

2.4 Decarbonising Transport

An efficient transport system is a key enabler for enhanced productivity and delivering Government's overarching Purpose of increasing sustainable economic growth. Since 2007, the Scottish Government has prioritised improvements to Scotland's transport system through the Government Economic Strategy.

Section 2 discusses the strategic objectives previously outlined in section 1.3 of the strategy and economic opportunities which relate specifically to transport. Associated actions are described in Section 1.3. These relate closely to the actions set out in the Scottish Government's Energy Efficiency Action Plan⁷⁹ of the strategy. Wider issues relating to business and industry, energy, the built environment and land-based industries are dealt with in other parts of Section 2.

Transforming the Transport Sector

The National Transport Strategy published in 2006, was founded on three key strategic outcomes focused on improving journey times and connections; improving quality, access and affordability, and reducing emissions. These continue to be the foundation of the approach to transport policy and investment. When planning transport infrastructure, the Scottish Government uses an investment hierarchy of:

- maintaining and safely operating existing assets;
- making better use of existing capacity; and
- targeted infrastructure improvements.

The Climate Change Delivery Plan suggests that, if we are to reduce total emissions in Scotland by at least 42% by 2020, transport emissions need to be reduced by 27%. The Committee on Climate Change identified that in order to achieve this target, air travel has to be capped to at least pre-2005 levels which will increase the level of cuts required elsewhere⁸⁰. The Delivery Plan also states that, by 2030, good progress should be made towards decarbonisation of all road transport. There is also a target for 10% renewable energy use in transport by 2020, in line with the mandatory EU target set for each Member State. While the main policy drivers to effect reductions in transport emissions lie with the EU or the UK Government, the Scottish Government has identified a range of devolved policies which will make a significant impact.

Transport is a major contributor of greenhouse gases, adding 14.4 Mt of carbon dioxide emissions to the atmosphere in 2008; 26% of all Scotland's emissions. Approximately 69% of transport emissions come from road vehicles, with maritime contributing 15% and aviation 12%.

Major emission reductions from transport are not expected to materialise until the medium and longer terms and will be largely underpinned by technology advances, and their widespread uptake. The European Environment Agency recently warned that: unfortunately traffic levels are growing at around the same rate as average emissions are projected to fall, meaning that the net effect may still be far from what we need⁸¹. This emphasises the need for effective local policy aimed at influencing planning and transport behaviour.

⁷⁹ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan>

⁸⁰ <http://www.theccc.org.uk/reports/carbon-reduction-commitment>

⁸¹ <http://www.eea.europa.eu/articles/climate-change-mitigation-impossible-without-transport>

The achievement of emission reductions in the shorter term requires changes now in our travel and transport behaviours. Strategic Development Plans (SDP) provide an opportunity to influence the transport system infrastructure people utilise to travel at a city region level. The plans can help to influence travel habits, reduce congestion and address the poor air quality that currently exists in all of Scotland's major city centres. The strategic nature of the plans provides a means of tackling the growing problem of commuter traffic.

The Scottish Government is developing transport policy options around three strategic objectives to reduce transport emissions: reducing the need for travel; widening travel choices and increasing energy efficient driving, encouraging the need for widespread uptake of low carbon options such as electric vehicles.

There are a range of barriers and drivers influencing the transition:

Barriers

- high unit costs for low carbon vehicles;
- lack of recharging/refuelling infrastructure;
- current cultural norms;
- current low cost flights; and
- Relative lower costs and ease of travel using private rather than public transport.

Drivers

- fuel security;
- rising fuel costs; and
- growth of global demand for low carbon vehicle technologies.

Market Opportunities

As described in Section 1 of the strategy, Scotland's economic development priorities relate to renewable energy and the broader low carbon and environmental goods and service sector, specifically 'Environmental and Clean Technologies'. [One of the five ECT sub-sectors offering the greatest economic potential for Scotland is Sustainable Transport e.g. low carbon vehicles and intelligent transport.](#)

Low Carbon Vehicles

While forecasting the rate of technological development is extremely difficult, global demand for low carbon vehicle technology is expected to grow exponentially over the next 20 years in response to demand for renewable energy, rising fossil fuel prices, the need for secure fuel supply, and new technology investment. [With a global market of £345 billion for alternative fuel vehicles and £0.5 billion in Scotland, the sustainable transport sector presents a growing opportunity for the Scottish economy⁸².](#)

⁸² *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010.
Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

Over the next three to five years the sector will see the development of an ‘early adopters market’, where low carbon vehicles are deployed in public and private sector fleets to demonstrate feasibility and to stimulate popular demand. In addition, demand for supporting infrastructure will encourage innovation and offer commercial opportunities for organisations participating in new global supply chains.

While Scotland has no major indigenous car manufacturing industry, [Scottish companies have emergent capability in niche vehicle manufacturing and are already bringing prototypes to market](#). These companies include Allied Vehicles (electric vehicles), Green Machines from Tennant Company (electric sweepers), Axeon (batteries), Alexander Dennis (hybrid buses) and Artemis Intelligent Power (hybrid car and truck transmissions) and ABSL (hybrid powered armoured personnel carriers). [Sustainable transport offers a real opportunity to re-focus Scotland’s expertise in high value manufacturing into a new, dynamic and rapidly growing market for low carbon vehicles](#). This includes electric vehicles, hybrids (combining electric and conventional engines) and alternative fuels such as hydrogen and biomethane.

[The opportunity for Scotland lies in niche vehicles](#), which will be produced in volumes of thousands per annum rather than high volume automotive, (which will continue to be dominated by the large car manufacturers). Examples are road sweepers, ferries, sub-sea exploration vehicles and electric utility vehicles for airports.

[Scotland has a rich history of success in high value manufacturing](#). We have the skills, culture and supply chains to support successful industries in the design, development and production of high value products. Where these are manufactured in low to medium volumes we

have been proven to be globally competitive, over many decades, in sectors such as aerospace and defence, engineering and electronics.

Applied Sweepers Green Machines

Part of the Tennant Group **Applied Sweepers now know as Green Machines**, a Falkirk based company have developed and launched the world’s first electric road sweeper.

When travelling it is virtually silent allowing early morning or late night sweeping to take place with minimum impact on either workers or residents. Power is provided by twin Lithium Ion battery packs and this means the road sweeper produces zero engine or CO₂ emissions. The ability to provide an 8 hour sweeping time on one charge and the capability to recharge in just 4 hours allows the machine to meet the needs of the most demanding requirements.

This new machine resulted in the Company being selected for a prestigious Ruban d’Honneur in the European Business Award which celebrates businesses that demonstrate exceptional performance within their sector.

Our ambitions to harness our vast renewable energy resource could give Scotland an advantage in the development of hydrogen fuelled vehicles, in the long-term and perhaps initially for niche markets. In order to seize the transport fuel opportunities potentially available from hydrogen further research and development work will be necessary.

Edinburgh Napier University/Argent Energy

Edinburgh Napier University launched its Biofuel Business Programme in June 2010, the first of its kind in the UK, it is intended to work with companies to find innovative ways of converting waste products into fuel. Funded by the European Regional Development Fund and the Scottish Government's SEEKIT programme, the Biofuel Research Centre is part of the University's new Institute for Science & Health Innovation. As part of a £12m investment, the nine new institutes at Edinburgh Napier are designed to act as one-stop shop for businesses to access expertise, research, facilities and product testing.

Companies already successfully using such techniques include Argent Energy, the Motherwell based company that produces biodiesel from tallow and used cooking oil by-products. The Group commenced production in March 2005 and was the first large scale producer of biodiesel in the UK. The Motherwell plant is currently producing a weekly average of at least 875 tonnes (approximately 1 million litres), representing over 90% of the plant's weekly production capacity

Intelligent Transport Systems

The application of Intelligent Transport Systems (ITS) is fundamental to any low carbon transport system. ITS includes a variety of technology based 'tools' to make the most efficient use of a low carbon trunk road network by monitoring conditions, controlling traffic and informing motorists of conditions. Tools could include variable speed limits, variable message signs, ramp metering and average speed enforcement as appropriate, and targeted use of the hard shoulder as an additional 'managed lane' for priority vehicles.

As outlined in the Strategic Transport Projects Review, [the use of ITS to actively manage the most congested parts of Scotland's trunk road network will improve safety, journey time reliability and in some cases result in journey time savings](#). Smoother traffic flows can also result in a reduction in emissions per vehicle and reduced fuel consumption.

Scotland's strength in Intelligent Transport Systems (ITS) is demonstrated by the presence of three industry leaders, (Mott MacDonald, Atkins and IBI Group) who each have their global ITS departments (or significant project teams) located here. The company base also includes many dynamic small and medium sized companies such as Bitwise (embedded software), Coeval (traffic management), JMW (traffic control infrastructure), Journey Plan (digital mapping) and Indigo Vision (security management). This combination makes Scotland one of the leading ITS players in both UK and European terms.

[The EU anticipates the emergence of 600,000 new, high skilled jobs across Europe to develop software intensive systems on road and in-car over the next 10 years⁸³](#). In its associated Directive, the EU has provided a framework for the deployment of ITS across Member States. Priority actions include the deployment of EU-wide multimodal travel information services, real-time traffic information services and road safety related traffic information services.

[The 2010 EU Directive⁸⁴ on ITS opens up commercial opportunities for Scottish companies in hardware, software and systems development](#). Given Scotland's strengths in this area, [companies can position themselves to take advantage of the emerging opportunities](#). These

⁸³ Action Plan for the Deployment of Intelligent Transport Systems in Europe. EU [COMM (2008) 886]

⁸⁴ EU Directive 2010/40 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport. 7 July 2010.

include applications which allow travellers to get information 'in trip' through mobile and in car devices and, in future, through the development of cooperative ITS systems which allow infrastructure to vehicle and vehicle to vehicle communication. The Scottish Government's promotion and investment in ITS to maximise the efficiency of its strategic road network will help drive forward this market. In order to implement these measures and to adequately monitor and evaluate the impacts of these changes, a variety of technologies are required. As the operation of the strategic networks is optimized, opportunities will be open to organizations developing supporting technologies in these areas.

As a result of technology it has developed in Scotland **Artemis Intelligent Power** has introduced a new type of hybrid car and truck transmission. The new system came about from a project funded by the UK Department for Transport and the Energy Saving Trust. Independent tests on the prototype car a BMW 530i car, demonstrated a significant increase in MPG in city driving compared to the same car with a manual transmission. Overall, including highway driving, the prototype recorded 30% lower CO₂ emissions than it had before the company fitted its energy saving transmission.

It is thought that commercial vehicles rather than passenger cars will be the first on-highway vehicles to be fitted with the new transmissions. Commercial vehicles make up almost 20% of road traffic in the UK, but contribute disproportionately to the country's emissions because of their higher weight and high annual mileage.

Strategic objectives for Government and wider public sector

The Scottish Government and its agencies have key responsibilities both to set the framework for the transformation required in the transport system, and to encourage a positive response to the market opportunities these changes represent through policy and operation. These objectives are summarised with associated actions in section 1.3 of the strategy.

Objective 10: Reducing the need for travel.
Promoting development which reduces the need to travel, Facilitates travel by public transport and freight movement by rail or water, and provides safe and convenient opportunities for walking and cycling and invest in the necessary infrastructure to do so.

One way of reducing transport emissions is to reduce for the need for travel. While there will always be a significant number of people who need to commute to work and education, avoiding the daily commute is an aspiration shared by many. [Scottish Planning Policy](#), implemented through the local planning system in the form of Strategic Development and Local Development Plans already promotes a pattern of development which reduces the need to travel, facilitates travel by public transport and freight movement by rail or water, and provides safe and convenient opportunities for walking and cycling. This Prioritises the needs of pedestrians and cyclists over those of private motor vehicles, ensuring connectivity to public transport and creating connected walkable neighbourhoods all help reduce car travel. These approaches to designing the built environment are all advocated in [Designing Streets: A Policy Statement for Scotland](#)⁸⁵. This publication encourages a pattern of development which will create sustainable,

⁸⁵ <http://www.scotland.gov.uk/Publications/2010/03/22120652/0>

mixed use developments with good access to shops, services and employment alongside housing. The Scottish Sustainable Communities Initiative⁸⁶ is helping to generate good practice, by supporting the delivery of 11 exemplar developments.

We are considering the potential role of mixed use facilities or 'community hubs' in encouraging remote or teleworking in smaller communities and thus reducing commuting to our larger towns and cities. Such facilities will build on Scotland's digital communication strength's to also host a combination of other services benefiting communities and reducing the need to travel, as well as providing local business opportunities.

Objective 11: Widening travel choices.

Encouraging lower carbon options, like public transport, car clubs, car sharing and cycling and walking.

It is generally recognised that public transport, car clubs, car sharing, and cycling and walking represent lower cost and lower carbon options to the private car. Nevertheless, there is not as wide spread use of as there might be. Over 50% of all car journeys made are under 5km, and 40% are under 3km⁸⁷. Low carbon options can bring financial, health and environmental benefits to businesses and households

Cycling and Walking

More cycling and walking brings major health as well as environmental benefits. [The Cycling Action Plan for Scotland calls for a tenfold increase in the number of journeys undertaken by bicycle](#), and sets out a clear framework for its achievement with our partners in local government and other bodies. Road space reallocations, cycleways and other supporting infrastructure development will address safety concerns while cycle training

will improve confidence. [The creation of strategic routes for active travel is a key element of the Central Scotland Green Network initiative⁸⁸.](#)

Government investment in the National Cycle Network (NCN) has obvious benefits not only for commuter trips but also for the Scottish tourism. Over 1,900 miles of NCN in Scotland provides long distance cycling opportunities, but they also provide important community links to encourage local sustainable journeys.

In 2007, over 39 million journeys were made on the NCN in Scotland. Initial research carried out by Sustrans estimates that every cyclist on the UK NCN spends on average just over £5 in communities along the routes. Further research is expected in 2011. Cyclists and pedestrians are more likely to support neighbourhood shops and, with users of public transport, contribute to higher 'footfall', which can benefit smaller retailers and businesses.

Integrated Public Transport

The Government is seeking to increase the proportion of people using public transport by encouraging service and infrastructure quality improvements, journey time reliability and improved travel information in mobile, bus stop, and internet technology applications.

We will also seek to achieve a more coherent integration of bus, rail, light-rail and provision for cyclists, enabling reliable travel planning supported by integrated ticketing. Our long-term vision is for smart and integrated transport ticketing across modes and operators. Having now equipped the entire Scottish bus fleet with smart enabled ticketing equipment, we now have a substantial platform in which to encourage modal shift while reducing congestion and emissions. Reduced bus journey times will attract new patronage, reducing

⁸⁶ <http://www.scotland.gov.uk/Publications/2008/06/25093645/0>

⁸⁷ Scottish Household Survey: Travel Diary 2007/08.

⁸⁸ <http://www.centalscotlandgreennetwork.org/>

costs to operators and integrated ticketing time for rail passengers at gates and kiosks.

Electrification of the railways and High Speed Rail

The Strategic Transport Projects Review, published in 2008⁸⁹, established Scottish Ministers transport investment objectives for the next 20 years. It includes electrification of the Scottish strategic rail network, to be delivered in 5 phases. Moving from diesel to electric powered trains reduces journey times. *The Scottish Government will continue to work closely with the UK Department for Transport to ensure Scotland's inclusion in a UK High Speed Rail network.* By offering a low carbon alternative to domestic aviation, a full high speed connection, giving a three hour journey time between Scotland and London can make a longer term contribution to achieving Scotland's climate change targets while delivering economic benefits.

An assessment by Transport Scotland shows that the benefits to Scotland could be up to £20 billion over the standard appraisal period of 60 years, mainly due to reduced journey times. A further £5 billion of wider economic benefits could be realised through jobs being created in areas close to the line. This provides opportunities for Scottish firms to improve efficiency by enhancing connectivity and communication directly with suppliers, customers and other firms. They also have access to larger labour markets.

The infrastructure work required to electrify the strategic rail network will support jobs with the construction and wider transport sectors. This has already been demonstrated through the Airdrie to Bathgate project which has employed up to 900 people during construction.

Objective 12: Encouraging both energy efficient driving and supply chains. *Creating a demand at home and internationally for Scottish expertise in low carbon transport technologies.*

Low Carbon Vehicles

As discussed previously in this section, the early adoption of low carbon vehicle technologies is likely to be constrained initially by high upfront capital costs (generally double that of a fossil fuelled vehicle), uncertainties about their operational effectiveness (range of an electric vehicle is 60-100 miles) and refuelling options (for example, charging infrastructure for electric vehicles is starting to roll out but is in very early stages of development).

It is important to instil market confidence through interventions such as public sector procurement programmes which (a) provide greater visibility of low carbon vehicles on our streets and (b) test their effectiveness in a variety of urban and rural driving environments. There may be opportunities for Scottish research institutions in understanding the behaviours of people using these new vehicles.

The ECT Partnership⁹⁰ will bring forward an action plan in 2010 that will seek to create demand at home and abroad for Scottish expertise in low carbon transport technologies. Public sector leadership. Such leadership should give greater confidence to industry, in research centres and in the market; reduce unit costs and market prices substantially; and encourage yet further investment in our technology strengths. It is hoped that the growth of the LCV industry will encourage inward investment from the global motor industry, supporting further employment and research and development opportunities.

⁸⁹ <http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j10194b-001.htm>

⁹⁰ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/lowcarbon/ECTActionPlan>

The Scottish Government already taken positive steps through the announcement in June 2010 of the Green Bus Fund and the Low Carbon Vehicle Procurement Support scheme. [The Green Bus Fund](#) offers financial incentives to operators to hasten the introduction of low carbon buses across Scotland. As well as reducing emissions, the new buses will meet the latest air quality and accessibility regulations. [The Low Carbon Vehicle Procurement Support scheme](#), is supported by Local Authorities and through Community Planning Partnerships, offers public bodies the opportunity to add low carbon vehicles to their fleets at the same price as conventional vehicles, while also supporting associated infrastructure provision.

More Efficient Use of Existing Vehicles

Experience has shown that simple steps such as driving at optimum speeds, changing gear at the optimal times, maintaining tyre pressures at optimum levels and avoiding idling can reduce fossil fuel use and emissions by 10%.

It is estimated that providing eco-driving training to Scotland's three million drivers will require around 750,000 person hours of training over a five year period. There are clearly market opportunities for training providers in this, and for suppliers of on-board technologies which monitor and provide feedback to drivers on driving efficiencies.

Scottish Government, working across wider public sector, will [encourage more efficient driving and reduced fuel consumption](#) in the transport network by working with industry, motoring and freight organisations to establish how the driver training market can best deliver eco-driving training to improve vehicle efficiencies and reduce fuel consumption. We will also encourage the freight industry to reduce empty and partial-load running through collaborative approaches, and to reduce the overall number of freight journeys by increasing road freight vehicle capacity.

Maritime

The Scottish Government and Caledonian Maritime Assets Ltd (CMAL) are working with transport authorities in Ireland and Northern Ireland, with support from EU funding, on a joint project. This will examine the common [design and procurement for small ferries to serve remote communities off the Scottish and Irish Coastlines](#). A key aspect of the work is to look at the suitability of hybrid diesel-electric engines for this purpose. CMAL is in contact with Scottish shipyards to ensure that indigenous firms are able to compete effectively for arising construction contracts.

Scottish Public Sector Procurement

As a major procurer of goods and services, government and wider public sector is in an excellent position to encourage the supply chain [to be more sustainable in carrying out their functions](#). Since 2007, for example, Transport Scotland's work supports over 25% of the civil engineering contracting sector's workload in Scotland with over 95% of the agency's budget invested back into the private sector. [Current investment across road and rail, whether in long-term operation and maintenance or in specific infrastructure construction, currently supports nearly 11,000 jobs](#).

The Scottish Sustainable Procurement Action Plan was launched in October 2009, provides a 10 step methodology for making sustainability part of everyday procurement⁹¹.

The Climate Change (Scotland) Act 2009 allows Ministers, by Order, to require public bodies to prepare reports on their compliance with the Public Sector Duties introduced by the Act. These reports must contain information relating to how their procurement policies and procurement activity have contributed to compliance with climate change duties.

⁹¹ <http://www.scotland.gov.uk/Topics/Government/Procurement/policy/corporate-responsibility/sspap>

It is clear that companies that position themselves to meet the public sector demand arising from these developments are increasingly likely to become more competitive, particularly where they embrace sustainable, low carbon approaches. To accelerate the low carbon transition, sustainable business practices need to become the norm, regardless of size or sector.

Carbon Management

In order to manage and incentivise consistent, sustained and long-term carbon reductions throughout the transport delivery cycle, [Transport Scotland has developed a Carbon Management System](#) (CMS) in consultation and collaboration with its industry supply chain. Through simple data collection and design analysis, the CMS will enable the transparent recording and reporting of carbon emissions and savings. The CMS tool has been piloted and is now in the early stages of implementation. Once fully developed, the CMS can be used to drive down carbon emissions and improve resource efficiency, and therefore cost savings and competitive effectiveness across its suppliers and partners. The use of the CMS will be mandatory within the 4th generation trunk road term maintenance contracts, which will commence in June 2012.

In accordance with the principles contained within the Sustainable Rail Programme consideration will be given to carbon issues during the development of both the High Level Output Specification, and the franchise contract due to come into effect in 2014. These documents will contain Scottish Ministers' expectations on Network Rail's outputs and the franchise contractual requirements of ScotRail services.

Furthermore, the tools have the potential to be adapted and used for other Scottish Government departments.

2.5 Scotland's Resources

Section 2.5 outlines the economic opportunities which will arise from a move to a low carbon economy that relate to sustainable use of Scotland's natural resources, land, water, air. In addition it considers resource used by Scotland's economy; and the opportunity to become more resources efficient as well as take advantage of secondary resources, materials available within Scotland's waste stream. It discusses the strategic objectives previously outlined in section 1.3 of the strategy with immediate actions, for government and the wider public sector to support business and industry maximise those opportunities.

Transforming our land based industries and use of environmental resources

Climate change is one of the greatest challenges facing Scotland's environment and communities through its impacts not just on the climate, but also on the environmental resources including fresh water supplies, the air we breathe, the natural materials used to make goods and products, and our ability to produce food.

There are a number of challenges as a direct result of our changing climate that could potentially impact on Scotland's natural resources across Scottish industry and business more widely which government, the wider public sector and in particular Scotland's research community are tackling for instance in relation to flooding and/or drought impacting directly on industry e.g. food production, leisure use or using less energy in water supply and waste water treatment in order to decrease carbon emissions.

Scotland's rich and diverse environment is a national asset and a source of competitive advantage for Scotland. As a nation we trade on its quality, so its continuing health and improvement are vital to sustainable economic growth. In the current economic climate the challenge of protecting Scotland's resources is all the more important. [Many of Scotland's economic growth sectors such as tourism, agriculture and the food and drink sectors depend on our high quality air, land and water.](#) It is important the government and wider public sector take action to conserve and enhance Scotland's environment, supporting these critical sectors and ensuring they are resilient to future climatic changes in the transition to a low carbon economy and ensuring sustainable economic growth.

It is estimated that the eco-systems services sector is valued at around £20 billion to the economy. A low carbon economy and society should not only seek to mitigate climate change through the reduction in greenhouse gas emissions and build resilience to a changing climate, but also recognise the economic and innovation opportunities that lie within the wider environmental pressures and emerging challenges.

As discussed previously in this document, it will require investment and growth within the low carbon and environmental technology sectors as well as the renewable energy opportunities, to support Scottish and global industry meet their environmental responsibilities and achieve long-term environmental gain for businesses and communities.

Scotch Whisky industry distillers are not newcomers to sustainability; raw materials, traditional production methods, and world famous brands rely on a pristine environment.

Through the Scotch Whisky Association, distillers launched an ambitious industry-wide environment strategy in 2009, the first of its kind in Scotland. Commitments include:

- at least 80% of primary energy requirements from non-fossil fuel sources by 2050;
- 40% of packaging from recycled materials by 2020;
- 100% of packaging is recyclable or reusable by 2020;
- zero waste to landfill from packaging operations; and
- sustainable cask and water management policies.

Improved operational efficiency is being supported by major investments of over £100m, with an emphasis on renewable energy.

Gavin Hewitt, Chief Executive of the Scotch Whisky Association, said: *'We are looking to the future with a strategy that makes good environmental and business sense. Distillers are making more whisky but are using less energy to do so. Targets will be met through industry investment and collaboration, supported by our supply chain and government.'*

Resources/Materials

Access to raw materials is critical to the sustainable growth of any economy. Some of these resources are biotic and therefore directly dependent on the environment, for example agriculture and fisheries. Access to mineral resources is largely dependant on global markets, but there are important considerations around this:

- The extraction of mineral resources and primary processing of these materials is carbon intensive so the utilisation of these materials contributes to the overall climate impact of Scotland's economic activity; and
- With global economic development there is growing recognition that there are risks around future supply of resources critical to the Scottish economy

These factors suggest that the following should form an element of Scotland's approach to developing a low carbon economy:

- Achieving high levels of resource efficiency and cutting waste out of processes is critical. This has 2 key benefits, it should improve profitability and therefore competitiveness of the Scottish economy. Becoming more resource efficient will also reduce the carbon intensity of economic activity in Scotland;
- Scotland may not have access to primary materials critical to its economic development, but as a western developed economy it has access to secondary raw materials in its waste stream. Getting better at accessing these resources, and developing the ability to reprocess materials here in Scotland will help Scotland in managing its own demand for scarce materials, and will also allow Scotland to become a leader of environmental technologies in this area.

Zero Waste Scotland⁹² is a one-stop-shop service for businesses seeking advice and support around reducing waste and improving resource efficiency, the existing programme delivered over £30M saving to business in 2008

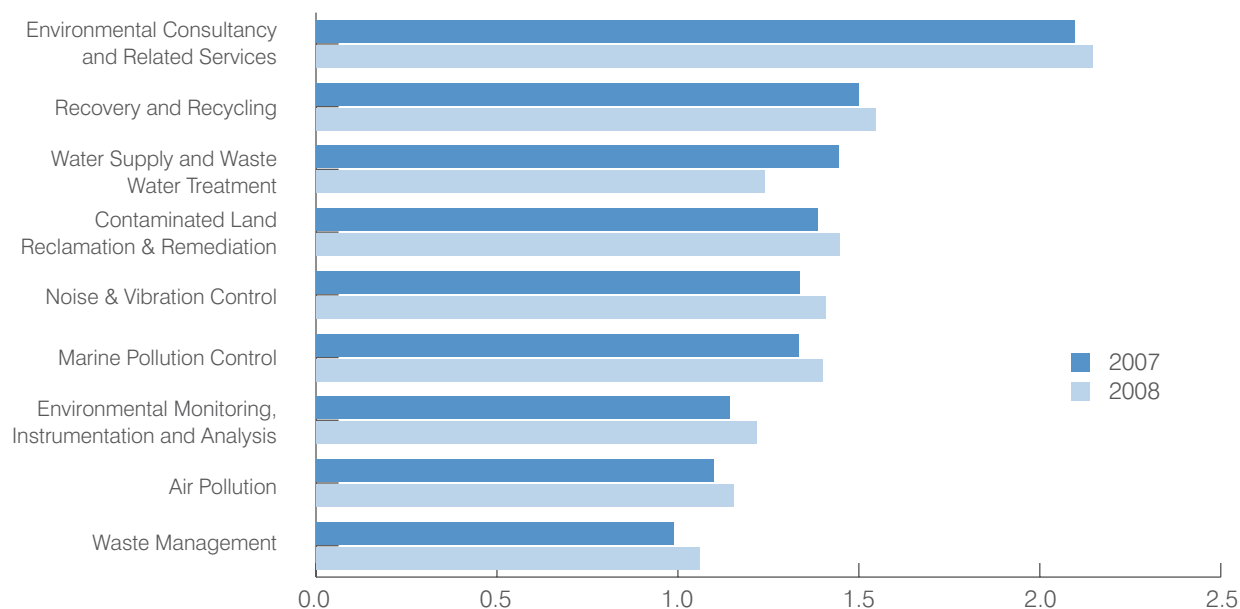
The Scottish Government and the wider public sector has an increasingly important role to play in maximising the influence and incentives to market that the public sector can bring through joined up public agency working and monitoring within environmental resources to:

- promote consistency of data collection and reporting, joint procurement and economies of scale;
- ensure technology developers, researchers, business and industry are aware of emerging legislation and environmental challenges so that technology opportunities can be realised, and Scottish firms can be ahead of the game.

Market Opportunities

Within the Low Carbon Environmental Goods and Services activities the Environmental sub-sectors offer a number of areas where Scotland has a revealed comparative advantage (RCA above 1 indicates that Scotland's exports/imports ratio for a particular item is greater than Scotland's ratio of exports/imports for all goods). This is illustrated in figure 18, below:

Figure 18: RCA Environmental Sub Sectors



Source: *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010.

There are several areas of opportunity that exist in the sub sectors relating to environmental resources across: environmental monitoring and instrumentation; land use; water supply and waste water treatment; minimising air pollution, and; recycling and recovery and waste management.

⁹² <http://www.zerowastescotland.org.uk/>

In 2008/09 the global [environmental monitoring and instrumentation sector](#)⁹³ was worth £4.5bn and the UK market was £0.16bn. By 2014/15 the UK market is expected to grow to £0.19bn.

There are specific opportunities in environmental monitoring sub sector in a number of specific areas relating to the commercialisation of emerging research in areas such as Environmental Genomics research to support environmental assessment and monitoring and the adaptation to environmental monitoring of sensor technology which has been developed for other sectors, for instance for defence. This technology has uses such as remote sensor monitoring which reduces the need to travel to collect environmental monitoring samples and the hazard of collecting samples in hard to access areas.

Biomatrix Water (BW), formed in 2008 and based in Forres, is working to provide high performance ecological water treatment and water recycling technologies which are modular, economically competitive, ecologically biodiverse and aesthetically beautiful. Delivering to markets in the three main countries in which they operate. They are on target to achieve turnover of circa £800k by 2013. The total water market is worth \$45 898m with growth of between 5% and 10.5%.

The majority of conventional treatment systems available today use a relatively narrow spectrum of biological treatment processes and despite advances, most conventional water treatment plants remain slow to build, energy intensive, and aesthetically unattractive. BW's modular ecological approach provides a powerful natural water treatment and water recycling solution. Close to one billion people remain without adequate sanitation or wastewater treatment and close to two-billion lack access to uncontaminated domestic water sources.

In recent years there has been a significant increase in demand for natural technologies, which support a broader spectrum of ecological processes and provide multiple environmental, amenity, and performance benefits. BW provides a range of ecological systems to meet this growing demand.

Water Supply and Waste Water Recycling

In 2008/09 the global [water supply and waste water treatment sub-sector](#) was worth £242bn and the UK market was £8bn. By 2014/15 the UK market will grow to £9bn. [There are over 300 companies in Scotland that play either a direct or indirect role in this sector, some of which are developing the latest technologies for the purification of water supply and the processing of waste water.](#)

Analysis carried out for the Scottish Government reports that the water supply and waste water treatment subsector had a market value in Scotland of £709m and employed 6,200 people in 2008/09. Of the £709m market value in 2008/09, £94m (13.3%) was in exports. Within the sub-sector, Scotland demonstrated strong or above-average performance compared to the rest of the UK in a number of areas⁹⁴:

- Technology, research and development was worth £39m – 21.2% of the UK market, as compared with an average of 7.9% share for the low carbon environmental goods and services sector as a whole;

⁹³ *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

⁹⁴ *Scotland's Low Carbon and Environmental Goods and Services Sector Study*, Innovas Solutions, 2010. Report will be published shortly and will be available at: <http://www.scotland.gov.uk/Publications/Recent>

- Engineering was worth £289m, 13.8% of the UK market;
- Other specific areas e.g. marine pollution control, and water and wastewater treatment.

DEFRA/HMRC Enhanced Capital Allowances for Water Efficient Technologies

The ECA scheme provides 100% first year allowances for investments in certain water efficient plant and machinery. It enables businesses to write off 100% of the cost of qualifying plant and machinery against taxable profits in the year of purchase. The scheme includes a variety of technologies, such as water efficient taps, toilets, monitoring equipment⁹⁵

There are also opportunities relating to development and deployment of renewable energy technologies to decrease carbon emissions from water supply and waste water treatment.

Recycling and Waste Management

In 2008/09 the global combined [recycling and recovery and waste management sectors](#) were worth £336bn and the UK market was £12bn (accounting for over 50% of the total UK environmental sector market value). By 2014/15, the UK market is expected to grow to £14bn. There are around 500 companies in Scotland that play either a direct or indirect role in these sub-sectors.

[Scotland's aspiration to achieve a Zero Waste Society](#) which include the planned legislative changes that will drive separate collection of materials and banning of key materials from landfill have potential to drive high levels of [investment within Scotland](#). This will include opportunities relating to developing technologies to divert banned waste from landfill, generating

energy from waste, and increase segregation of materials for closed loop recycling.

The development of a carbon metric for Scottish recycling performance that will capture and help prioritise the capture and recycling of key materials with high carbon impact as will introducing standards to increase recycle quality and recovered material content in products. There is strong cross over in this approach to protecting and enhancing Scotland's natural environment. Reducing food waste in the supply chain will reduce demand on agricultural land, reducing environmental impact and increasing productivity.

Collecting unavoidable food waste and treating through anaerobic digestion, avoids GHG emissions from landfill, provides green energy and offers a sustainable chemical fertiliser substitute. This example illustrates the sort of opportunities and synergies there will be in a future low carbon economy with the introduction of new technologies such as anaerobic digestion, efficient practices in the supply chain and behaviour change in all areas.

Air Pollution

Optimising climate change policies for air pollution can yield additional benefits of some £24 billion by 2050 to the economy, through actions discussed in previous sections such as:

- Use of ICT – Intelligent Transport Systems to reduce traffic congestion and improve local air pollution impacts;
- promoting ultra low-carbon vehicles;
- renewable sources of electricity which do not involve combustion;
- energy efficiency measures, and
- reducing agricultural demand for nitrogen.

⁹⁵ see the [Water Technology List](#)

DEFRA and the UK Devolved Administrations recently published '[Air Pollution: Action in a Changing Climate](#)'⁹⁶ This document encourages key agencies to examine policies to tackle poor air quality and climate change, and consider integrating these policies when suitable. This would make for a more effective use of limited funds and resources available to tackle these problems.

Land Use

The [Land use sector](#) includes agriculture, forestry, other land based industries such as food and drink tourism and recreation e.g. field sports. [Agriculture is hugely important to Scotland. It is directly responsible for contributing about £700 million to the economy and supporting 65,000 jobs.](#)

[Food and drink accounts for one in five manufacturing jobs in Scotland. If the whole supply chain is included, from primary producers to retailing and food services, the sector supports 75,000 businesses and 360,000 people.](#) The National Food and Drink Policy sets out the Government's economic, health and environmental aims for the food and drink sector.

The Scottish Government is doing educational work in food supply chains in schools, colleges and universities. The main research providers in food production and land management are conducting high level research into reducing carbon into our agriculture and other areas to drive towards lowering carbon usage in agriculture. Farming also provides a range of public goods which market mechanisms do not always reflect: for example, protecting the environment, sustaining communities in remote areas and maintaining a national food producing capacity.

Scotland is unique in that 85% of Scotland's agricultural land is Less Favoured, relying on support to offset the significant natural handicaps, and nearly 65% is suitable only for the rough grazing of sheep and cattle. The Less Favoured Area accounts for over 12,500 farming and crofting businesses. [A Vision for Scottish Agriculture sets out agriculture's significant role in the Scottish economy, food production and environmental sustainability](#)⁹⁷:

[The Scottish Government is working in partnership with the agriculture industry through the voluntary **Farming for a Better Climate** initiative to strengthen farm businesses](#)⁹⁸. The initiative outlines measures that farmers can take to reduce outline measures that farmers can take to reduce outputs and develop new income streams. These key action areas are:

- Using energy and fuels efficiently;
- Developing renewable energy;
- Locking carbon into the soil and vegetation;
- Optimising the application of fertiliser and manures;
- Optimising livestock management and storage of waste.

There are number of opportunities including supporting a move to more sustainable farming practices and developing knowledge and integration of new technologies and scientific practices into the traditional methods used by farmers to support economic sustainability and growth in a low carbon economy. These include:

- Supporting moves to more sustainable farming practice such as use of Anaerobic Digestate as agricultural biofertiliser. Digestates can be used as soil improvers, avoiding the need for farmers to purchase costly fertilisers and

⁹⁶ <http://www.defra.gov.uk/environment/quality/air/airquality/publications/index.htm>

⁹⁷ <http://www.scotland.gov.uk/Publications/2010/02/10144335/1>

⁹⁸ <http://www.sac.ac.uk/climatechange/farmingforabetterclimate/>

so reducing the potential for watercourse pollution;

- Integration of new technologies into farming methods such as the use of minimum tillage, slurry injectors, slurry separators;
- Integration of scientific practices into farming methods such as developing alternatives to nitrate based fertilisers and the use of nitrification inhibitors;
- Diversification to agricultural practices that are resilient to climate change and protect Scotland's rural environment; and
- Research into crop varieties for different climates⁹⁹

In 2008, the Scottish Government established a Climate Change Programme, delivered by Soil Association Scotland, specifically to assist farmers and land managers to be able to adapt and develop their farming practice and enable positive and profitable responses to climate change. The programme aims are therefore not just about skilling up to adapt to climate change, but encourage the farms to grow their profitability.

The Climate Change Programme uses practical skill based seminars based around real life examples of developing farming practice on farms across Scotland. Each seminar is hosted by a farmer who has already implemented adaptation measures. This practical approach is backed up with up to date information and follow up support. Participants feed back the practical adaptations they are putting into place across their farms and demonstrating with this an increased understanding of their role in ensuring agriculture is more efficient, more environmentally sustainable and more productive.

The Climate Change Programme is funded through Scotland Rural Development Programme. It is one of the actions the Scottish Government has put into place for Agriculture as part of the Government's Climate Change Adaptation Framework.

The Common Agricultural Policy (CAP) will be reformed by the European Union post 2013. This will have a strong stimulus on decisions taken at farm level. *Consideration will be given to making the best use of CAP tools through Scottish the rural development plan to support economic growth in the rural economy*¹⁰⁰.

The draft Land Use Strategy, which is currently the subject of public consultation, describes in broad terms the Scottish Government's approach to sustainable land use, and provides a vision for the long-term. It proposes three strategic objectives which mirror the three sustainability pillars: (i) successful land-based businesses; (ii) flourishing natural environments; and (iii) vibrant, sustainable communities, and backs these up with specific actions that Government will take in the next five years. By proposing a national framework of key principles for sustainable land use, the Strategy will inform decisions taken locally about the land, in line with Strategic and Local Development Plans.

The Land Use Strategy is produced against the background of the Government's climate change commitments, and demonstrates the role of land use in a low carbon economy: from reducing greenhouse gas emissions from land use to capitalising on renewable energy opportunities; from carbon retention in peat soils to balancing our goals on food security and tree-planting.

⁹⁹ <http://www.soilassociation.org/>

¹⁰⁰ <http://www.scotland.gov.uk/News/Releases/2009/09/30103311>

Marine economic activity is worth about £2.2bn to the Scottish economy¹⁰¹ Scotland's seas also account for another £20bn from the North Sea oil and gas sector.

The Marine (Scotland) Act 2010 paves the way for a national marine plan to be developed to guide the management of the activities in the seas around Scotland. The plan is required to include objectives relating to climate change, both for reducing Scotland's carbon footprint and on adaptation.

Scotland has significant research strengths in marine, and supported by the Scottish Funding Council, the Marine Science pool MASTS¹⁰² focuses on the effects of marine energy on the marine environment.

Scotland is supporting a growing sustainable aquaculture industry through the implementation of 'A Fresh Start': the renewed Strategic Framework for Scottish Aquaculture¹⁰³. Examples of initiatives which will help Scotland along the road to a low carbon economy include:

- Support for a growing Scottish Shellfish sector (including the establishment of a national shellfish forum). Shellfish production is an environmentally benign/carbon positive industry – taking carbon out of the environment and locking into shells;
- Work on developing microalgae as a feed substitute for finfish aquaculture – as one future solution to reduce ecological & carbon footprint of using fish-only based feed sourced from wild stocks and exported globally;
- Work on developing macro-algae as a biofuel including the establishment of a pilot macro-algae farm.

A Marine and Fisheries adaptation plan is also being prepared as part of the Scottish Government climate change adaptation framework.

Strategic Objectives for Government and Wider Public Sector

There are two main areas of market opportunities in relation to environmental resources and the industries that relate to them, which the Scottish Government and wider public Sector will focus on. These are in relation to: developing and supporting the uptake of new emerging technologies and encouraging and supporting industry to develop sustainable practices that will secure a successful transition to a low carbon economy; and, implementing a regulatory framework that supports the growth of industry and protects environmental resources. Immediate actions are set out in Section 1.3 of the strategy.

Objective 13: the development and uptake of emerging technologies. *Encouraging industry to develop sustainable practices that will support economic growth, while protecting the environment through efficient resource use and minimising waste and pollution.*

The threats to Scotland's environment are changing. Traditional risks arising from well understood, long regulated industries are reducing. New risks are being identified and will require ongoing research and monitoring to understand how Scotland's environment responds to new developing industries. This is essential so that we can target regulatory activities and identify new technology solutions to reduce environmental harm, protect the environment whilst supporting business and economic growth.

¹⁰¹ <http://www.scotland.gov.uk/Publications/2008/04/03093608/0>

¹⁰² <http://www.masts.ac.uk/>

¹⁰³ <http://www.scotland.gov.uk/Publications/2009/05/14160104/8>

Improvement in data and understanding where there is real harm to the environment resulting in a more targeted approach to environmental protection and improvements where we can make the greatest impact, will underpin development of business and industrial processes for the future.

It is essential that Scotland's low carbon economy will impact positively on air, soil and water quality, food production, and will contribute directly towards climate regulation. Many aspects of the LCE will have effects on the supporting ecosystem.

Ecosystem Services¹⁰⁴ provides a framework for sustainable management of environmental resources. It requires the consideration of the effects of actions on every element of an ecosystem, based on the recognition that all elements of an ecosystem are linked. While water supply and waste water treatment is an area where Scotland has strengths, we currently lack a single market-focused grouping to pool the efforts of our water companies into a comprehensive effort to meet our domestic needs for water solutions, and additionally to collectively target and exploit international market opportunities.

Scottish Water will evolve from a successful utility into a dynamic water agency, helping Scotland to become the world's first hydro-economy, wisely exploiting our water to help drive our economy. Scottish Water is currently the largest consumer of electrical power in Scotland. Instead, the Scottish Government intends to give it the powers to become one of the largest generators of renewable electricity in Scotland. Scottish Water will also support the bid to hold the **2015 World Water Forum**, which would bring up to 30,000 delegates to Glasgow, including heads of state and Government.

Scottish Water will also assist in establishing a **Scottish centre of excellence** that is modelled on the Stockholm International Water Institute, to foster commercial and humanitarian innovation. Scottish Enterprise and Scottish Development International are already working with a number of companies and universities to create a new industrial grouping to address the opportunities and challenges in the water market at home and abroad;

Assessing carbon in decision making

A broad view is required when identifying where Scotland should be targeting its greatest low carbon opportunities, taking a balanced approach to the consideration of environmental/resource, costs and benefits, when assessing options for the future economic transition e.g. water resources against energy use, food production against sustainable biofuels, natural habitats against agricultural intensification.

As an example Scotland's soils are rich in carbon, containing some 3,000 Mt of carbon. Developments on peat might generate losses of carbon which in some cases may reduce the potential environmental benefits of the scheme. **Scottish Government, energy suppliers and environmental NGOs are working together to better understand the impact of building wind farms on peatlands, which will facilitate a measured sustainable approach being taken.** Work funded by Scottish Government developed a tool to calculate the impact of wind farm developments on soils carbon stock held in peat. This provides a transparent and easy to follow method for estimating the impacts of wind farms on the carbon dynamics of peat lands. The tool is recommend for use by developers in the consenting process¹⁰⁵.

¹⁰⁴ <http://www.ecosystems-services.org.uk/ecoserv.htm>

¹⁰⁵ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance>

Carbon Decision Making

Scottish Government is developing a carbon metric to drive recycling of all resources in Scotland. This metric is aimed decision makers in the waste management sector to help them priorities the reuse and recycling of specific material, with a high embedded carbon content. The metric will be used to measure Scotland's recycling performance in the future. Recycling has the potential to not only reduce Scotland's direct emissions, but Scotland's global carbon footprint.

SEPA's Controlled Activities Regulation Methodology (WAT-RM-34) for licensing of hydro schemes – balancing adverse impacts on water environment against positive climate change impacts. The methodology requires the positive and negative impacts of new activities to be taken into account so that clear and consistent decisions about their contribution to human health, human safety or sustainable development can be made.

Working with the UK water industry, Scottish Water has developed mechanisms for carbon accounting that may prove to be useful when considering how to assess carbon in regulation. Work is ongoing between SEPA and Scottish Water to explore how this approach might work in regulatory decisions.

Materials

Scotland's economy is highly dependent on the availability of primary materials to produce the goods, services and infrastructure that we all take for granted as part of modern life. The transition to a low carbon economy requires inputs of materials and energy – aggregates, timber and steel for construction; indium for solar panels; lithium and rare earth metals for wind turbines and electric vehicles; phosphorous for agriculture; palm oil for food and drink; copper for transformers and electricity transmission.

Quality Meat Scotland, the National Farmers Union and the Scottish Agricultural Organisation Society published *Producing More With Less: A Joint Industry Commitment on Climate Change*. This sets out the agricultural industry's commitment to achieving a low-carbon economy and highlight that agriculture can mitigate the effects of climate change while enhancing its own economic sustainability. http://www.nfus.org.uk/uploadedFiles/Campaigns/Climate_Change.pdf¹⁰⁶

Some raw materials can be considered to be particularly critical, for three reasons: their significant economic importance for key sectors; high supply/cost risks; and a lack of substitutes.

A crucial challenge to Scottish business and industry is therefore to become more efficient in the production of goods and services, reducing primary resource demand and recovering valuable resources from the waste stream.

Strategic Objective 14 Setting a policy and regulatory framework. Supporting the growth of industry and protects the environment and available natural resources.

Environmental Regulation should not be viewed as a barrier to realising new low carbon opportunities and solutions. Effective, targeted and enabling Policy and Regulation can support business and communities secure the transition to a low carbon economy through the setting of standards, emission limits; and drive innovation/behaviour changes to encouraging cost effectiveness through resource efficiency and the uptake of new environmental and low carbon technology solutions and practices.

¹⁰⁶ http://www.nfus.org.uk/uploadedFiles/Campaigns/Climate_Change.pdf

Economic opportunities lie in developing technologies to support Scottish business and industry in meeting emission standards and compliance with regulation and adapting the regulatory framework to support the innovation processes (particularly in the areas of development and demonstration) and uptake of new technologies. Some examples of how environmental regulation can support innovation and a low carbon economy are highlighted below:

The [Better Waste Regulation Action Plan](#) recognises that legislation on waste was written at a time when Scotland's principal means of dealing with waste was to landfill it. New policies, practices and technologies have emerged in recent years which mean that the legislative controls could be improved to encourage innovation and ensure that the aims and requirements of the Waste Framework Directive are delivered in their modern context.

[Scotland's Zero Waste Plan](#) looks at new regulations to achieve its vision whilst creating a stable regulatory framework providing confidence for investment and innovation, and helping to reduce green house gas emissions. For example:

- Reducing the amount of bio-degradable and valuable resources waste in landfill to avoid production of methane, one of the main greenhouse gases;
- Driving separate collection of all materials, to aid high levels of recycling and reduce dependence on primary raw materials. This will reduce energy (and CO₂) required to extract raw materials; and
- Specifically drive separate collection of all food waste. This will lead to Anaerobic Digestion facilities, renewable energy potential and production of a sustainable fertiliser.

Fertilisers account for a significant part of Scotland's green house gas emissions resulting from land use. [Environmental legislation \(Nitrates Directive\)](#) has limited the quantities of nitrogen fertiliser that farmers in certain areas may apply to land and introduced other measures for the protection of the water environment.

Following a formal transfer of functions from the UK Government to Scottish Ministers, the [Pollution Prevention and Control \(Scotland\) Amendment Regulations 2009](#) extended SEPA's powers to reduce the energy consumed by industrial plants. While not designed to directly regulate CO₂ emissions from industrial processes, the regulations enable SEPA to indirectly influence the carbon intensity of larger industrial processes (referred to as Part A0 through the requirement to apply Best Available Techniques (BAT) to the efficient use of raw materials and energy.

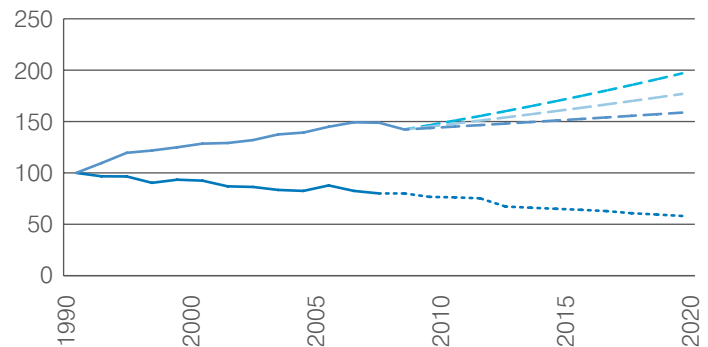
[Water Framework Directive – River Basin Management Plans \(RBMPs\)](#) ensure that public sector bodies, businesses and individuals work together to protect the water environment and address significant impacts by co-ordinating all aspects of water management to protect and improve ecological quality of the water environment. Actions include ongoing reduction of pollution, over-abstraction, engineering modifications that have caused damage to banks, beds and shores; invasive non-native plants and animals.

Low Carbon Economic Indicators for Scotland.

The tables below show give an indication of the impact that moving to a low carbon economy is having on GVA, carbon productivity and energy productivity in Scotland.

Low Carbon Economy – GVA & Emissions

- GVA (1990 Prices)
- - 1% GVA Growth Scenario – Based on Long Run Average
- - 2% GVA Growth Scenario
- - 3% GVA Growth Scenario
- Emissions
- Projected Emissions

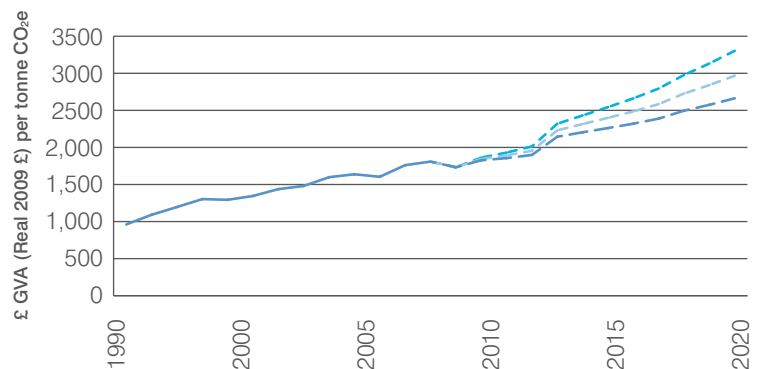


Emissions have fallen by around 20% from 1990 to 2008. GVA increased by around 45% over the same period.

Low Carbon Economy – Carbon Productivity

$$\text{Carbon productivity} = \frac{\text{GVA}}{\text{Emissions}}$$

- Carbon Productivity
- - 1% GVA Growth Scenario
- - 2% GVA Growth Scenario – Based on Long Run Average
- - 3% GVA Growth Scenario

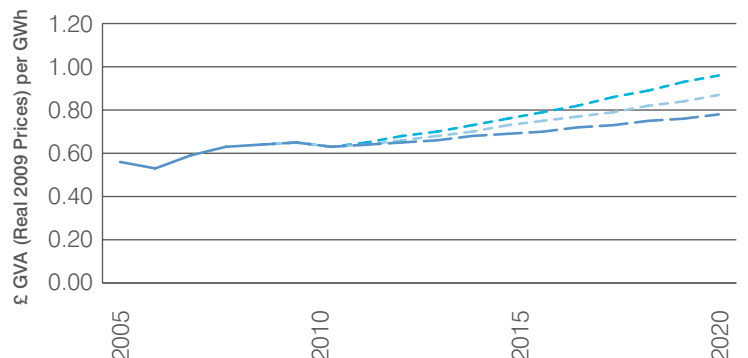


Carbon productivity has risen by almost 90% between 1990 and 2008. Successful delivery of the reduced emissions target would see it improve by a further 50%-75% depending on the growth rate of the economy.

Low Carbon Economy – Energy Productivity

$$\text{Energy productivity} = \frac{\text{GVA}}{\text{Energy Consumption}}$$

- Energy Productivity
- - 1% GVA Growth Scenario
- - 2% GVA Growth Scenario – Based on Long Run Average
- - 3% GVA Growth Scenario



Energy productivity in Scotland had been rising prior to the recent recession and would be expected to continue to rise as the economy recovers.



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