

One of the frustrations with the ongoing Brexit burach is that important debates about the future of our economy have been crowded out.

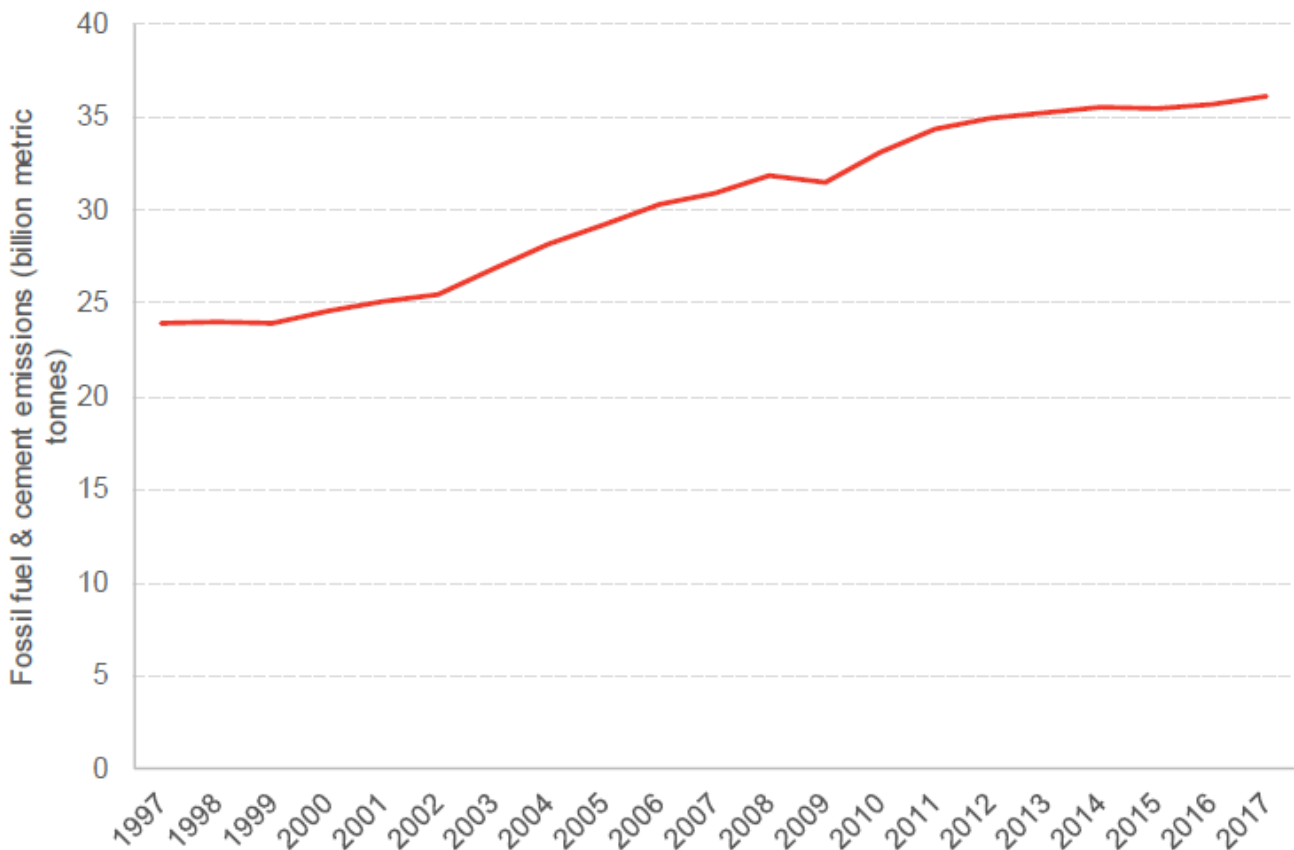
As we have highlighted in previous Commentaries, Scotland faces a number of significant structural challenges. Our population will age significantly, whilst - for many - the world of work will change radically as existing tasks are increasingly automated.

But there are also opportunities, with new markets opening up and technology helping to support improvements in living standards.

One area that has captured the public attention has been climate change. Across the world, we have seen a renewed desire from governments to step up their response to the environmental challenge.

Global CO₂ emissions rose sharply at the start of this century and, despite a range of international initiatives, they remain at near record high levels. The consequences of a rapidly changing climate for the vital ecosystems on which we all depend are hugely significant.

Chart 62: Global CO₂ emissions from fossil fuel & cement emissions, 1997 - 2017



Source: Global Carbon Project

In April, the First Minister declared a 'global climate emergency'.

Just last month, the Scottish Parliament passed a new Climate Change Bill, which legally binds the Scottish Government to achieve 'net zero' by 2045 - five years ahead of the UK. An opposition amendment to up an interim target, to achieve a 75% reduction by 2030, was also supported.

This puts Scotland as one of the most ambitious countries in the world in terms of its commitment to tackling climate change.

Of course, targets do not themselves reduce emissions.

The Scottish Government has backed up its ambitions with a range of policy announcements, most recently in September's Programme for Government, on transport, housing and business investment. This is clearly an area where Holyrood is setting a bold agenda, with a consistency of approach, visibility of leadership and commitment to action that sets it apart from the rest of the UK.

The Committee on Climate Change's chairman Lord Deben commented on Scotland's ambitious target: "Scotland has led the UK in reducing its emissions and has ambitions to lead the world in tackling climate change: this Programme for Government suggests that vision is alive and well".

But the scale of the challenge - in both Scotland and the UK - should not be underestimated.

Achieving such significant reductions in CO₂ emissions will require a fundamental change within nearly every aspect of day-to-day life, including the way we heat our homes, the locations and types of new building stocks, the sources of our food supply and the transport systems we depend upon.

It is not clear that the true scale and pace of this change required is yet fully appreciated.

Moreover, many of the most difficult - and unpopular - decisions have yet to be taken. The hope that technologies such as carbon capture and storage, hydrogen or large scale battery capabilities, will come to the rescue and so minimise the need for substantial changes to the lives of households across Scotland remains a risky bet.

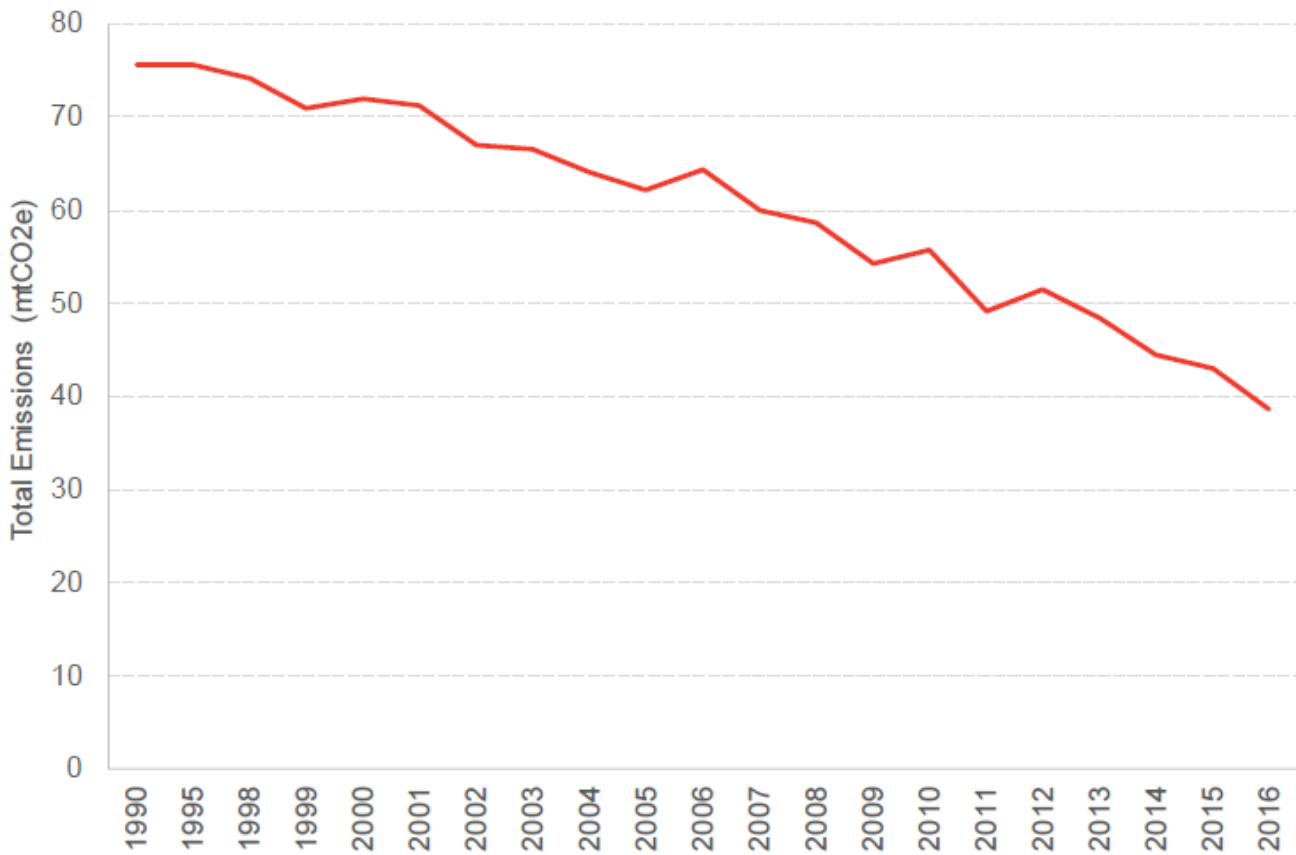
And even if net zero is achieved globally by 2050, the science suggests that our climate will continue to warm. So alongside efforts to reduce emissions, policymakers will need to plan for coping with this reality.

The transition to net zero

In 2009, the Scottish Parliament passed a ground-breaking Climate Change Act which bound the government to reduce emissions by 80% by 2050 from a 1990 baseline.

Over time, Scotland has seen significant emission reductions, with total emissions almost half the 1990 level.

Chart 63: Total emissions in Scotland, 1990 - 2016

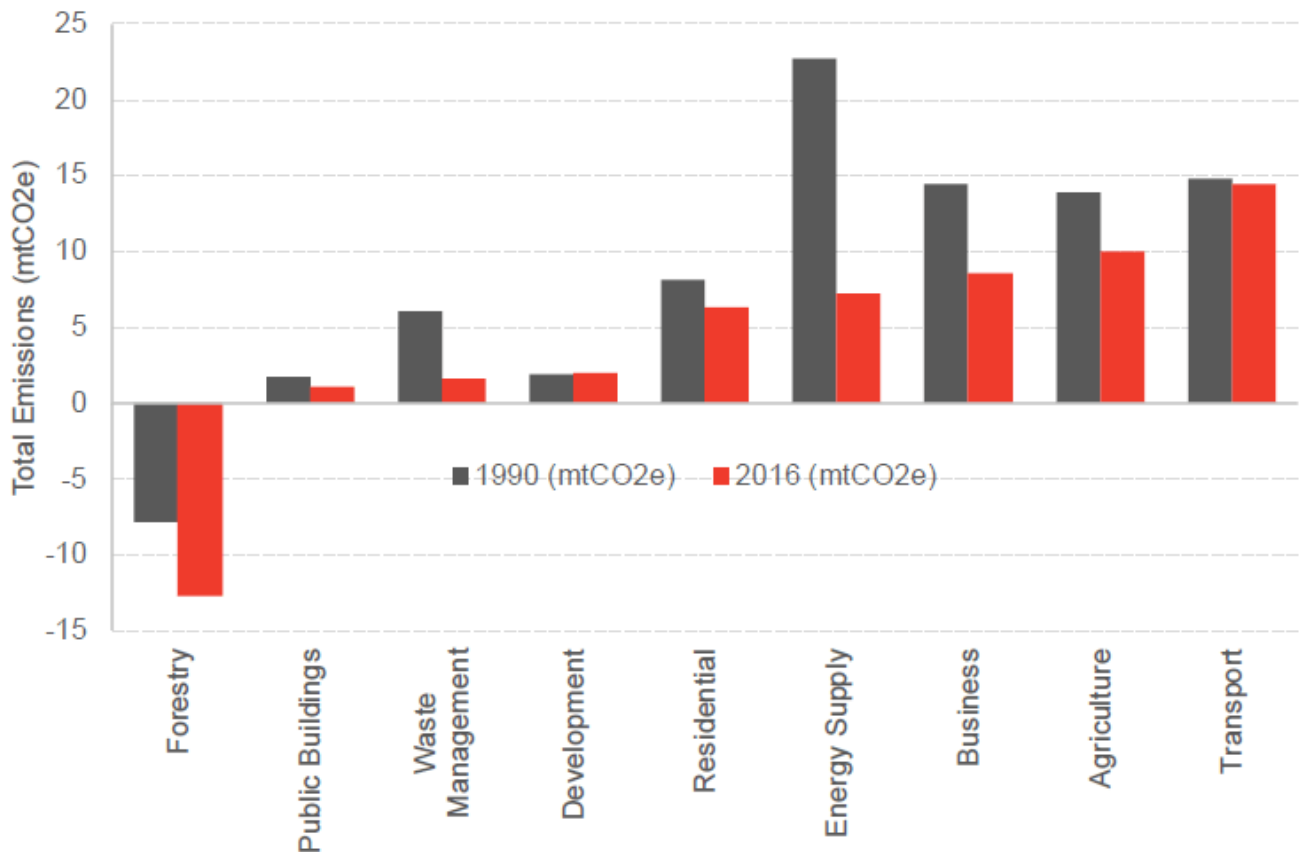


Source: Scottish Government

Whilst this reduction is significant - and ahead of most EU countries - Scotland now plans to go further, and over a much shorter time period.

The strides made in reducing emissions have been spread across different sectors of Scottish society.

Chart 64: Scottish emissions by sector, 1990 & 2016



Source: Scottish Government

Energy supply has clearly been a major success story. Scotland now has the second highest percentage of renewable electricity in the EU, increasing the proportion of consumption generated by renewables from 20% in 2007 to over 75% in 2018.

But to reach net zero, there will need to be much more. Electricity demand will rise rapidly as more systems — such as cars, buses and heating — shift from fossil fuels. To meet future demand, renewable generation is likely to have to quadruple in capacity.

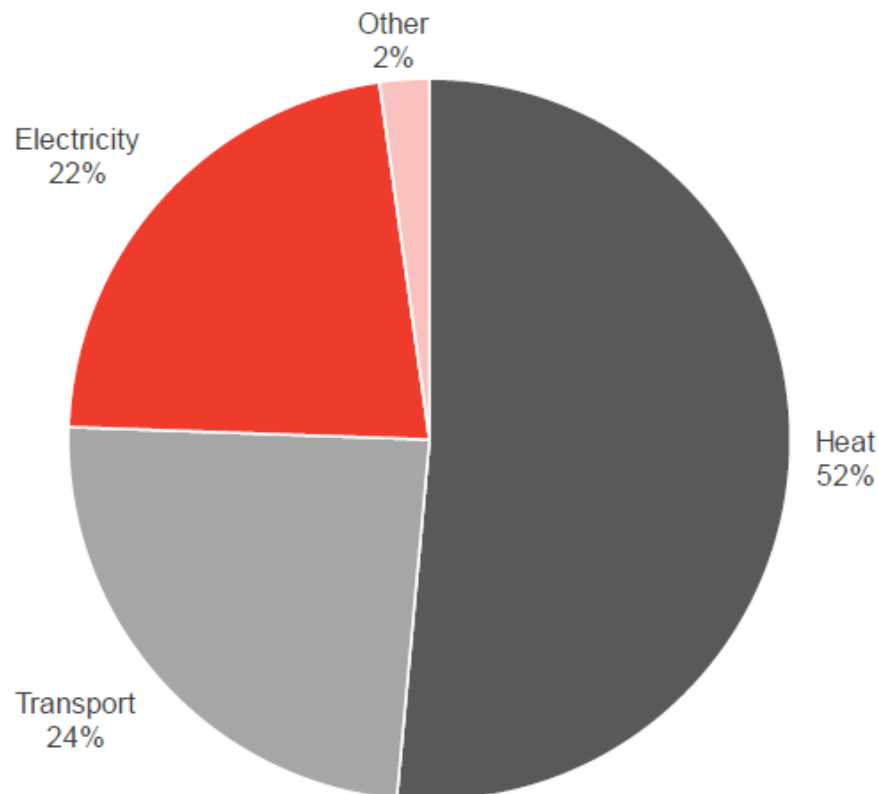
In other areas, progress has been slow.

Scotland has amongst the lowest levels of renewable heat source in Europe.

With around 80% of Scotland on the gas grid, converting millions of households to

renewable sources will be a major undertaking. From 2025, gas boilers will no longer be fitted in new homes.

Chart 65: Total final energy consumption by sector



Source: Scottish Government, BEIS

But for existing homes (75% of Scotland's housing stock was built prior to 1982) a scalable solution - whether through local heat networks, heat pumps or hydrogen - is needed.

There has yet to be any large-scale trials for any of these technologies. And it is likely to be years before they are tested to a standard to operate across Scotland's housing stock and environment. This is one area where there is an urgent need for a more ambitious - and deliverable - plan for change.

Similarly, whilst other sectors have decarbonised, transport has not. Surface transport

emissions have now risen for the fourth consecutive year. When including aviation and shipping, transport is now Scotland's single largest source of greenhouse gases, accounting for 37 per cent of emissions.

The electrification of our transport network is for example a daunting task. More than 70% of Glasgow residents live without private off-street parking with limited capacity to install charging facilities. Much also depends upon manufacturers bringing enough new electric cars to market.

While a large part of cutting emissions will stem from renewables and cutting back on our energy demand, industries such as steel, petrochemicals, and construction will still produce large amounts of CO₂. Solutions for these industries will be needed.

A further radical change is likely to be required over land use, with the need for new forests both to help offset any remaining emissions and as a source of bio-fuel. But how much of Scotland's countryside will be impacted even just to generate 10% of heat demand from biomass? Similarly, what might be the implications from radical efforts to restore peatlands?

The political and environmental implications of changing Scotland's eco-system, and re-imagining land-use management, in radical ways should not be underestimated.

How much - and what - we eat is also likely to change. Agriculture is a major source of emissions. A combination of changes to sourcing of food, diet and waste will all be required. The Committee on Climate Change believe that we will need to reduce consumption of meat and dairy by 20% (at least). This is one area where Brexit provides an opportunity to design a new post-CAP framework that has a greater role for low-carbon farming practices.

But even with such changes, current plans are still heavily dependent upon much of the heavy lifting coming from new technologies that are in their infancy or have yet to be even invented. Their development, cost and timing of deployment are all elements that the Scottish Government has little, if any, influence over.

All of this will require a level of investment and degree of economic planning not seen since the Second World War.

The policy agenda

The establishment of high-level targets are clearly an important step.

And the announcements in this parliamentary term are significant. But collectively, they will

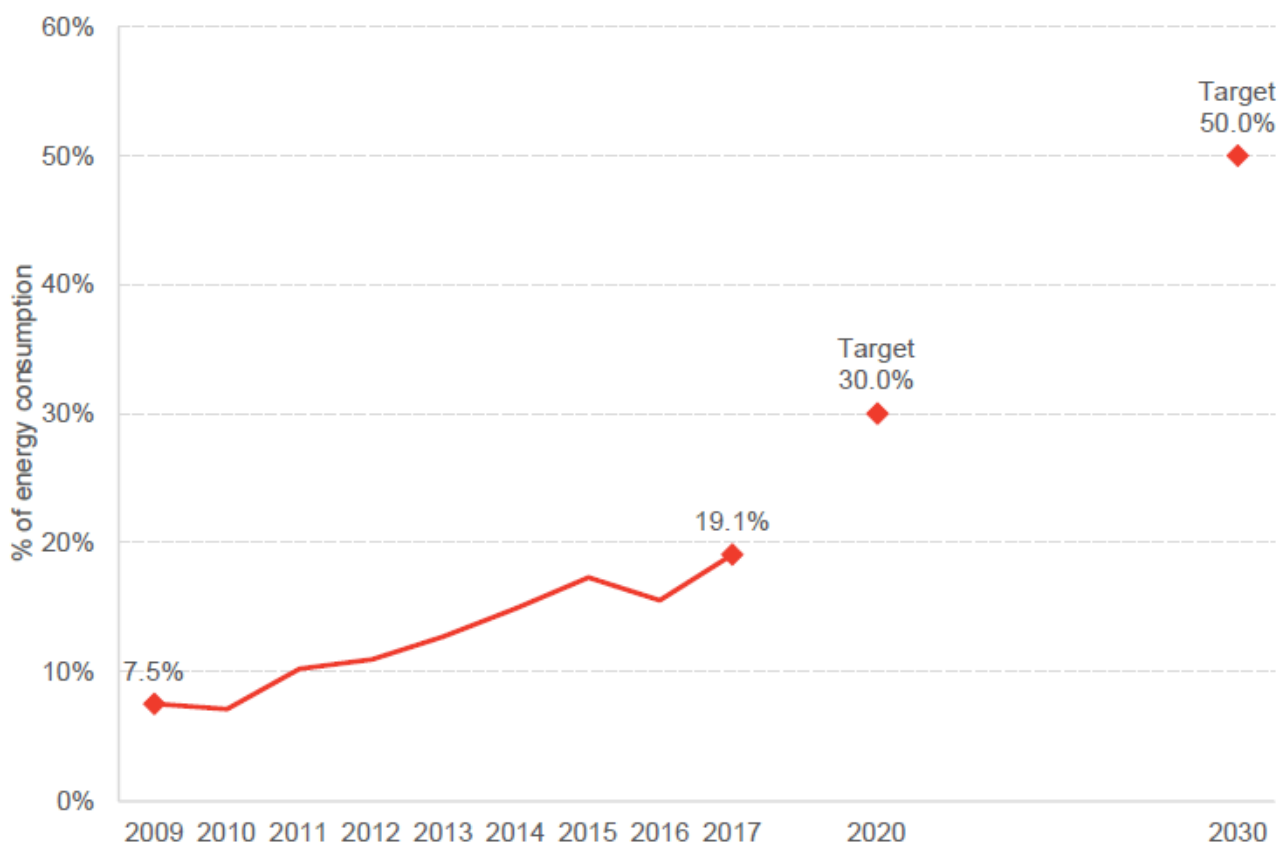
still only make a small dent in the scale of the change needed.

At the UK level, the Committee on Climate Change concluded in July that progress was generally "off-track" in most sectors, with only seven out of 24 indicators where they should be in 2018.

Arguably, many of the 'quick-wins' - e.g. in renewable electricity - have been made. Many more will not be as easy.

The scale of the progress required is hugely significant.

Chart 66: Share of renewable energy in gross final energy consumption, Scotland, 2009 - 2017 (with targets)



Source: Scottish Government, BEIS

Many of the changes so far have yet to impact upon people's day-to-day lives. But future changes will.

And they won't be costless.

Of course, many of these 'costs' will take the form of new investment, creating jobs and across the economy. The Committee on Climate Change estimated an extra 1% of GDP per year will need to be diverted to investment by 2050.

But even then, real 'net' costs will still be incurred. Being upfront about their scale, timing and who they will impact upon (and how any 'losers' will be compensated in the "just" transition, will be crucial in ensuring long-term public support)

Not all of the changes will be popular.

The Scottish Government has already faced some pushback over its reversal for planned cuts to Air Passenger Duty (which incidentally was a nonsensical policy anyway) and plans to permit councils to implement a workplace parking levy (the so-called 'car park tax').

But major changes will be necessary. And whilst there might - quite rightly - be disagreement over individual policy decisions, there is a responsibility on politicians of all parties to avoid seeking to make short-term political gains at the expense of longer-term action.

Building citizen acceptance through political leadership and harnessing trusted voices and institutions will be crucial. Rapid consumer transitions have happened in the past, but require effective information sharing and rapid responses to public concerns.

Achieving net zero is not something that is purely in the gift of the Scottish Government. Scotland's success in reducing emissions will be heavily dependent upon action taken at the UK level, particularly in reserved areas linked to industrial emissions and in large scale financial support for innovation and R&D.

Whilst it is right that the Scottish Government is leading the charge, the onus must be on businesses themselves to deliver change. Individual businesses and business leaders need to commit to net zero carbon and collaborate across their supply chains to implement low-carbon technologies at scale and pace to drive long-term change.

Ensuring that existing business that might not consider itself as low carbon make the changes needed to operate in a low carbon environment will not be easy. Whether or not we

ultimately end-up with a carbon tax will largely depend upon how businesses themselves push forward the climate change agenda

The economic opportunities

But whilst there are challenges, there are also significant opportunities.

Across the globe, an estimated \$13.5 trillion of new public and private investment in the global energy sector alone will be required by 2030. This will create jobs and opportunities across our economy.

It is arguably in this area that most of the hard thinking needs to take place – how to secure the economic opportunities from Scotland's climate change leadership?

Scotland has major potential in key aspects of the low carbon economy, from developing technologies to improve the efficiency of renewable energy projects through to agriculture and forestry. The development of a circular economy through design, re-use, re-manufacturing and re-cycling has the potential to create new jobs across a range of sectors. To achieve this, Scotland can draw upon its strong scientific research base and expertise in key sectors from energy through to high-value service and financial firms.

Scotland's oil and gas industry will be crucial, both in terms of continuing to supply vital energy needs for the foreseeable future but at the same time using its expertise in key technologies to support the transition into new energy systems of the future.

Past history suggests that this is easier said than done. We have not yet created the large-scale manufacturing cluster that our renewables figures would suggest we should have done. Much of the technology and kit for the large onshore and offshore windfarms that now exist in Scotland has been imported.

The jobs boom promised as yet to materialise. The ongoing challenges around BiFAB are a reflection of many of the wider challenges faced by the sector.

However, there are signs that the government has listened.

The new Scottish National Investment Bank's primary mission is to ensure transition to net zero, with the aim of helping to support the growth of low carbon businesses and technologies. The new National Manufacturing Institute of Scotland (NMIS) aims to help support a renaissance of advanced manufacturing – skills and expertise that will be required to support the building of the new technologies required.

New developments in offshore wind technologies demonstrated in Scotland and the UK will have a global market of up to £30 billion per year by 2030.

But as always, the challenge will be balancing these more indirect, longer-term investments with short-term pressures. In a world of tight public sector budgets and increased demand in areas such as health and social care, money will be scarce.

At the same time, care is needed to ensure that arbitrary annual targets on emissions do not create unhelpful incentives. There is a risk of sunk investment and businesses struggling to make changes in very tight timescales, which might ultimately undermine long-term objectives. Careful planning and coordination will be key.

The UK Government's Industrial Strategy, its Clean Growth Strategy and National Productivity Investment Fund all have important roles in helping to unlock future business opportunities. But here, there is a chequered history. The UK's record on supporting new technologies such as carbon capture and storage is not great.

But it is only at the scale of the UK as a whole can there be sufficient resource to support increased ambition in developing complex and high capital cost technologies and systems.

It is inevitable that much greater investment from the public sector will be required than is currently planned. This is why the concept of a 'Green New Deal' continues to gain traction. Alongside investment, new policies and incentive mechanisms will be required to support innovation, the deployment of new technologies, the creation of new markets and the need for workers with the appropriate training and skills to take advantage of the global opportunities.

At the same time, there will need to be greater recognition of the complex interactions of different policies and investments.

New frameworks and analytical tools will need to be developed to assess the consistency of policy approaches and the potential for both positive and negative spill-over effects. In recent work, as part of the UK Energy Research Centre, we showed how economic policy objectives – such as to boost productivity or international exports – could actually make achieving net zero more difficult.

Perhaps most of all, the importance of setting out a stable long-term environment for investment will be the most effective policy that anyone could set.

It will also require international cooperation, both in terms of connectivity, R&D and

investment.

In the current climate both of these elements might seem far off, but the sooner stability and cooperation returns to our political system the better for all of us.