



Scotland analysis: Energy

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Any enquiries regarding this publication should be sent to us at:

The Correspondence Unit
Department of Energy and Climate Change
3 Whitehall Place
London
SW1A 2AW

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Contents

Executive summary	5
Introduction	15
Chapter 1 A single integrated market	19
Chapter 2 Low carbon energy	45
Chapter 3 Oil and gas	57
Chapter 4 Effects on businesses and consumers	69
Chapter 5 Energy liabilities	83
Annex Glossary	95





Executive summary

In September 2014, people in Scotland will take one of the most important decisions in the history of Scotland and the whole of the United Kingdom (UK) – whether to stay in the UK, or leave it and become an independent state. This paper looks at the implications for energy policy if people in Scotland vote in favour of independence.

Energy is critical: it is needed for heat, transport, and to power homes and businesses. Energy is key to a functioning economy and the sector is crucial to delivering growth and investment. Ensuring the UK has a secure, clean and affordable energy supply and that energy plants that have reached the end of their lives are dealt with safely, are therefore key priorities of the UK Government.

Scotland, Wales and England currently enjoy a fully integrated Great Britain (GB) energy market.¹ The GB energy market is ten times larger than Scotland's alone and therefore costs can be spread across 30 million households and businesses. The scale of the UK economy provides an attractive environment for investment. This makes it easier and cheaper to achieve the UK's energy goals – maintaining energy security while decarbonising and keeping bills as low as possible.

If Scotland becomes an independent state, the current integrated GB energy system could not continue as it is now. Both an independent Scottish state and the continuing UK would understandably be focussed on securing outcomes that best serve their own policy objectives and consumers. This would make it difficult to agree a common approach to energy policy which would be required to maintain a fully integrated energy system, as proposed by the current Scottish Government.

Without unrestricted access to the integrated GB market, the costs of supporting Scottish energy network investment, small-scale renewables and programmes to support remote consumers would fall on Scottish bill payers alone – this would add at least £38² to annual household energy bills and around £110,000 to energy costs for a medium-sized manufacturer in 2020.

¹ For a number of reasons, including geographical proximity, Northern Ireland has a shared energy market with the Republic of Ireland – Single Electricity Market. Unlike with the current GB model, the Single Electricity Market does not share the full cost of maintaining and strengthening the transmission network across borders, nor share the cost of incentivising low carbon and renewables generation in the same manner as the UK integrated system. See Chapter 2 for more details.

² Further detail set out in Chapter 4.

In addition, if the full costs of supporting large scale Scottish renewables fell to Scottish bill payers the total potential increase would rise considerably – up to £189 for households and £608,000 for a medium sized manufacturer in 2020. This could rise even further depending on an independent Scottish state's share of historic energy liabilities and how these are paid for.

Scotland is currently a net exporter of electricity to other parts of the UK; however this is only a small proportion of demand in England and Wales (4.59 per cent). In the event of Scottish independence, the continuing UK would need to consider how to meet this electricity demand in the best interests of its consumers. An independent Scottish state would be one of the countries the continuing UK could source energy supplies from. The decision to import energy from an independent Scottish state would be taken on a commercial basis and in the national interest of the continuing UK.

Benefits of the single energy market in GB

With its superb natural and human resources, Scotland is one of the world's energy hubs, with oil and gas in the North Sea and a thriving renewable energy industry. The UK is fundamental to the success of Scotland's energy industry. The size of the UK economy, the integrated market, its regulatory regimes and the scale of financial support provided to the oil and gas and low carbon sectors, provide the conditions for business to invest in the energy industries across the whole of the UK.

As part of the UK, Scotland's energy industry is set to benefit from reforms to the electricity market which will bring increased investment in infrastructure – up to £110 billion for the UK in the electricity sector alone by 2020. The UK's integrated regime gives investors the certainty they need to deliver electricity generation at least cost to consumers. This will boost the economy and generate skills, expertise and thousands of jobs in this sector as the UK reduces its dependence on fossil fuels.

The integrated single market is good for consumers in Scotland. The costs of transmitting electricity and gas and support for low carbon energy in Scotland are shared across GB and UK wide schemes. This reduces costs for Scottish consumers and enables investment so renewables can thrive in remote areas. Being part of a larger market also provides opportunities for greater competition, which helps place downward pressure on energy prices and drive up energy company performance.

Integration is also good for the energy industry, as the GB energy market ensures unrestricted access to around 30 million homes and businesses rather than just three million in Scotland alone. Scottish generators have unrestricted access to the wider GB market and UK financial incentives. This underpins and sustains the full commercial potential of the energy industry in Scotland.

The integrated single market supports the ambition of the current Scottish Government to meet 100 per cent of Scottish electricity consumption from renewable sources by 2020.³ This is made possible by the diverse energy mix of the GB market which can balance the intermittency of some renewable power such as wind.

In the event of independence, the integrated GB market could not continue in its current form. Decisions would be taken in the national interests of the continuing UK and its consumers and an independent Scottish state and its consumers. The UK has interconnectors that transport electricity to and from a number of countries in the rest of Europe, and is seeking to develop more.⁴ The market price is paid for power traded across these interconnectors. The UK does not currently provide financial support for network infrastructure or support generation in these

³ *Renewables revolution aims for 100 per cent*, Scottish Government, May 2011.

⁴ The physical linking of electricity transmission systems across border – further detail in Chapter 1.

other countries. When purchasing power from an independent Scottish state, the continuing UK is unlikely to be prepared to continue to make additional financial contributions – such as support for low carbon technologies – to what would be a separate country, over and above the market price for the energy in question.

Energy security

The current arrangements in GB are designed to match energy supply and demand. This requires the sophisticated networks and diverse sources of supply across the whole of GB. This will be critical as Scotland brings on increasing levels of intermittent renewables generation.

UK energy security is high. A recent Energy Index compiled by the US Chamber of Commerce rated the UK second overall in the world for energy security.⁵ The current Scottish Government argues that Scottish generation is essential to keep the lights on in the continuing UK.⁶ The analysis in this paper does not support this conclusion.

In common with other European Union (EU) Member States, the UK is taking steps to ensure that its energy security continues. The UK Capacity Mechanism will find the most cost effective way to maintain security. Scotland, with its ambitions for large scale renewables, is set to benefit from this approach. Scottish independence raises serious questions about how the government of an independent Scottish state would fund required market interventions to ensure security of supply. These have not been addressed by the current Scottish Government.

National Grid balances power supply across the GB market to take account of shifts in demand and generation intermittency. At present Scotland exports power to England and Wales, typically when wind farms are generating electricity. The effect of exports of wind power from Scotland is to reduce the need to generate power from coal and gas fuelled power stations elsewhere in GB. Wind farms in England and Wales also tend to generate electricity at times of high wind, reducing any risk of a shortfall.

In the event of independence, there would be no need for the continuing UK to support an independent Scottish state's energy costs to ensure its own security of supply. The analysis in this paper shows that – even in a hypothetical scenario where there were no flows of electricity between an independent Scottish state and the continuing UK – there would only be minimal impacts on security of supply in England and Wales. This is because the lack of access to Scottish generated electricity under such a scenario would be balanced by the removal of Scottish peak demand⁷ from the system, so would not heighten the risk of blackout or brownout in the continuing UK.⁸

Investment and jobs

Low carbon energy

The UK is one of the most attractive destinations in the world for renewable energy investment and in first place for offshore wind.⁹ Businesses have announced over £34 billion of investment

⁵ *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market 2012*, Institute for 21st Century Energy and US Chamber of Commerce. October 2012.

⁶ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013, page 294.

⁷ Periods of peak demand occur during simultaneous, strong consumer demand. For example, on a cold day households and offices may turn up their heating simultaneously causing a sharp increase in electricity demand.

⁸ Brownouts are instances of electrical voltage reduction, which can cause lights to dim, whilst blackouts are the involuntary disconnection of some customers.

⁹ *Renewable energy country attractiveness index*, Issue 40, Ernst & Young Global Limited, February 2014 pages 16 & 30.

in the renewables industry between January 2010 and February 2014 – over £14 billion in Scotland – with the potential to support around 12,000 Scottish jobs.¹⁰

Scotland accounts for around 10 per cent of electricity sales in the UK but received 28 per cent (£560 million) of the total paid by all UK consumers to support renewable generators through the current Renewables Obligation in 2012-13. Scottish independence risks undermining the current basis for success of the low carbon sector in Scotland. The reality of independence is that Scottish low carbon energy is unlikely to be able to rely on the current levels of financial support provided by all UK energy bill payers.

In addition, the current Scottish Government target of 100 per cent Scottish electricity consumption coming from renewable sources by 2020¹¹ is more likely to be achievable and affordable as part of the UK. An independent Scottish state, meeting these targets by relying exclusively on bill payers in Scotland, would increase household energy bills (detail set out in Chapter 4).

The UK Government is now introducing the Contracts for Difference scheme, which will provide long term support for all forms of low-carbon electricity generation. These contracts provide industry with the long-term framework to make further large scale energy investments at least cost to the consumer.

The UK Government is also pursuing specific measures to support development of renewables in areas of Scotland with considerable energy potential but challenging conditions for developers. As part of the Contracts for Difference incentive scheme, onshore wind generators on Shetland, Orkney and the Western Isles will be granted more support to overcome the additional costs faced by generators, including underwater transmission links and significantly higher operation costs. This is affordable because costs are spread across the UK.

Scotland benefits from other competitions and grants provided by the UK Government and supported by the large UK consumer and tax base, such as a programme to support the commercialisation of Carbon Capture and Storage projects and activities of the UK Green Investment Bank which has its headquarters in Edinburgh. The UK Government has set aside £1 billion for the development of projects in its CCS Commercialisation Programme and is making £100 million available now to the Peterhead project in Aberdeen and the White Rose project in Yorkshire for engineering and design work ahead of final investment decisions. In the event of a vote for Scottish independence, under the competition criteria, it is unlikely Peterhead would be eligible for further funding from the £1 billion available. In addition, the UK Green Investment Bank is underpinned by £3.8 billion of UK Government funding and in the event of Scottish independence it would remain an institution of the continuing UK.¹²

Renewables Targets

The UK's move towards a low carbon economy is strengthened by UK legislation and by legally binding European Union renewable energy targets. In the event of Scottish independence, it is difficult to be sure what Scotland's European Union renewable energy target¹³ would be as an independent Scottish state would have to negotiate the terms of its membership of the EU.¹⁴

¹⁰ *Speech: Address to the Scottish Renewables conference 2014*, Department of Energy and Climate Change, March 2014.

¹¹ The target is to achieve 100 per cent of renewable electricity generation as a proportion of gross consumption: *Renewables revolution aims for 100 per cent*, Scottish Government, May 2011.

¹² *Scotland analysis: Devolution and the implications of Scottish independence*, HM Government, February 2013

¹³ The 2009 European Union Renewable Energy Directive target commits the UK to ensuring that 15 per cent of the UK's final energy consumption (including power, heat and transport) is generated from renewable sources by 2020, either by direct generation, supporting projects in other Member States, or by purchasing renewable credits.

¹⁴ *Scotland analysis: EU and international issues*, HM Government, January 2014.

The current Scottish Government cites the continuing UK's need to meet renewable targets as a reason why the continuing UK would wish to establish a single energy market with Scotland. The analysis in this paper does not support this conclusion. In the event of independence, the continuing UK would need to consider carefully how to meet a new target, as it considers how to meet its energy needs. This could include further investment in renewable energy generation within its own borders (which provides benefits of employment, tax revenues and greater energy security within the UK), imports from outside its borders including from an independent Scottish state or elsewhere, or by supporting projects elsewhere in the EU to get credit towards its target. An independent Scottish state would compete in an international market to sell renewable energy or renewable credits.¹⁵ The likelihood of doing this and the value of credits is difficult to judge at this stage. This is because it is unclear how many EU Member States will have met or exceeded their renewable energy targets in 2020 (and therefore may be able to sell credits), or how many EU Member States will not have met their targets (and may therefore be looking to buy credits). Consumers in an independent Scottish state are likely to have to contribute more of the cost of Scottish low carbon generation than is currently the case, which could mean a significant increase in consumer bills.

If the continuing UK were to look beyond its borders for low carbon and renewable energy or credits towards meeting its target, it would need to consider which sources provided the cheapest and most reliable options. Scottish production would be one of several possible sources.

Oil and gas

The United Kingdom Continental Shelf is one of the UK's success stories. It has been a major contributor to the UK's energy supply, producing over 40 billion barrels of oil equivalent to date. It has also brought widespread economic benefits in terms of jobs and investment, including direct employment of at least 450,000 people.¹⁶ Industry estimates that approximately half of the UK oil and gas industry jobs are based in Scotland.¹⁷

As part of the UK, Scotland benefits from being part of a larger economy, better able to support the industry to ensure the continued exploitation of oil and gas reserves. It also benefits from the broader and more diverse UK tax base which shields the Scottish economy from the volatile exploration tax receipts, and an active UK Government working at home and internationally to promote the industry and secure investment.

The UK Continental Shelf is a relatively mature region, which must compete for investment with other younger basins across the world, many of which have fewer technical and economic challenges associated with extraction. The UK Government is committed to increase the competitive appeal of the UK Continental Shelf and maximising the economic recovery of the UK's offshore oil and gas resources. Over the coming decades, the challenges of extraction are changing, with greater investment needed to recover reserves. This requires greater emphasis on fiscal incentives than ever before. By accepting and fast-tracking all the main recommendations of Sir Ian Wood's review into maximising North Sea revenue, the UK Government is providing substantial support to the industry with the ambition of keeping the

¹⁵ The EU's Renewable Energy Directive allows for some flexibility in meeting the target through 'flexibility mechanisms', designed to allow those Member States with lower renewable generation potential or higher costs to partially fulfil their renewables targets in or with other countries. One of the flexibility mechanisms included within the Directive includes statistical transfers (Article 6): whereby one Member State with an expected surplus of renewable energy can trade it statistically to another Member State. A statistical transfer allows a Member State to buy or sell a unit of renewable energy credit from or to another Member State without having to physically transfer that unit of energy.

¹⁶ *Economic Report 2013*, Oil & Gas UK, 2013, page 9.

¹⁷ *Economic Report 2013*, Oil & Gas UK, 2013, page 58.

basin competitive and potentially recovering 3-4 billion more barrels of oil than would otherwise have been produced.

Scottish independence risks undermining the very features of the oil and gas regime that have brought it such success. An independent Scottish state, with its smaller economy, would have to support the industry in the long-term as reservoirs become more challenging to extract and reserves begin to deplete. UK Government analysis concludes that an independent Scottish state would have to invest around £3,800 per head – over ten times more than when costs are spread across the UK – to match the £20 billion the UK Government has committed towards decommissioning in the North Sea. In addition, even if an independent Scottish state was able to radically adjust fiscal policy and implement an oil fund, it may take considerable time to build up a fund of adequate size to manage volatility in Scottish public finances.¹⁸

Energy Networks

Energy needs to be transported to where it is needed to heat homes and power businesses. This currently relies on complex and interconnected energy networks and the physical infrastructure that transports energy around GB. These are receiving major investments to upgrade them to adapt to changing energy production and needs. A GB-wide perspective is taken about where investment is made, who benefits and how the costs are shared.

Ofgem has already earmarked investment of up to £6 billion (almost 30 per cent of the investment earmarked for GB upgrades) for 2013-21 for electricity transmission projects¹⁹ in Scotland, which are critical to reinforcing the grid. Projects such as the Western High Voltage Direct Current Link (a 2200MW transmission cable, sited under the sea) also help to underpin the growth in deployment of renewables generation. In addition to the investment in electricity transmission, the total expenditure for gas transmission networks across GB is £5.5 billion between 2013 and 2021.

Extensive energy infrastructure upgrades are needed in Scotland. At present these important electricity and gas transmission upgrades are financed by consumers across GB. In the event of independence, these costs would need to be negotiated between an independent Scottish state and the continuing UK. It is highly unlikely that the current levels of integration and the GB-wide approach to maintaining and improving the transmission network could continue since it is underpinned by the principle of shared costs across GB and the integrated GB energy market, which could not continue in its current form.

As part of the UK's approach to managing the energy system as a whole, consumers in Scotland benefit from schemes which support the costs of supplying gas and electricity to those who live in more remote areas. Specific provisions exist to support the operation of gas networks supplying Scottish customers in Stornoway, Wick, Thurso, Oban and Campbeltown. These networks are not connected to the main GB gas network transmission system and are supplied by liquefied natural gas or liquefied petroleum gas. In 2012, Ofgem approved spending of around £92 million²⁰ between 2014/15 – 2020/21 for supplying independent gas networks in Scotland.²¹ The additional cost of supply is met through a charge levied on gas shippers across the whole of GB.

¹⁸ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

¹⁹ Make-up of £6 billion figure sourced from *R110-T1: Initial Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd*, Ofgem, February 2012, page 1.

²⁰ 2009/10 prices.

²¹ *National Grid Gas Plc (NTS): Gas transporter licence special conditions*, National Grid, July 2013, page 281.

The Hydro Benefit Replacement Scheme protects consumers in the North of Scotland from the high costs of distributing electricity over a remote and sparsely populated area. In 2012 this scheme provided an annual saving of around £36 to 690,000 domestic consumers in North Scotland, with the remainder giving bill savings to the 70,000 non-domestic consumers.²² The scheme is paid for by all domestic and non-domestic consumers across GB, costing households less than £1, on average, a year.

In the event of Scottish independence the government of an independent Scottish state would need to decide whether it would continue providing support to schemes which are specifically designed to assist remote Scottish communities, since these would be for the benefit of consumers in what would become a separate country.

Affordability

Keeping energy bills affordable is a key priority for the UK Government. The UK Government is working hard to reduce bills for householders and businesses, recognising the pressures created by rising bills.

The analysis in this paper shows that energy bills for homes and businesses in Scotland would be likely to rise in the event of a vote for Scottish independence. Without unrestricted access to the integrated GB market, the costs of supporting Scottish investment in network investment, small-scale renewables and supporting consumers in remote areas would fall on Scottish bill payers alone. This would add at least £38 to annual household bills in 2020 and £110,000 to energy costs for a medium-sized manufacturer.²³

Scottish consumers also benefit from the funding for Scottish renewable projects provided by the UK Renewable Obligation scheme and the future Contracts for Difference. If the full costs of supporting large scale Scottish renewables fell to Scottish bill payers the total potential increase would rise considerably up to £189 for households and £608,000 for a medium sized manufacturer in 2020. This could rise even further depending on Scotland's share of historic energy liabilities and how these were paid for.

The extent of the impact on Scottish consumer bills would depend on how much of the cost of incentivising the current Scottish Government's ambitions for 100 per cent renewable electricity generation could be recuperated from the sale of renewable energy credits to EU Member States. It is not possible to predict what the price of renewable credits will be as it will depend on supply and the overall demand from Member States who have not met their renewable energy targets in 2020. It would therefore be high-risk for an independent Scottish state to rely on the sale of credits given the potential for it to be highly burdensome for consumers in Scotland.²⁴

²² *Hydro Benefit Replacement Scheme and Common Tariff Obligation: DECC response to the call for comments on the three year statutory review of these schemes*, Department of Energy and Climate Change, August 2013.

²³ A medium-sized manufacturer is an example of a medium-sized business user of energy and is defined as consuming around 10,100 MWh of electricity and 12,300 MWh of gas in 2020. The figures quoted are equivalent to around 6 per cent on energy bills for a medium-sized business user. This percentage figure would be broadly applicable to smaller enterprises as well.

²⁴ A detailed explanation of the potential impact of independence on Scottish energy bills, including the basis for the numbers set out here, can be found in Chapter 4.

There are other costs that would also fall to Scottish taxpayers or bill payers in an independent Scottish state, but these are not included in the figures above as they are difficult to quantify. In particular an independent Scottish state would continue to fund its share of the historic liabilities associated with the nuclear, coal, oil and gas industries (set out in Chapter 5). These costs include £3.5 billion earmarked for nuclear decommissioning costs in Scotland, £620 million associated with the historic liabilities of the GB coal industry, and up to £20 billion the UK has committed to support decommissioning North Sea oil and gas infrastructure that is no longer in use. An independent Scottish state would be expected to take a share of these costs.

An independent Scottish state may also have to address the higher cost of attracting investment to a smaller market with a regulatory regime with less of a track record, costs of investing in the Scottish gas transmission networks, and the likely higher costs incurred in balancing demand and supply across the electricity transmission system in Scotland.

The current Scottish Government claims that bills would be lower in an independent Scottish state, because some costs currently met by consumers that support energy efficiency and provide help to the most vulnerable would be transferred to Scottish taxpayers. This proposal would cost approximately £175 million each year and would need to be met from central resources through increased taxation or reductions in other spending commitments.

The current Scottish Government proposal does not take account of recent initiatives by the UK Government which reduce household bills on average by £50. On 2 December 2013 the UK Government announced measures to reduce household energy bills in Scotland and the rest of the UK. This includes reducing the costs of the Energy Company Obligation, an energy efficiency scheme delivered by major energy suppliers, saving consumers £30-35 on their bills in 2014 with further savings continuing to 2017,²⁵ as well as providing a rebate saving the average customer £12 on their bill in 2014 and 2015. In addition, electricity distribution network companies are taking voluntary action to reduce network costs in 2014/15, leading to a further one-off reduction of an average of around £5 on electricity bills.

The UK Government also announced changes to the Carbon Price Floor at Budget 2014.²⁶ These are expected to reduce household energy bills by £15 and business bills by 3 per cent in 2020.

The UK with its larger and more diverse economy has more scope to take action of this sort. It is uncertain how an independent Scottish state, with its smaller economy, would be able to offer similar support into the future without causing increases in taxation.

Conclusion

Scotland has excellent energy resources and it benefits from the UK's long-term strategy for fiscal and consumer support which unlocks the necessary investment. Current arrangements support the creation of jobs: in low carbon energy with the costs shared across the whole of GB; and in oil and gas, because as part of a larger economy it is possible to invest in the tax reliefs needed to exploit remaining reserves and manage the volatility of tax revenues, and because of the well-established regulatory regime.

In the event of a vote for Scottish independence, the current arrangements for energy across the UK could not continue as they are now. A vote for Scottish independence would create an international boundary where one does not currently exist, with potentially divergent fiscal and regulatory regimes. Maintaining the fully integrated energy system, as proposed by the current Scottish Government, would require both governments committing to agree a common approach. This would be very difficult when both would want to make decisions in

²⁵ The precise reduction in individual households' bills will depend on their energy supplier.

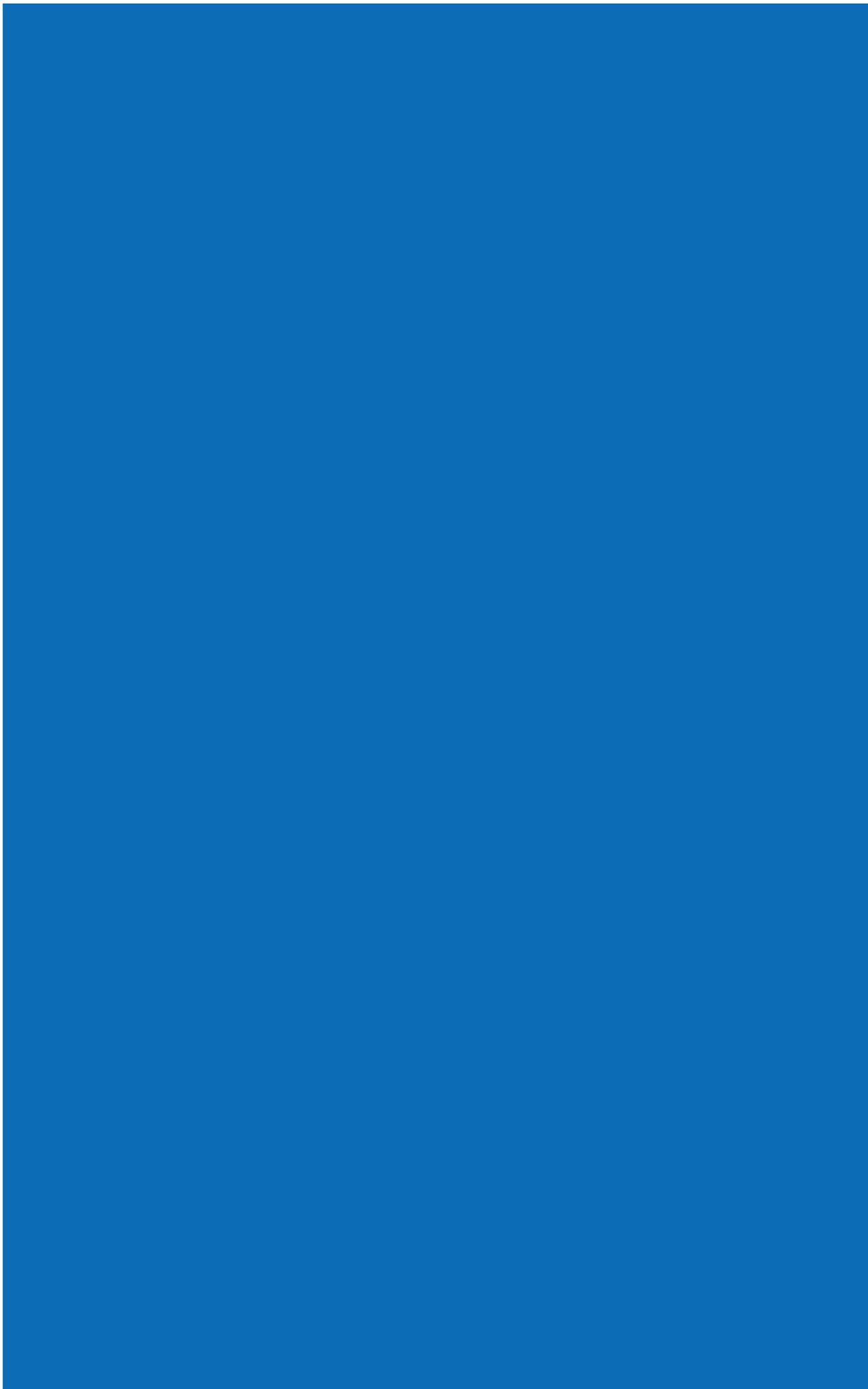
²⁶ *Budget 2014*, HM Treasury, March 2014.

the best interests of their citizens and consumers. This analysis concludes that, with a range of generation sources within its own borders and elsewhere, a continuing UK would not be obliged to purchase energy from an independent Scottish state.

In the event of independence, additional costs for Scottish consumers would be inevitable as the shared costs of network investment and low carbon generation between consumers in an independent Scottish state and the continuing UK would be unwound.

As part of the UK, the costs of energy will be lower for Scottish consumers and businesses as they will continue to benefit from sharing the costs across GB of network investment, low carbon incentives and protection for remote communities. In the event of independence this would inevitably change. At present Scotland benefits from considerable support which is spread over all GB consumers. This includes up to £6 billion (for 2013-21) for electricity transmission projects (almost 30 per cent of total GB upgrades); some £560 million of support for the renewables sector (28 per cent of the total) in 2012-13; and support to 690,000 North of Scotland domestic electricity consumers to protect them from the high costs of distributing electricity over remote and sparsely populated areas.

The analysis in this paper shows that Scottish consumers would end up paying more, possibly considerably more, for energy infrastructure in an independent Scottish state than they do as part of the UK.





Introduction

The union between Scotland and the rest of the United Kingdom (UK) has resulted in deep integration across many areas including energy. It has created a large domestic market, bringing benefits to businesses and consumers across the UK. Bringing this union to an end would have considerable implications for the relationship between an independent Scottish state and the continuing UK. The UK Government believes that Scotland is better off as part of the UK, and that the UK is stronger with Scotland as part of it.

The referendum on independence presents one of the most important decision points in Scotland's and the UK's history. In the event of a yes vote, in the eyes of the world and in law Scotland would become an entirely new state, and the remainder of the UK (England, Wales and Northern Ireland) would continue as before.¹ Scottish independence would fundamentally change the relationship between Scotland and the continuing UK on energy issues. It is therefore crucial that the debate ahead of the referendum is informed by wider analysis, and that the facts that are crucial to considering Scotland's future are set out.

The onus is on those who want Scotland to leave the UK to set out their proposals for independence and address the key questions relating to the implications. However, not all of the answers to these questions can be known in advance of the referendum. This is because some of the details can only be established through negotiations between the representatives of an independent Scottish state, the continuing UK, and other bodies, for example the European Union. These negotiations would have to take place in the event of a vote for Scottish independence.²

The objective of the UK Government's Scotland analysis programme is to provide comprehensive and detailed analysis of Scotland's place in the UK and how that would be affected by independence. The outputs of the analysis will provide sources of information and aim to enhance understanding on the key issues relating to the referendum. As such, the programme should be a major contribution to the independence debate.

Scope of this paper

This paper is the twelfth in the Scotland analysis programme and presents the UK Government's analysis of the energy markets and the policy implications of the debate on Scottish independence. It first reviews the benefits of the current GB and UK frameworks for managing energy policy which has been integral in ensuring secure, clean and affordable energy supply and that energy liabilities are dealt with safely. It then explores some of the potential

¹ *Scotland analysis: Devolution and the implications of Scottish independence*, HM Government, February 2013.

² *Scotland analysis: Devolution and the implications of Scottish independence*, HM Government, February 2013.



implications, costs and risks to which an independent Scottish state may be exposed to ensure Scotland's energy needs are met.

In their White Paper, the Scottish Government set out a number of assertions about how the energy market would operate after independence.³ Although the analysis in this paper considers some policy options that could be available in the event of a vote for independence, the conclusions do not attempt to anticipate final decisions, as this would depend on the outcome of political negotiations between representatives of the continuing UK and an independent Scottish state.

Other important factors affecting some areas of energy policy are addressed in separate papers in the Scotland analysis programme.

The UK Government's fifth Scotland analysis paper, *Scotland analysis: Macroeconomic and fiscal performance*,⁴ sets out the role of economic and fiscal integration in shaping Scotland's economic performance as part of the UK and describes the potential macroeconomic impact of independence. It discusses Scotland's strengths in the oil and gas sector and explores how the UK's broader and more diverse tax base helps maintain the stability of public spending and smoothes the impact of volatile receipts.

The fourth paper, *Scotland analysis: Business and microeconomic framework*⁵ shows that effective common regulations and institutions, a unified labour market, a shared knowledge base and integrated infrastructures are central to the success of the unified domestic market, including the energy sector. However much an independent Scottish state sought to stay aligned with regulations and institutions in the continuing UK, a single market between two separate states is not the same as a fully integrated domestic market. The paper discusses how divergence and fragmentation would be likely to lead to short-term and long-term costs, and prolonged uncertainties, for businesses and consumers.

*Scotland analysis: EU and international issues*⁶ presents the UK Government's analysis of the international implications of the debate on Scottish independence. The UK energy sector, like others, benefits from the UK's global diplomatic network and its 'soft power' – its brand, reputation or attractiveness in other societies – to help it achieve its objectives. The paper considers in depth the issue of an independent Scottish state's European Union membership, including the issues that would be important in a membership negotiation and the likely impact on Scotland's contributions to the European Union budget.

Scotland analysis: Borders and citizenship,⁷ examines the creation of international borders between Scotland and the continuing UK. In the event of a vote for independence, an independent Scotland and the continuing UK would need to agree their international maritime border, which would have significant implications for the division of energy resources in the UK's territorial waters, particularly North Sea oil. The paper considers the two options as to how to agree the delimitation of the continental shelf – bilateral negotiation between an independent Scottish state and the continuing UK leading to agreement, or an international judicial settlement if bilateral negotiations are unsuccessful.

³ *Scotland's Future: Your guide to an independent Scotland*, Scottish Government, November 2013.

⁴ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

⁵ *Scotland analysis: Business and microeconomic framework*, HM Government, July 2013.

⁶ *Scotland analysis: EU and international issues*, HM Government, January 2014.

⁷ *Scotland analysis: Borders and citizenship*, HM Government, January 2014.

Assessing Scotland's place in the UK energy market

This paper explores the energy market arrangements that exist in the UK, and the benefits of the current single market framework.

Energy is a reserved responsibility of the UK Parliament and UK Government for the whole of Great Britain (GB). Whilst the Scottish Government has some specific powers for areas such as climate change and development consent policy, decisions on issues such as electricity generation, transmission and supply; oil and gas; coal; and international relations are taken by the UK Government. These constitutional arrangements mean that people in Scotland benefit from the size and strength of the GB market, whilst having a devolved government in Edinburgh to pursue specific aspects of energy policy alongside and with the support of the UK Government.

This paper refers to the energy arrangements in GB unless explicitly stated otherwise in the text – Scotland is an integral part of this GB arrangement. Northern Ireland is part of the Single Electricity Market – the wholesale electricity market operating in the Republic of Ireland and Northern Ireland. Energy policy is largely transferred in relation to Northern Ireland, although there are exceptions including nuclear policy and schemes such as the Renewables Obligation which operate across the UK.

The evidence presented in this paper demonstrates that Scotland, as part of the UK, is an attractive place for energy investment and benefits from being part of the wider UK framework. Data on the impacts of energy policy on the Scottish economy, as separate from the UK economy, has been used wherever possible. Where Scotland specific data or assessments do not exist, it has been necessary to draw conclusions from the wider UK data.

Structure of this paper

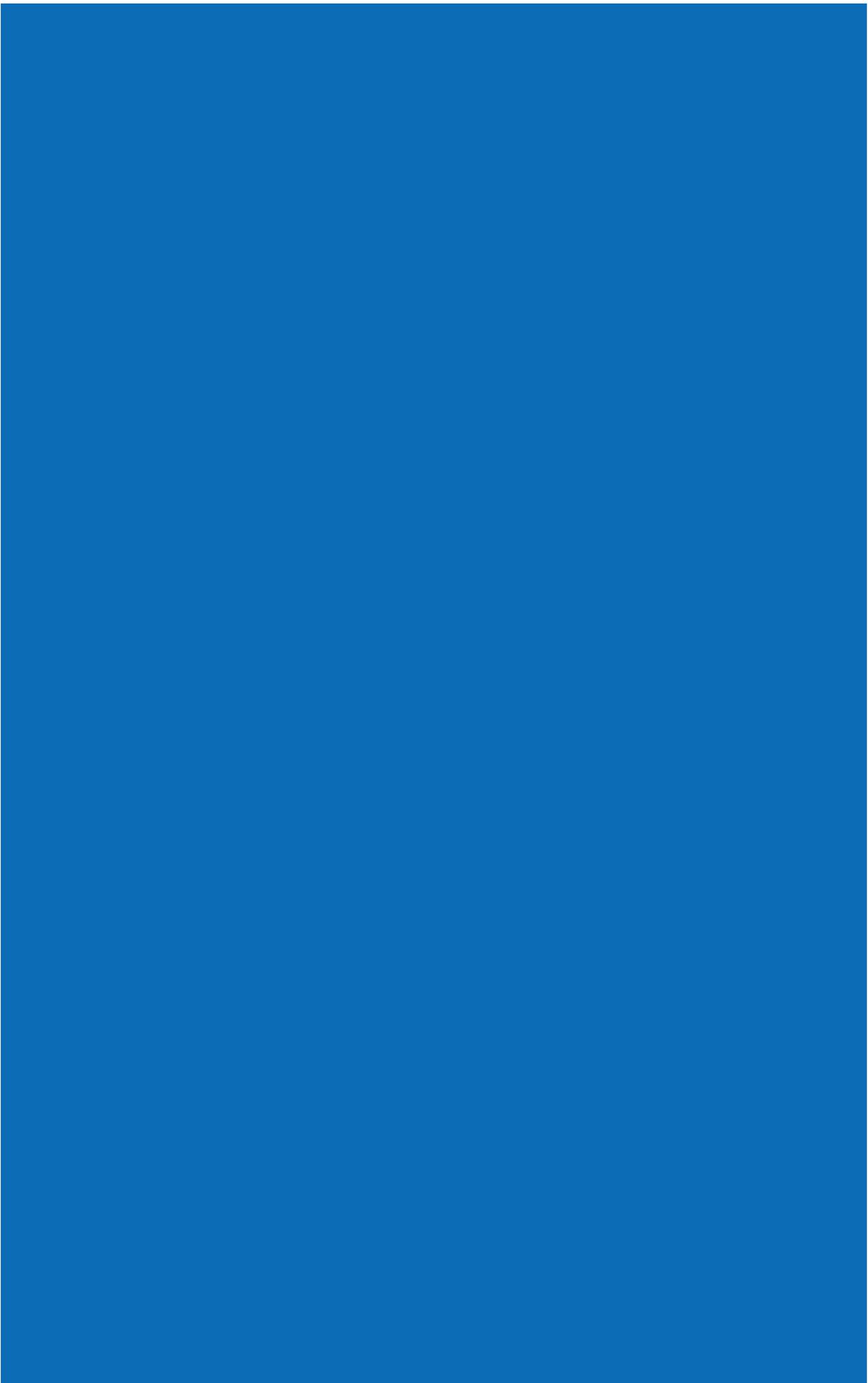
Chapter 1 discusses the current single energy market and corresponding regulatory frameworks in GB. It describes the benefits of a UK and GB-wide approach to managing the UK's energy infrastructure and considers how this may be affected if Scotland became an independent state.

Chapter 2 considers Scotland's role in the transition to a low carbon economy with a particular focus on renewables and Scotland's contribution to meeting the UK's decarbonisation goals. It sets out how Scotland has benefited from access to the UK's support mechanisms for low carbon technologies and considers some of the possible implications of independence.

Chapter 3 outlines the importance of the UK's oil and gas industry. It discusses the challenges facing the industry, the UK Government's approach to providing long term certainty and support and the implications of Scottish independence.

Chapter 4 explores the UK's work to reduce energy bills for householders and businesses, and discusses the impact of independence on consumers' bills in light of the Scottish Government's assertions that energy bills would be lower in an independent Scotland.

Chapter 5 considers the past and potential future energy legacy of the UK including oil and gas, nuclear and coal industry liabilities. It sets out the benefits of the current arrangements for dealing with these liabilities and discusses how Scottish independence would impact on these.



Chapter 1:

A single integrated market

Scotland's integration into the single Great Britain (GB) energy market and wider GB and United Kingdom (UK) regulatory framework mean that collective decision-making brings benefits to both Scotland and the UK as a whole. The integration delivered through the current UK political arrangements strengthens energy security, increases opportunities for competition through a wider and more diverse generation and consumer base, and enables a wider distribution of costs of investment in key infrastructure, such as transmission networks.

Whilst the current Scottish Government has said it would look to establish a strategic partnership with the continuing UK, and has referred to existing international examples as possible models (such as the Single Electricity Market operating in the Republic of Ireland and Northern Ireland, and Nordpool in northern Europe), these cannot be regarded as equivalents. The current UK system is uniquely integrated, and has a far greater level of cost sharing. With a high proportion of low carbon generation, this cost sharing benefits Scottish consumers and the Scottish low carbon sector.

The current framework of a single market with one regulator (Ofgem) and one System Operator (National Grid) allows a coherent approach when taking difficult and complex decisions.

All the citizens of the UK benefit from collective decision-making and collective endeavour at the UK level.

Scottish independence would inevitably change this. As two separate countries, respective governments and regulators will understandably be focused primarily on securing outcomes that best serve their own policy objectives and these would not always be the same. In practice this could lead to significant changes in the way energy needs are managed. For example:

- Investment in network transmission is already being made as part of a coordinated programme through the UK regulatory framework. Scotland is set to benefit from up to £6 billion of investment in the electricity transmission network (almost 30 per cent of the investment earmarked for GB upgrades). As these important transmission upgrades are largely financed by consumer bills across GB, it is unlikely that the distribution of payments to support Scottish upgrades would continue between the governments of an independent Scottish state and the continuing UK.

- There are a number of measures which shield Scottish consumers in remote communities from the high costs associated with obtaining gas and electricity supply. For example, around £92 million 2009/10 prices (between 2014/15–2020/21) of approved spending for supplying gas to remote Scottish communities under the Statutory Independent Undertaking arrangements and around £54 million (in 2013/14) to support the infrastructure needed to distribute electricity over remote and sparsely populated areas in the north of Scotland under the Hydro Benefit Replacement Scheme. These add a relatively small cost to GB consumer bills but make a significant difference to consumers in remote Scottish communities. These can be justified on the basis that it is beneficial for GB consumers to protect the vulnerable, but as a separate country these would likely become a matter for the respective Scottish consumer base or taxpayer to fund.

Any new energy partnership would require negotiation of uncertain duration and there would be pressure on both Scotland and on the continuing UK to protect local economic interests. The outcome would therefore be very uncertain, raising doubts over existing levels of financial support for renewables in Scotland.

As an integrated system, incorporating diverse forms of energy generation, security of supply is well managed. The UK's success has been independently recognised – a recent Energy Index compiled by the US Chamber of Commerce for example, placed the UK fourth overall in the world for energy security.¹

Although Scotland is currently a net exporter to other parts of the UK – with net exports ranging from 11 to 23 per cent of total Scottish generation between 2004 and 2012² – this only represents a small proportion of demand in England and Wales. The current Scottish Government's White Paper '*Scotland's Future: Your Guide to an Independent Scotland*'³ has stated that without Scottish generation and Scottish renewable energy, the spare capacity across the grid would be in negative figures. This represents a misunderstanding of the way in which the current system is balanced in practice by National Grid as an integrated GB-wide market.

It is true that at present Scotland exports significant levels of power to England and Wales. This typically happens when wind farms are generating. At these times wind farms in England and Wales also tend to generate reducing the risk of a shortfall of electricity. The effect of exports of wind power from Scotland is to reduce the need to generate power from stations with high fuel costs like coal and gas.

When the wind is less strong, flows of electricity between Scotland and England and Wales are more balanced. In the event of independence, there would be a mutual benefit to Scotland and England and Wales from continued cross-border trade in electricity, but no overriding need for the continuing UK to support Scottish energy costs to ensure its own security of supply.

¹ *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market 2013*, Institute for 21st Century Energy and US Chamber of Commerce, March 2014.

² *Energy trends: Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England 2009 to 2012*, Department of Energy and Climate Change, December 2013.

³ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

UK Government analysis shows that – even in a hypothetical scenario where there were no flows of electricity between an independent Scottish state and the continuing UK – there would only be a small impact on capacity margins in England and Wales. This is because the lack of access to Scottish-generated electricity under such a scenario would be largely balanced by the removal of Scottish peak demand from the system, so would not significantly heighten the risk of blackout or brownout in GB.

Whilst developments such as the Irish Single Electricity Market and Nordpool have been beneficial to industry and consumers in those areas, these models have taken many years to establish, and neither model has the same level of integration as GB's single market. Crucially, neither the Irish Single Electricity Market nor Nordpool share the full cost of maintaining and strengthening the transmission network investment across borders, unlike with the current GB model. The inherent features of the GB market mean that more costly forms of renewables generation in Scotland can be met automatically through unimpeded access to the GB consumer market. It also means that more remote areas of Scotland can benefit from pooled investment in the transmission network.

A single energy system and market

- 1.1 GB has single integrated energy markets in both natural gas and electricity. Electricity and natural gas are fed into separate⁴ nationwide networks, which transport the energy the length of the country to where it is needed.⁵ The process of managing supply and demand across the country is managed by a single System Operator – National Grid – and a single regulator – the Office of Gas and Electricity Markets (Ofgem). As the System Operator, National Grid manages the electricity and gas supply and demand across GB. Ofgem's role as regulator makes it responsible for protecting consumers and ensuring the GB's energy wholesale⁶ and supply markets are competitive. Ofgem also helps to ensure security of supply, administers the licensing system for energy companies and where appropriate, takes enforcement action.

Box 1A: Overview of the GB electricity industry

Generators produce electricity from coal, gas, oil and nuclear power plants and from renewable sources. Electricity is hard to store efficiently so is generated as needed.

Suppliers supply and sell electricity to consumers. They use the transmission and distribution networks to pass the electricity to homes and businesses.

The national transmission network, owned by National Grid in England and Wales and Scottish Power and Scottish and Southern Energy in Scotland, maintains the network that transport generated electricity through to the regional distribution networks.⁷

⁴ Northern Ireland has separate arrangements, and is part of the Single Electricity Market – the wholesale electricity market operating in the Republic of Ireland and Northern Ireland. Further detail is set out in the glossary.

⁵ The exceptions to this are those 2.8 million GB households which are not connected to the gas grid, of which 490,000 are in Scotland. Some of these households are on separate local grids for gas. Others use heating oil or Liquefied Petroleum Gas (LPG) for heating. Where these households use heating oil or LPG for heating, the market is instead overseen by the Office of Fair Trading.

⁶ The wholesale markets are where energy suppliers purchase gas and electricity for their customers.

⁷ The transmission network carries power at high voltages over long distances. The regional distribution network, of which there are fourteen in GB, ensure the supply reaches homes and businesses.

Distribution network operators own and operate the distribution network of towers and cables that bring electricity from the national transmission network to homes and businesses. They do not sell electricity to consumers.

National Grid, as the System Operator, manages the transmission system and ensures the electricity and gas systems are balanced (ensuring there is sufficient supply to meet demand). Users of the electricity network (i.e. electricity generators connecting to the network, or shippers using the gas network to transport gas to customers) are subject to three elements of transmission charges. These are set by National Grid – acting under the conditions set out in their licence by Ofgem – and include charges for: building and maintaining connections, transmission infrastructure and costs incurred by National Grid in the day-to-day operation of the electricity system. There are also costs associated with losses on the transmission network.

Office of Gas and Electricity Markets (Ofgem) provides the regulatory oversight of the electricity and gas market. Ofgem's responsibilities include helping to secure GB's energy supplies by promoting competitive gas and electricity markets – and regulating them so that there is adequate investment in the networks. It takes decisions on price controls and enforcement, acting in the interests of consumers and helping the industries to achieve environmental improvements.

- 1.2 Under the current single market, with its one set of standards, regulatory requirements, institutions and network codes, the UK Government, Ofgem and National Grid in their respective roles, take a single view of the best solution for GB consumers as a whole. It also enables a genuine GB-wide perspective when taking difficult and complex decisions about where investment is made, who benefits and how the costs are shared.
- 1.3 Accordingly, the present integrated system, encompassing the single market and the shared regulatory regime and approach to investment in networks, brings benefits to both Scotland and the whole UK. It strengthens energy security and resilience, provides a larger, more attractive market for investors, increases competition, and underpins the shared approach to investing in low carbon generation.

History of the integrated electricity market

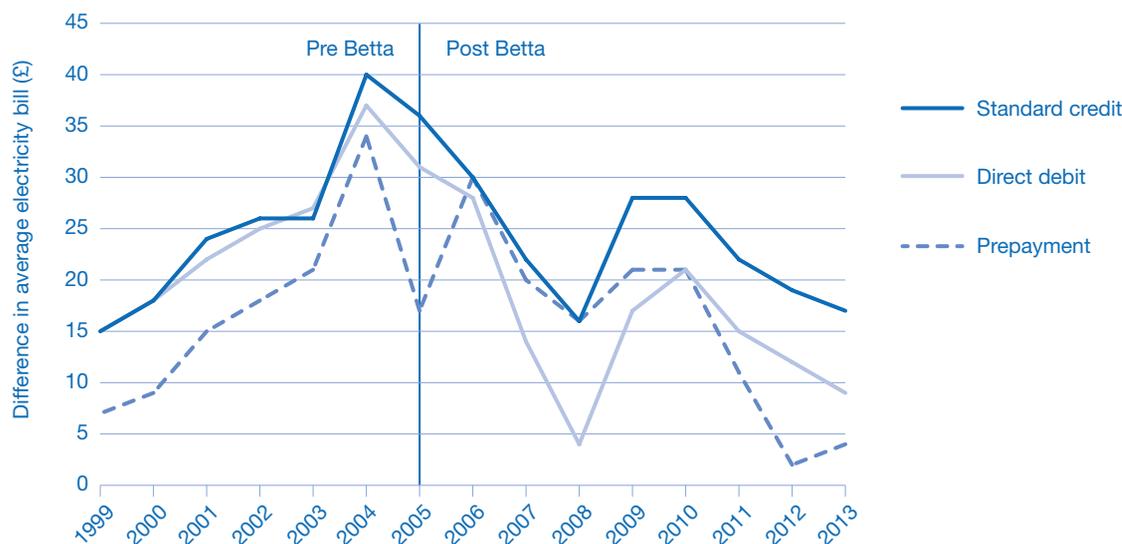
- 1.4 The single integrated electricity market was established in 2005 when the British Electricity Trading Transmission Arrangements (BETTA) were introduced. Prior to this, Scotland had a separate self-contained electricity market which was dominated by two electricity companies, Scottish Power and Scottish and Southern Energy. These covered the full range of electricity provision, including generation, transmission, distribution and supply businesses.
- 1.5 These two incumbent Scottish companies accounted for some 76 per cent of generation capacity in Scotland⁸ and about 74 per cent of supply to domestic consumers in Scotland.⁹ The resulting monopolies limited effective wholesale competition, and therefore were more likely to lead to a market environment of less choice, higher prices and reduced service levels to the Scottish consumer.

⁸ *Digest of United Kingdom Energy Statistics (DUKES)*, Department of Energy and Climate Change, July 2013, Table 5.11.

⁹ The remaining percentage generation was largely from British Energy's two nuclear plants, with the remaining supply companies were British Gas Trading (with 19% share) and a small number of other suppliers. *Energy Trends: Special feature article – Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2009 to 2012*, Department of Energy and Climate Change, December 2013, Table A1.

- 1.6 Moving to larger, more diverse markets provides consumers with greater choice, the benefits of increased innovation, and lower prices. The high levels of market concentration in Scotland meant that Scottish consumers were particularly exposed to previous failures in competition. Prior to the introduction of the single integrated market, consumer energy bills in Scotland were over £30 higher on average than those in England and Wales (as shown in Chart 1A below). Accordingly consumers in Scotland particularly felt the benefits experienced by all GB consumers as a result of the introduction of a single integrated market in 2005. The establishment of a single electricity market also introduced National Grid as a single GB Energy System Operator, enabling it to manage the energy networks independently of generation and supply interests.
- 1.7 Following the opening up of the market, Scottish generator access to the wider GB market was made less restrictive. Before the introduction of the single market, electricity was traded between Scotland and the rest of GB across 'interconnectors' (the physical linking of electricity transmission systems across borders). The changes that came through integration meant Scottish generators were free to trade in the rest of GB's market without having to reserve specific capacity on the interconnectors as they were simply subsumed into the wider network, so fees for trading across the interconnector were abolished.
- 1.8 The advantages of a single market are wide ranging; from sharing costs and boosting efficiencies to providing a more attractive connecting point for other markets and increasing scope for exports to the wider Single European Market. The benefits have been enjoyed by consumers not just in Scotland but across GB.

Chart 1A: The difference between average electricity bill prices in England and Wales and average electricity bill prices in Scotland.¹⁰



- 1.9 Chart 1A above illustrates the benefits Scottish consumers have felt through a reduction in the difference in the price of the average bill between Scotland and England and Wales since the introduction of the single market in 2005, across all types of payment. There are a range of factors which mean that there is a difference between electricity bills in Scotland and in England and Wales (such as differences in network distribution costs for geographical reasons), and some fluctuations in the scale of the difference over time resulting from changes to cost bases and competition levels. Nevertheless, Chart 1A shows that there is a clear downward trend from the 2004 pre-BETTA peak, meaning that the difference between prices across parts of GB is considerably less marked.

¹⁰ *Quarterly Energy Prices: March 2014*, Department of Energy and Climate Change, March 2014, Table 2.2.2.

- 1.10 A single GB electricity market provides a more attractive commercial proposition for investors, with millions more consumers in demand of Scottish electricity than Scotland can provide alone: there are around 27 million domestic consumers of electricity in GB compared with 2.5 million in Scotland.¹¹ Since the introduction of the single integrated market, there has been an increase in competition in the Scottish market – both in terms of the number of independent generators in the market and in the retail market.^{12 13} This has incentivised companies to provide reliable supplies in order to attract and retain customers, and helped put downward pressure on prices.
- 1.11 Driving down prices by increasing competition in the electricity market is a key goal of the UK Government. Ofgem has implemented its Retail Market Review reforms that are designed to address low levels of switching amongst consumers, and ensure that energy companies place consumers on the cheapest tariff that meets their preferences. Ofgem has also announced a significant package of reforms designed to support independent suppliers and generators by strengthening electricity market liquidity.
- 1.12 Widening consumer choice and diversity in the market is a key part of ensuring the market is as competitive as it can be. Since 2010 nine new suppliers have entered the market, and small suppliers are increasing their market share. The UK Government's Electricity Market Reform programme is also designed to support a competitive market and open up access to the energy market. Additionally, the Annual Energy Statement 2013 announced that Ofgem would work with the Office of Fair Trading and the new Competition and Markets Authority to deliver the first annual competition assessment by the end of March 2014.¹⁴ The report of the assessment was published by Ofgem, the Office of Fair Trading and the Competition and Markets Authority on 27 March 2014. Ofgem concluded that the legal test to make a Market Investigation Reference to the Competition and Markets Authority has been passed. Ofgem have now commenced a consultation on making the reference. This is an important step as the Competition and Markets Authority has wide ranging powers to tackle competition issues, including the ability to make structural reforms.
- 1.13 For the period of January to June 2013, UK households paid the lowest retail gas prices and some of the lowest retail electricity prices in the EU 15 (including taxes), as shown in Chart 1B.¹⁵ Provisional data for the second half of 2013 suggests that the UK still has the lowest retail domestic gas price and fifth lowest retail domestic electricity price (data available as of 27 March 2014).¹⁶ With wholesale energy costs making up around 50 per cent of a typical domestic consumer's energy bill,¹⁷ it is essential that competition continues to function effectively to promote choice, competitively priced energy and secure supplies to industrial, commercial and domestic customers.

¹¹ Sourced from Department of Energy and Climate Change estimates based on Domestic Fuels Inquiry survey data from 2008 to 2013.

¹² *Digest of UK Energy Statistics (DUKES) 2013*, Department of Energy and Climate Change, July 2013, Table 5.11: Power stations in the United Kingdom, page 143.

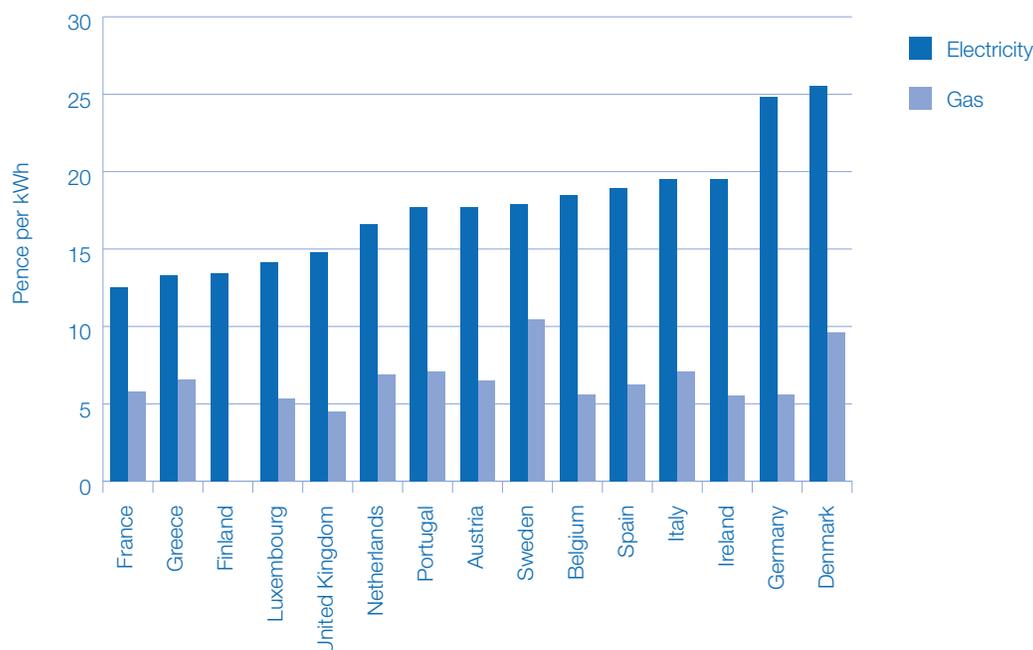
¹³ *Quarterly Energy Prices: December 2013*, Department of Energy and Climate Change, December 2013, Table 2.4.1: Percentage of domestic electricity customers by region by supplier type for September 2013, page 23.

¹⁴ *Annual Energy Statement 2013*; Department of Energy and Climate Change, October 2013.

¹⁵ *Quarterly Energy Prices: September 2013*, Department of Energy and Climate Change, September 2013, pages 52 and 56.

¹⁶ *Statistical data set: International domestic energy prices*, Department of Energy and Climate Change, March 2014.

¹⁷ *Estimated impacts of energy and climate change policies on energy prices and bills 2012*, Department of Energy and Climate Change, March 2013, page 20.

Chart 1B: Average electricity and gas price (per kWh) across EU 15.

Source: Eurostat data, published in DECC's Quarterly Energy Prices for the period of January to June 2013. Gas data for Finland was unavailable for this period. Data sorted by electricity prices.

Integrated energy networks

- 1.14 In addition to the integration of the electricity market, the sophistication of the integrated GB energy network allows for effective management of a varied energy mix – including renewables, nuclear, gas and coal – with all the different challenges that they bring, whilst ensuring that demand is met. Comprehensive and reliable gas and electricity networks are crucial to ensuring energy security and facilitating the transition to a low carbon energy mix.
- 1.15 There are inherent advantages to the current GB integrated networks and energy systems, as larger energy systems are intrinsically more resilient. This is because they are able to draw on a greater number and more diverse range of energy sources. Where there are disruptions to supply due to technical failure, natural disasters or human impact, alternative sources can be used to meet demand. The UK has experienced strong energy security in recent years from a combination of liberalised energy markets, robust regulation and oil and gas resources from the UK Continental Shelf. The UK's success has been independently recognised – a recent Energy Index compiled by the US Chamber of Commerce for example, placed the UK fourth overall in the world for energy security.¹⁸
- 1.16 The GB energy system as a whole is now being upgraded, as the UK transforms into a low carbon economy, meets its renewable energy and carbon reduction targets, and increases the level of energy imported from outside the UK. It is estimated that up to £40 billion of additional investment in the GB electricity networks may be needed up to 2020 to meet the challenge of moving to a low carbon economy.¹⁹ As the electricity generation mix changes and demand increases (in the shift to using electricity to power cars and heat homes), electricity transmission networks will need to deliver increased network capacity and extend the network to new locations to connect renewable sources of generation, which are often in remote locations.

¹⁸ *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market 2013*, Institute for 21st Century Energy and US Chamber of Commerce, March 2014.

¹⁹ *Electricity Market Reform – ensuring electricity security of supply and promoting investment in low-carbon generation Delivery Plan update*; Department of Energy and Climate Change; July 2013.

- 1.17 As one country, the GB regulator, Ofgem, the transmission System Operator, National Grid and various network companies manage the network and proceed with upgrades and investment on the basis of unified regimes. This is important, as the energy network of the future requires a coordinated approach and significant investment to ensure that the networks remain fit for purpose and continue to serve all parts of GB as efficiently as possible. Scotland is set to benefit from up to £6 billion of investment that has already largely been committed in the electricity transmission network.²⁰ This, along with investment in the gas transmission network, will further strengthen Scotland's access to the wider GB network; facilitate a greater share of renewables generation to be brought into the energy mix supporting renewables targets; and protect consumers by helping to ensure Scotland and GB's energy security. This investment will also help ensure economic growth as the benefits of the significant investment are felt within local economies, bringing with it new jobs.

Electricity networks

- 1.18 A key feature of the current approach to the management of the electricity network is that the costs of building and maintaining the large transmission system are spread across the whole of GB. The UK Government believes this is a sensible approach within the current market arrangements; drawing on the benefit of having a wider consumer base to help cover the substantial costs associated with ensuring the network is fit for purpose.
- 1.19 The various costs associated with the electricity transmission networks are recovered through a range of charges administered by National Grid. Costs associated with building and maintaining electricity infrastructure (which are recovered via Transmission Network Use of System (TNUoS) charges) represent the largest share of costs and are divided between generators (27 per cent) and suppliers (73 per cent), so are largely passed through to consumer bills, equating to around 5 per cent of an average household electricity bill for a dual fuel user.²¹ This is discussed in more detail in Chapter 4. All GB consumers share the costs of the network upgrades in Scotland. In 2012-13, this transfer reached £132.5 million reflecting the on-going investment in infrastructure in Scotland and in enabling England-Scotland cross border capacity.^{22 23}
- 1.20 There are a number of other projects²⁴ within the £6 billion Scottish transmission network investment allocation which are under consideration or development by Transmission Owners, but would need full funding approval from Ofgem and receive planning consents. In the event of independence, an independent Scottish regulator would have to consider the funding of these projects, should they be submitted by Transmission Owners.

²⁰ *RIO-T1: Initial Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd*, Ofgem, February 2012.

²¹ *Household energy bills explained factsheet*, Ofgem, February 2013.

²² Major projects within Scotland, which are currently under construction include: the Beaulay-Blackhillock-Kintore Reconducting (0.3GW), Beaulay-Mossford (0.3GW), Hunterston-Kintyre (0.35GW), and Beaulay-Denny Upgrade (1.2GW). Under construction projects to increase England-Scotland cross border capacity include: installation of shunt capacitors, East-West Upgrade and series compensation and Western HVDC; combined these England-Scotland projects will increase the cross border transmission network capacity to 6600MW from the current 3150MW.

²³ Figure sourced from Transmission Network Use of System (TNUoS) paid by Scottish Generation and Demand to National Grid as System Operator, and TNUoS passed through to Scottish TOs by National Grid to meet the capital costs of the Scottish Transmission network.

²⁴ Projects under consideration or development by Transmission Owners include an Eastern HVDC Link from Scotland to England and a subsea HVDC link from Caithness to Moray. Sourced from major project lists www.gov.uk.

- 1.21 The current charging regime has been designed to reflect the costs that users place on the transmission network. To that end it encourages generators to take effective decisions on location and make efficient use of the existing network infrastructure. This means that generators in Scotland, located far from centres of demand pay higher transmission charges than those in the south of GB. Conversely, the average TNUoS transmission charge per unit paid by supply companies for consumers in Scotland is around half that paid by companies supplying consumers in England and Wales.²⁵ As part of Project TransmiT, an independent and open review of electricity transmission charging and associated connection arrangement, Ofgem are considering the introduction of an element of network sharing for variable generators, such as wind farms.²⁶ Renewable generators in the more remote, higher charging areas of Scotland would see particular benefits from this.
- 1.22 In addition to the costs of building and maintaining the network, there are costs associated with the day-to-day balancing of the network by National Grid to ensure supply meets demand. Balancing costs relate to the services and actions that National Grid – in its role as electricity System Operator – needs to procure or take in order to balance electricity supply and demand on the transmission system. These balancing actions are taken to manage system events such as surges in demand (for example, during TV commercial breaks), sudden generation loss; and network congestion (known as ‘transmission constraints’). The total cost of balancing services in 2012/13 was £601 million.²⁷ A quarter of these balancing services costs related to constraint costs.
- 1.23 Transmission constraints occur where there is insufficient transmission network capacity between two locations at a particular point in time to transmit all the available electricity generation from where it is produced to where the demand for it is situated. In these instances, National Grid balances supply and demand by paying generators to either decrease or increase their output, with ‘constraint payments’ provided to generators to account for costs incurred in changing their amount of planned output to help resolve a constraint.
- 1.24 The majority of constraint payments are associated with the most congested part of the network in GB at the boundary between England and Scotland, partly resulting from the high levels of wind generation in Scotland. In the first half of 2013/14, total constraint costs stood at £161 million, of which £77 million related to the England-Scotland boundary and a further £31 million were incurred within Scotland – totalling 67 per cent of all constraint payments.²⁸ In the event of Scottish independence the current integrated network could not continue as it is now, and this raises a question around whether these constraint costs would still be incurred. At present, even though the cost of covering the charges is spread evenly between generators and suppliers across the whole of GB, the cost is largely associated with transmitting Scottish generated electricity.

²⁵ Analysis based on *TNUoS Tariff Statement for 2013/14*, National Grid, January 2013.

²⁶ *Project TransmiT*, Ofgem website www.ofgem.gov.uk.

²⁷ *Procurement Guidelines Report 2012/13: 1 April 2012 to 31 March 2013*, National Grid.

²⁸ *Monthly Balancing Services Summary*, National Grid, September 2013.

- 1.25 In order to use Scottish generation resources efficiently, the network needs to be expanded across Scotland to connect remotely located and spread out renewable generation, and the links between Scotland and the rest of GB need to be strengthened and broadened. Ofgem, through its price control process²⁹ has already earmarked up to £6 billion of investment for Scottish transmission networks for the period 2013/14 to 2020/21, representing just under a third of the total expected investment in upgrading the GB high voltage electricity network for that period.³⁰ It is unclear how this investment would be delivered and the resulting costs distributed by an independent Scottish state. Chapter 4 sets out more detail on the potential impact on consumer bills in Scotland.
- 1.26 The impact of this investment funding will mean that constraints are eased between the networks linking Scotland and England; ageing networks are replaced; and Scottish access to the wider network improved, particularly for Scottish renewables. Furthermore, these improvements will ensure Scotland is able to import electricity to meet its electricity demand, particularly in time of little wind.
- 1.27 Through the current approach to cost sharing in the integrated system, Scottish consumers benefit from the size of the GB consumer base, as the costs of key investment in the transmission network are spread across the whole of GB. Distribution network costs are largely paid for locally, and so in addition, a number of schemes have been put in place to insulate Scottish consumers, particularly those in remote areas, from very high distribution costs that would otherwise occur. This is discussed further in Chapter 4.
- 1.28 The UK Government introduced the Hydro Benefit Replacement Scheme to help protect consumers in the North of Scotland from the high costs of distributing electricity over a remote and sparsely populated area, providing 690,000 domestic consumers in the north of Scotland with an average annual saving of £36.^{31 32} Funding of this support which was £54 million in 2013-14 is spread across all GB domestic and non-domestic consumers, costing the average household less than £1 a year. The scale of GB's consumer base means that a significant level of support can be provided to those Scottish consumers that would otherwise face much higher energy bills, as detailed in Chapter 4.
- 1.29 Given the fundamental questions and challenges that would need to be addressed, it appears unlikely that the current levels of integration and a GB-wide approach could continue in the event of independence. This would have significant implications for the sharing of costs of future upgrades to the transmission network, given that it is unlikely that consumers in the continuing UK would be willing to continue to support the development of energy infrastructure in Scotland. Similarly, the government and regulator of an independent Scottish state would need to decide whether it would continue to provide support such as the Hydro Benefit Replacement Scheme.

²⁹ Ofgem, as the regulator, sets price controls for the companies that operate Britain's gas and electricity networks. The current transmission and gas distribution price controls aim to encourage network companies to play a full role in the delivery of a sustainable energy sector, and to do so in a way that delivers value for money for existing and future consumers. For further information see www.ofgem.gov.uk.

³⁰ Make-up of £6 billion figure sourced from *RIO-T1: Initial Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd*, Ofgem, February 2012, page 1.

³¹ *Hydro Benefit Replacement Scheme and Common Tariff Obligation – Department of Energy and Climate Change response to call for comments on the three year statutory review of these schemes*; Department of Energy and Climate Change, August 2013.

³² Sourced from: *Charging Statement – Assistance for areas with high electricity distribution costs scheme*, National Grid, July 2013.

Gas networks

- 1.30 Gas forms an integral part of the UK's energy mix, and it is vital that the network over which it is supplied operates effectively and consistently. In 2012 gas provided 28 per cent of electricity generation.³³ At present, gas is brought into the UK through nine terminals: from gas producers, from offshore facilities at fields in the UK Continental Shelf; through pipelines connecting to Norway, the Netherlands and Belgium; and via three terminals in England which allow liquefied natural gas to be delivered by boat from around the world.
- 1.31 National Grid Gas ensure that supply is sufficient to meet consumer demand at the right time and in the right place, and manages the transport of gas through the National Transmission System, to power stations (for electricity generation), to large industrial users, and to gas storage facilities.
- 1.32 The National Transmission System is connected to eight Gas Distribution Networks, which transport gas to homes, buildings, and small industry for use as heat. Networks serving remotely located customers in Scotland are not connected to the wider GB transmission system. Some liquified natural gas is now transported to Scotland using road tankers from a storage facility in south west England.
- 1.33 Overall the Scottish gas networks and the standalone networks cover up to 75 per cent of Scottish households and serve around 1.8 million customers across the whole of Scotland.
- 1.34 The cost of supplying liquified natural gas and liquid petroleum gas to these remote standalone networks is supported through a charge³⁴ levied on all shippers using the National Transmission System across the whole of GB. As discussed in Chapter 4, in 2012, Ofgem approved spending of around £92 million (2009-10 prices) to support five remote networks which supply gas to Scottish communities not directly connected to the main gas grid, through the Scottish 'Statutory Independent Undertakings'.³⁵ The costs are shared across all GB consumers through a charge placed on the transmission network. In the event of independence, it is unlikely that the continuing UK would be prepared to share the costs of supporting Scottish consumers through this scheme, as these would now be consumers in a separate country. The government of an independent Scottish state would therefore need to decide how the scheme would be funded.

³³ *DUKES 2013, Chapter 5: Electricity*, Department of Energy and Climate Change, July 2013, page 111.

³⁴ The charge covers the cost of booking capacity at a LNG storage facility, the cost of LNG tanker filling and the cost of transporting the LNG to the standalone networks.

³⁵ *Continuation of cross-subsidy arrangements for the Statutory Independent Undertakings (Scotland Gas Networks)*, Ofgem, March 2013.

- 1.35 When the National Transmission System was first established, it was primarily designed to transport indigenous gas supplies from the North Sea to the rest of GB. However, now is a critical time for the National Transmission System as significant investments are needed to meet the challenges ahead. As indigenous gas supplies decrease GB is becoming increasingly dependent on gas imports and the system needs to adapt. The Department of Energy and Climate Change Energy Security Strategy estimated that declining gas production from the UK Continental Shelf would mean that net import dependency of around 57 per cent in 2012 is expected to increase to above 71 per cent by 2025.³⁶ This shift in the pattern of supply, along with new demand profiles creates additional needs to allow greater flexibility in varying gas flows from England and Wales to Scotland, connect extra capacity required by liquified natural gas and storage facilities and to accommodate increasingly volatile demands for gas as back up to more variable renewable generation.
- 1.36 Over the last 10 years the GB gas market has invested significantly in improving import facilities. This has resulted in increases of 580 per cent in GB's import capacity,³⁷ which means GB has import capacity to meet up to 188 per cent of annual demand. The GB gas market has responded successfully to these challenges and in 2012 UK wholesale gas prices were lower than many western European countries.³⁸
- 1.37 There is one major gas import facility in Scotland (St Fergus) which brings in gas from the gas fields in the North Sea and from Norway (there is uncertainty surrounding future Norwegian production beyond 2020 due to lack of knowledge about the extent of gas resources in the Barents and Norwegian Seas³⁹). The other import points are all located in England, and Scotland has no liquified natural gas terminals. This creates a lack of options for moving gas north into Scotland to meet demand. As shown in Figure 1A below, the flow of gas in the National Transmission system has changed over time; Winter 2010/11 saw liquified natural gas imports (specifically to the Milford Haven and Grain terminals) exceeding St Fergus flows for the first time.^{40 41}

³⁶ *Energy Security Strategy*, Department of Energy and Climate Change, November 2012, page 9.

³⁷ *Statutory Security of Supply Report 2013*, Ofgem and Department of Energy and Climate Change, October 2013.

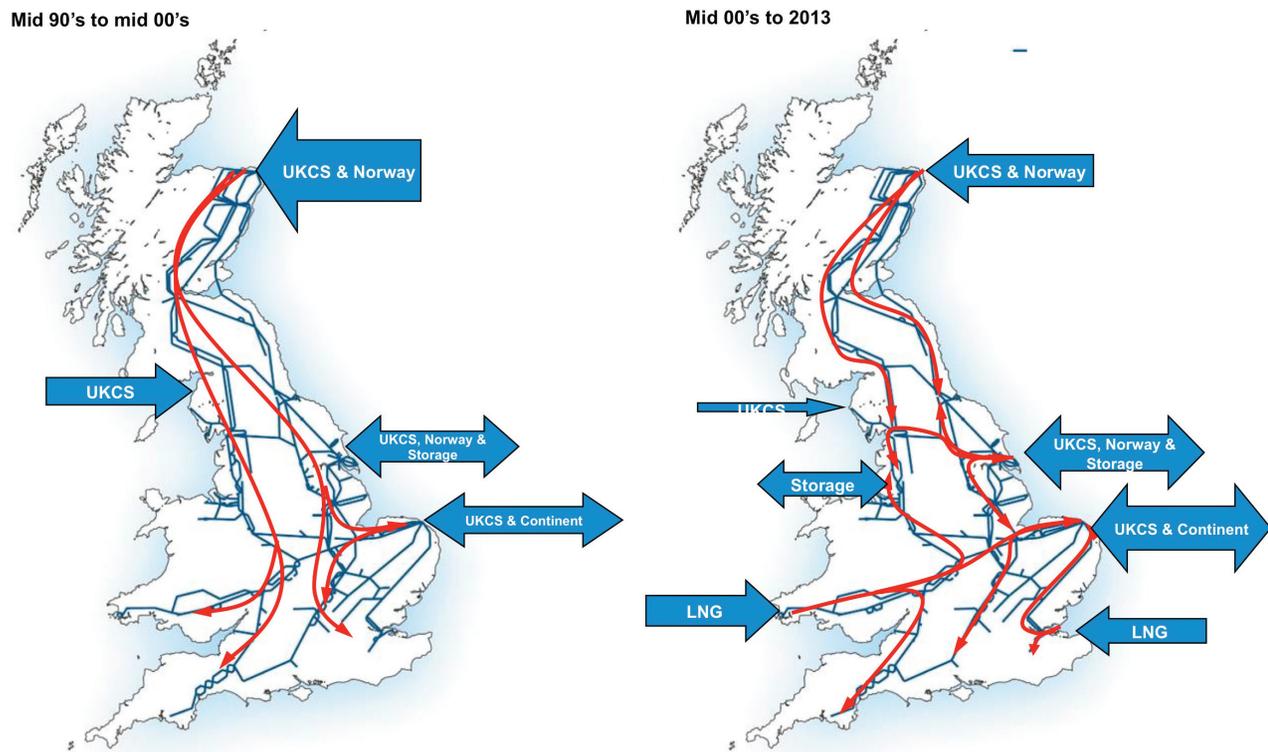
³⁸ *Wholesale Gas Price Survey – 2013 Edition*; International Gas Union, Figure 3.16, July 2013.

³⁹ *Statutory Security of Supply Report 2013*, Ofgem and Department of Energy and Climate Change, October 2013.

⁴⁰ *Business Plan RII/O*, National Grid, July 2011.

⁴¹ *Gas 10 year statement 2012*, National Grid, December 2012.

Figure 1A: Flow pattern in the National Transmission System (NTS)



Note numerous proposed storage projects are not shown

Source: National Grid, Gas Ten Year Statement, December 2012.

- 1.38 The sophistication of the integrated GB energy network and market allows for a genuine GB-wide perspective to be taken when making difficult and complex decisions about getting the right mechanisms and infrastructure in place to address issues such as the changing flows of gas.
- 1.39 Through the current price control mechanism⁴² (1 April 2013-31 March 2021), Ofgem accepted National Grid's case that investment is required to adapt the existing network in response to changes in the GB gas market. Investment is needed to support increase in gas flows originating from liquefied natural gas and continental interconnector terminals in South Wales and Southern England, and heading north to Scotland. This is in response to expected long term decline in North Sea production and greater reliance on gas imports. The changing profile of gas usage will also require further investment; increased use of gas generation to supplement wind energy and replace coal power stations will create different usage profiles and demands on the gas network, especially during periods of peak demands.⁴³ The total expenditure for gas transmission networks across GB between 2013 and 2021 is £5.5 billion. As these important upgrades are financed by consumer bills across GB, it is unlikely that the distribution of payments to support Scottish upgrades would continue between the governments of an independent Scottish state and the continuing UK.

⁴² Price controls explained- factsheet, Ofgem, March 2013.

⁴³ Statutory Security of Supply Report 2013, Ofgem and Department of Energy and Climate Change, October 2013.

Energy security

Future investment

- 1.40 Energy security is primarily concerned about ensuring that consumers have access to the energy services they need (physical security) at prices that avoid excessive volatility (price security). It is fundamental to the day-to-day business of a nation and is therefore one of the UK Government's top priorities. While the UK Government cannot control world energy market prices, which are largely responsible for recent bill increases, it is working to ensure that energy services are as affordable as possible, both for consumers and businesses, and in the long term to reduce the UK's dependence on imported fossil fuels. The UK's energy system is relatively resilient to energy security challenges and is set to be strengthened as the UK Government takes tangible action to diversify the nation's energy supply.
- 1.41 Whilst Scotland has significant energy resources and is an overall net-exporter of electricity to other parts of the UK, it is also dependent on the wider GB energy mix. The size and diversity of the GB energy system ensures Scottish security of supply, meeting Scottish energy demand, particularly in light of the declining flows of gas into Scotland from the UK Continental Shelf, and enabling Scotland's more variable renewable electricity supply to be balanced, for example affecting onshore and offshore wind when the wind does not blow.
- 1.42 The UK Government is currently undertaking activities in a number of areas to further enhance energy security whilst also delivering wider energy goals. This includes measures to incentivise deployment of flexible gas and low carbon generation; improve the capacity and flexibility of the energy transmission and distribution networks; maximise economic production of domestic oil and gas reserves; and resilience measures to prevent possible disruptions ranging from natural hazards through to industrial action.
- 1.43 Ambitious plans to reform the electricity market form a key part of the UK Government's strategic approach to security. Electricity Market Reform will enable the UK to develop a clean, diverse and competitive mix of electricity generation that will deliver security of supply and minimise costs to consumers to deliver the investment that is needed. Without reform, electricity prices will become increasingly exposed to the risks of high and volatile international fossil fuel prices. The reform of the GB electricity market, the largest since privatisation, will put in place the institutional and market arrangements to incentivise up to an additional £110 billion of capital investment by 2020 that is needed to replace and upgrade GB electricity generation and transmission infrastructure.
- 1.44 As set out in Chapter 2, this will be hugely beneficial to the Scottish low carbon sector, driving billions of pounds of investment in renewables generation and transmission network upgrades so that the new generation can feed into the GB-wide grid. The reforms will provide opportunities to support economic growth, supporting as many as 250,000 jobs in the UK energy sector. Electricity Market Reform is also expected to reduce annual household electricity bills by an average of £41 (six per cent) over the period 2014 to 2030 (real 2012 prices) compared to decarbonising through existing policy instruments. Making the same comparison for businesses shows electricity prices and bills lower by an average of around seven to eight per cent over the period 2014 to 2030.⁴⁴

⁴⁴ *Electricity Market Reform Delivery Plan*, Department of Energy and Climate Change, December 2013.

- 1.45 Part of the reform includes increasing the UK's share of energy from renewables. The current Scottish Government set out in its Electricity Generation Policy Statement that a plausible generation mix in 2020 could see around 55 per cent of Scottish generation from onshore and offshore wind.⁴⁵
- 1.46 Increasing renewables generation, and in particular wind generation, to this extent presents unique challenges to the electricity system. Renewables (particularly wind power) are by their nature more intermittent forms of generation. The level of electricity generated directly relates to the strength of the wind, making it more difficult to accurately forecast levels of generation given the presently limited ability to forecast wind levels ahead of time.
- 1.47 Whilst the UK Government is clear that wind generation must play an important part in meeting the UK's energy needs, it is also clear that this needs to be part of a wider, diverse energy mix. This includes nuclear power, carbon capture and storage and more flexible forms of generation, such as gas, which can be brought on and off the system at short notice, to ensure the overall supply is maintained and the system as a whole can be balanced. Developing these technologies will require significant level of investment, and in practice, this means that whilst Scotland may continue to export electricity to other parts of the UK, it may also need to increase the electricity it imports at certain times in order to meet peak demand.
- 1.48 The current Scottish Government has acknowledged this dependency on the wider GB energy mix. Their Electricity Generation Policy Statement, states that increases in Scotland's capacity for electricity import and export would be needed to balance renewable intermittency.⁴⁶ As electricity cannot be easily stored, the higher portion of variable electricity generation in Scotland is managed by National Grid drawing on the more balanced and diverse energy mix outside of Scotland to meet any shortfalls. While not without challenges, as part of the GB electricity system, Scottish intermittency can be managed.
- 1.49 The network companies and regulator are working to resolve the issue of the current constrained network between Scotland and England (discussed at paragraphs 1.22 to 1.26), and help ensure that Scottish renewable generation capacity is being fully utilised and the occurrence of constraint costs is minimised. A number of network upgrades are under construction which will help relieve constraints by lifting the cross border network capacity from 3150MW to 6600MW by 2016. These include a 2200MW link along the west coast – the Western High Voltage Direct Current (HVDC) Link. The Western HVDC Link is expected to cost around £1.1 billion and could deliver up to £4 billion of benefit to consumers over the lifetime of the project (mainly through reduced constraint costs).⁴⁷ Whilst electrical power is mostly expected to flow from north to south, the Western HVDC Link will be bi-directional in that power can also be made to flow in the opposite direction according to future electricity supply and demand requirements. These transmission upgrades between Scotland and the rest of GB, along with other upgrades in Scotland also under construction and potential further network reinforcements being considered by network companies, will be critical to enabling this import/export capacity. They will underpin the current Scottish Government assumptions for its growth in deployment of renewables generation.

⁴⁵ *Electricity Generation Policy Statement (EGPS) 2013*, The Scottish Government, July 2013.

⁴⁶ *Electricity Generation Policy Statement (EGPS) 2013*, The Scottish Government, July 2013.

⁴⁷ *Decision on funding arrangements for the Western High Voltage Direct Current link ("Western Bootstrap")*, Ofgem, July 2012.

1.50 A new independent Scottish National Regulatory Authority for Energy (as proposed by the current Scottish Government in its White Paper)⁴⁸ would be required to assess whether all of these planned upgrades are pursued. Furthermore, it would have to consider how the costs would be distributed. Although these are currently spread over the whole GB consumer base, this case for the enhancement of the transmission network is made on the basis of a single regulatory system and market. In the event of independence, how these costs are shared would need to be negotiated between an independent Scottish state and a continuing UK. It is highly unlikely that the current levels of integration and GB-wide approach to maintaining and improving the transmission network could continue, given that it is unlikely that consumers in the continuing UK would be willing to continue to support the development of energy infrastructure in Scotland. This would have significant implications for the sharing of costs of future upgrades to the transmission network.

Security of supply

1.51 In the White Paper on independence,⁴⁹ the current Scottish Government has stated that without Scottish generation and Scottish renewable energy, the spare capacity across the grid would be in negative figures. However, although Scotland is currently a net exporter to other parts of the UK – with net exports ranging from 11 to 23 per cent of total Scottish generation between 2004 and 2012 – this only represents a small proportion of demand in England and Wales.⁵⁰ Demand in England and Wales was met mainly by English and Welsh generation, with the rest met from imports both from Scotland and continental Europe. With the opening of the Netherlands interconnector in April 2011, in addition to the French interconnector, net imports from continental Europe exceeded those from Scotland in 2012. National Grid data demonstrated that across a sample period from 1 April 2011 to 8 January 2014, imports from Netherlands (1.98 per cent) and France (3.05 per cent) contributed a higher proportion than imports from Scotland (4.59 per cent).⁵¹

1.52 There is no anticipation that in the event of independence trade between an independent Scottish state and the continuing UK would stop, given the rules under EU Capacity Allocation and Congestion Management European Network codes.⁵² Additionally, it is likely that it would remain in the interests of both to trade, given the security of supply benefits of a larger and more diverse energy mix discussed above. However, this would not be the same as the current integrated GB wide approach to managing energy. At present when the UK trades in energy with other states it buys energy at prices set by international markets, which is very different to the joint approach to energy supply that exists between Scotland and the rest of the UK today, through which National Grid manages the flow of electricity in order to balance supply and demand and where the costs of supporting the deployment of low carbon technologies is shared across all consumers.

⁴⁸ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013, Chapter 8.

⁴⁹ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013, Chapter 8.

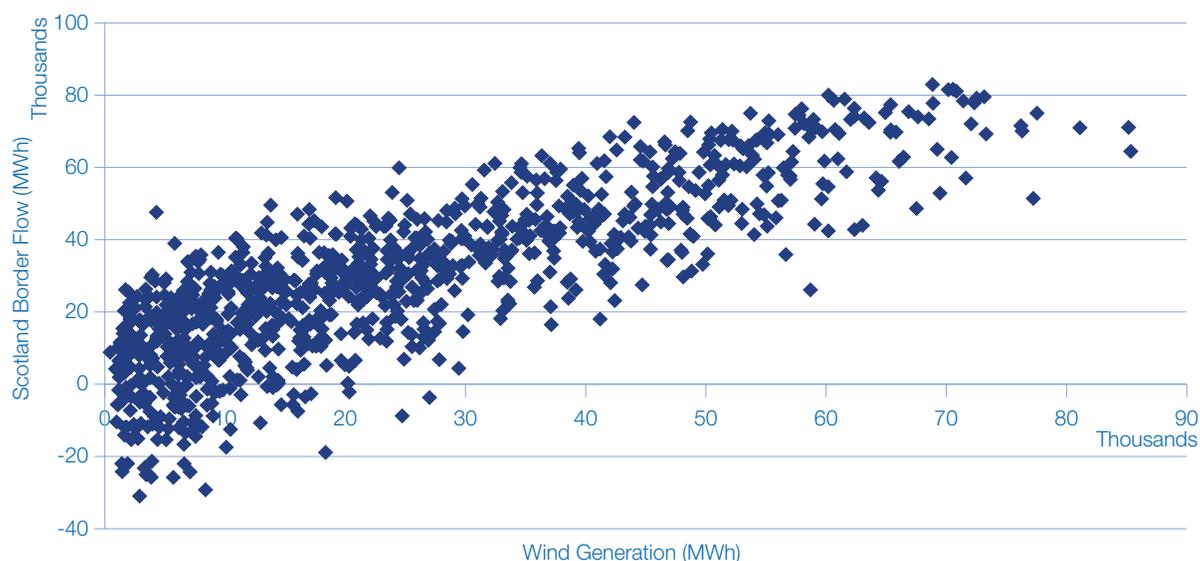
⁵⁰ *Energy Trends: Special feature article – Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2009 to 2012*, Department of Energy and Climate Change, December 2013.

⁵¹ Figures from National Grid analysis using metered real-time data across the period 01/04/11 – 08/01/14 on the transmission lines connecting England and Scotland, metered real-time data on BritNed (1GW interconnector to Netherlands) and IFA (2GW interconnector to France) at the GB connection end and metered real-time data on transmission connected windfarms. National demand data is obtained from real-time metering on the Grid Supply Points (GSPs) with corrections for station demand, interconnector demand and pumping demand.

⁵² Regulation establishing a Network Code on Capacity Allocation and Congestion Management and a Guideline on Governance and supplementing Regulation (EC) 714/2009.

- 1.53 The assertion in the White Paper⁵³ that Scottish generation is essential to ensuring the lights stay on across GB is misleading as it represents a misunderstanding of the way in which the current system is balanced in practice by National Grid as an integrated GB-wide market.
- 1.54 It is true that at present Scotland exports significant levels of power to England and Wales. This typically happens when wind farms are generating, as illustrated by Chart 1C which shows the relationship between Scottish wind generation and border flows. At these times wind farms in England and Wales also tend to generate so reducing the risks to security of supply. The effect of exports of wind power from Scotland is to reduce the need to generate power from stations with high fuel costs like coal and gas.

Chart 1C: The relationship between Scottish wind generation and Scottish border flows⁵⁴



- 1.55 When the wind is less strong, flows of electricity between Scotland and England and Wales are more balanced. In the event of independence, there would be a mutual benefit to Scotland and England and Wales in continued cross-border trade in electricity, but no overriding need for the continuing UK to support Scottish energy costs to ensure its own security of supply.
- 1.56 As set out elsewhere, an independent Scottish state and the continuing UK would trade electricity between themselves. However, for the purposes of illustrating the position of security of supply, this paper also examines a hypothetical situation in which there were no flows of electricity between an independent Scottish state and the continuing UK. The analysis in this paper shows that there would only be a small impact on capacity margins in the continuing GB. This is because the lack of access to Scottish-generated electricity under such a scenario would largely be balanced by the removal of Scottish peak demand from the system (see Box 1B). The risks of brownouts or blackouts⁵⁵ for consumers in the continuing GB would not therefore be materially increased.

⁵³ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

⁵⁴ Based on analysis from National Grid.

⁵⁵ Brownouts are instances of electrical voltage reduction, which can cause lights to dim, whilst blackouts are the involuntary disconnection of some customers.

Box 1B: Capacity Margins in the event of independence

Under current market arrangements the electricity system is operated as a single GB market. As a result, estimating capacity margins in any separate geographic area of the network is likely to be misleading as it does not reflect the way in which the System Operator currently manages security of supply. While independence may lead to separate electricity systems being established in an independent Scotland and the continuing UK, it is reasonable to assume that some electricity would continue to be traded between Scotland and the rest of the UK given that the UK currently trades with other interconnected markets and as the EU is moving to greater harmonisation of energy markets.

However, in order to provide estimates of potential capacity margins under the scenario of separate markets and in the hypothetical absence of any electricity flows between Scotland and the rest of the UK, modelling has been undertaken based on the projected 2020 generation mix in GB from the Electricity Market Reform Delivery Plan analysis (Scenario 1). The outputs are sensitive to the underlying assumptions. The modelling approach assumes that Scotland achieves its target of 100 per cent renewable electricity as a share of gross annual consumption in 2020, that derated capacity in 2020 is 6.4GW, with peak demand of 5.5GW. In the rest of GB, derated capacity and peak demand are estimated to be 56GW and 51GW in 2020 respectively.

In the Electricity Market Reform Delivery Plan analysis the derated capacity margin⁵⁶ for GB was estimated to be 8.3 per cent in 2020 under the assumption that current integrated market arrangements persist and that the grid continues to be managed to ensure the supply and demand of electricity is balanced for GB as a whole. Splitting this capacity margin for Scotland and the rest of GB using the above assumptions on derated capacity and peak demand results in a 7.4 per cent derated capacity margin for the rest of GB and a 16.3 per cent derated capacity margin for Scotland in 2020.

This demonstrates that if there were no flows of electricity between Scotland and England or Northern Ireland in 2020, it would not have a significant impact on the capacity margin in the rest of GB. This is because the assumed loss of Scottish de-rated capacity to the rest of GB in 2020 is largely offset by the removal of the need to meet Scottish peak demand. As outlined above, this example is for illustrative purposes only, as it abstracts from the way in which electricity supply and demand is currently balanced by National Grid at the GB wide level.

⁵⁶ The de-rated capacity margin is the capacity margin adjusted to take account of the availability of plant at peak, specific to each type of generation technology.

De-rated capacity margin analysis also includes an adjustment for the reserve held by the System Operator for the single largest infeed loss. This type of reserve is required to maintain the stability and integrity of the electricity system and its importance is such that the System Operator would curtail demand before using this reserve. The largest infeed loss is currently set as a single figure for the whole of GB. As it is unclear how security of supply would be managed in an independent Scottish state, this analysis was based on a simplifying assumption of zero infeed loss for Scotland. However, this is a key assumption and it would be reasonable to assume that a System Operator of a separate electricity market in Scotland would include an adjustment for infeed loss in a similar way to the approach under current GB market arrangements. For example, an infeed loss adjustment for Scotland of 0.7GW (assumed to be equivalent to the assumption made for the rest of GB) would have a significant downward impact on the capacity margin in Scotland, given that it would account for around 11 per cent of total derated capacity in Scotland. In this scenario, the capacity margin in Scotland would reduce to 3.6 per cent in 2020.

- 1.57 Therefore, whilst there would not be a significant impact on capacity margins in the continuing GB in this extreme scenario, an independent Scottish state would need to decide whether to continue to pursue an energy mix that is so dominated by renewables generation, given the issues of variable supply discussed in the section above. Key to managing intermittent generation is having sufficient flexible generation capacity (i.e. generation that can be quickly and easily increased or decreased such as gas power stations). Low carbon electricity plant has lower operating costs and without further policy action by an independent Scottish state, the increase in renewable generation could lead to under-investment in flexible reliable generation. The UK Government is addressing this issue through the introduction of a Capacity Market to ensure consumers across GB continue to benefit from reliable supplies at affordable cost. Scotland, with its ambitions for large scale renewables is set to benefit through access to this source of electricity. Independence raises questions about how the Scottish Government would deal with these issues and fund required market interventions.
- 1.58 These intermittency issues, coupled with the declining flows of gas directly into Scotland and increasing dependence on imports via England, mean an independent Scottish state may wish to increase and diversify its gas infrastructure, whether through new interconnectors, new liquified natural gas import terminals or increased gas storage capacity, to reduce its dependency on a single separate country. All of these options would require significant investment, and decisions on how these would be funded would need to be assessed by the government of an independent Scotland and its regulator.
- 1.59 An independent Scottish state may also need to create its own Capacity Mechanism to ensure there is sufficient incentive for more flexible generation, such as new gas generation, to be built and ensure security of its electricity supply. This will take time to design and establish. Given the high levels of wind, gas load factors⁵⁷ would necessarily be lower because it would only be required when the wind was not blowing, making it a less attractive investment for private commercial developers.
- 1.60 Work is underway to establish the GB Capacity Market, which will drive the investment that is needed and keep existing plant on the system. This will ensure security of electricity supply across GB by providing regular payments to capacity providers, in return for their availability to produce energy (or reduce demand) when the system is tight. It is expected that the first Capacity Market auction will run in late 2014, for delivery in 2018-19, subject to state aid approval.

⁵⁷ Load factors are based on the amount of time at which a generation plant operates.

Box 1C: Interconnection

Interconnection can enable the most efficient location of generation, increase competition and lead to reduced electricity bills. By giving access to generation beyond national borders it can improve security of supply, providing market prices reflect scarcity and flows across interconnectors follow prices. It can also help with the integration of intermittent sources of energy and the associated system balancing.

GB currently has 4GW of interconnection through four interconnectors – 2GW to France (through the interconnector known as IFA), 1GW to the Netherlands (BritNed) and two links of around 500MW each to the Irish grid (Moyle and East-West). In addition, there is around 5GW of further GB interconnection with other countries in the pipeline due to become operational by 2020.

The UK Government report, *More interconnection: improving energy security and lowering bills*,⁵⁸ outlines concrete steps underway to increase interconnection capacity.

Last year the UK supported a number of new interconnection projects in development – including to France, Belgium, Norway and the Republic of Ireland – to benefit from European Projects of Common Interest status. In recognition of the potential for further interconnection to contribute to security of supply, Department of Energy and Climate Change is also developing proposals to allow non-GB interconnected capacity to participate in the GB Capacity Market.

- 1.61 An independent Scottish state could look to increase interconnection with other markets to increase and diversify its access to external sources of power. Scotland currently only has one electricity interconnector of 0.5 Gigawatts (GW) connecting to Northern Ireland (compared with the three in England and Wales which have a total capacity 3.5GW).
- 1.62 The current Scottish Government has emphasised the importance of interconnectors to strengthen security of supply and a keenness for the number of links to grow.⁵⁹ However, in practice, developing such links can be a complex process and take significant amount of time. GB interconnectors in the pipeline typically expect around 4 to 6 years between reaching final investment decision and becoming operational. The decision will typically only be reached itself after several years of extensive works, including seabed studies.

UK Government's international influence

- 1.63 Energy security and supply is not just a domestic issue, Scotland and the UK must work within the wider global markets. Currently, Scotland benefits from the influential position the UK holds within these markets; a position built up over many years. With the UK becoming more dependent on imports, particularly for oil and gas, it is more important than ever that the Government is able to secure favourable positions for the UK, whether it be securing new routes for imports or opening up international markets.
- 1.64 The UK takes an active role on the international stage to ensure its interests are promoted. For example, the UK has a memorandum of understanding with Algeria and 'One North Sea Agreement' with Norway. Beyond these more formal arrangements there are also a great deal of more informal engagements and interactions that take place, such as ministerial visits and larger events, such as the 2012 meeting of the Clean Energy

⁵⁸ *More interconnection: improving energy security and lowering bills*, Department of Energy and Climate Change, December 2013.

⁵⁹ *Scotland's Future: Your guide to an independent Scotland*, Scottish Government, November 2013.

Ministerial group hosted by the UK, the formal UK-Saudi Energy Dialogue and International Energy Forum events. These agreements and informal diplomatic engagement are the product of decades of relationship building.

- 1.65 In the event of a vote for independence, in the eyes of the world and in law, Scotland would become an entirely new state.⁶⁰ An independent Scottish state would have to start afresh in terms of its formal alliances and links with every other sovereign state, including the UK. The UK's membership of key international organisations and involvement in treaties would be largely unaffected by Scottish independence. As set out in *Scotland analysis: EU and international issues*,⁶¹ while the continuing UK may choose to cooperate on issues of mutual interest, it would no longer have any obligation to represent Scottish interests as it currently does.

Prospects of a cooperative model

- 1.66 Scottish independence would introduce fundamental questions about what would happen to the level of integration in the current single GB markets in electricity and gas and how the markets would be managed in Scotland.
- 1.67 In its White Paper on independence, the current Scottish Government has stated that it would continue to participate in the GB wide market and proposes to establish an Energy Partnership with the UK Government to ensure a joint approach.⁶² However, in the event of independence, initial steps towards maintaining the fully integrated energy system preferred by the current Scottish Government would require both governments committing to agreeing a common approach; a process which would be very difficult when both will want to make decisions in the best interests of their citizens and consumers.
- 1.68 In some cases, interests may coincide, but in others, creating a national boundary would place tension on existing integration, raising the prospect of divergent regulatory and fiscal regimes. These are barriers that would be faced by many industries: however the energy market has an additional complexity in how different forms of generation are supported through consumer bills. Different forms of generation receive different levels of financial support, and achieving a balance between divergent policies can be challenging even within a fully integrated system. This would be exacerbated with two different administrations. If markedly different approaches were adopted on supporting different forms of generation, it is unlikely that accommodation could be reached to support an Energy Partnership as described by the current Scottish Government. The current Scottish Government's stated opposition⁶³ to new nuclear energy as part of the energy mix illustrates the potential for differing policy objectives. Some institutional implications are considered in detail below.

⁶⁰ *Scotland analysis: Devolution and the implications of Scottish independence*, HM Government, February 2013.

⁶¹ *Scotland analysis: EU and international issues*, HM Government, January 2014.

⁶² *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

⁶³ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

Regulation

- 1.69 In order to maintain an integrated market in the event of independence, the governments of an independent Scottish state and the continuing UK would need to agree to align standards, regulatory requirements and industry codes across the whole of GB. For a range of legal and practical reasons including compliance with EU law,⁶⁴ Ofgem could not remain as regulator for an independent Scottish state, and the current Scottish Government's White Paper has noted the intention to create a new independent National Regulatory Authority for Energy.⁶⁵ Divergence in regulatory regimes is more likely with two separate regulators, and would increase complexity and the administrative costs for industry, particularly for companies operating across both regimes, as well as adding uncertainty for investors while new regulatory approaches are put in place.
- 1.70 Furthermore, the two separate regulators – Ofgem and its Scottish equivalent – would need to agree to work together to ensure a common approach. It is likely that some form of supranational institutions, bodies and committees would be needed to ensure alignment and provide a forum for resolving differences. In the event of independence, both states would need to consider whether there is sufficient alignment in strategic approaches to managing energy markets, and whether such alignment would be in the interests of their citizens and consumers. Inevitably, governments may favour different approaches to how energy matters should be managed – for example some may reflect a more market focused approach, whilst others favour a more interventionist approach – and national legislation will reflect this.
- 1.71 The current Scottish Government has stated that an integrated market would continue in the event of independence, arguing that the continuing UK would need Scottish generation to ensure security of supply and to meet its renewables targets (as discussed in Chapter 2).⁶⁶ It is reasonable to assume that gas and electricity would continue to be traded between Scotland and the rest of GB, given that the UK already trades with other interconnected markets, and as the EU is moving to greater harmonisation of energy markets through its Third Package (see paragraph 1.78 below). However, this is very different to the fully integrated system which exists in GB currently, and the Scottish Government has not costed out the alternative options.
- 1.72 Whilst objectives may be aligned in some circumstances, a single system operator (National Grid) could not be accountable to two governments who may have differing views, objectives and priorities. Technical decisions could take on political dimensions, potentially distorting market operation; in doing so, all consumers in the current GB market, including Scotland, would lose the many benefits of an integrated market outlined above.
- 1.73 Investment decisions are currently made on the assumption of generators being connected within a particular timeframe, through the existing administrative regime managed by National Grid and on the basis of the current charging regime. Changes to these arrangements in the event of independence could fundamentally alter the business models for new transmission upgrade projects, and could risk delays to investment.

⁶⁴ Article 35(1) of the Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, and Article 39(1) of the Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.

⁶⁵ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

⁶⁶ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

- 1.74 As discussed through the chapter, a key feature of the current approach to network management is that the costs of maintaining the gas and electricity system are spread across the whole of GB. The UK Government believes this is a sensible approach as there is a wider consumer base to spread the substantial costs associated with ensuring the network is fit for purpose.
- 1.75 Whilst it may in practice be easier for two separate states to agree less controversial matters, such as technical or safety requirements, decisions that impose costs upon a state's consumers could be much more difficult to decide, particularly if there is a perception of imbalance. As explained in more detail in Chapter 2 and Chapter 4, Scotland holds considerable energy potential but, due to the geography and landscape, it also presents infrastructure challenges for companies involved in generation, requiring financial incentives to make investment viable. There are already a number of areas where there is financial support to help cover the cost of: Scottish renewables deployment; Scottish electricity network upgrades; and to protect Scottish consumers from the higher distribution costs associated with transporting energy to more remote parts of Scotland. As one country, it is more straightforward to agree such funding arrangements to benefit the country as a whole, but as two separate states this would inevitably become more difficult.

Cross-border and integrated markets

- 1.76 The UK Government is pushing for greater integration of energy markets across Europe, including through the implementation of the European Target Model, which seeks to harmonise cross-border trading of electricity and the management of interconnection capacity. This approach, which includes the 'coupling' of markets, will help foster competition, apply downward pressure on energy prices and, by ensuring that electricity flows where it is most needed, increase security of supply.
- 1.77 There are a number of examples of cross border cooperation and integrated markets which have been cited to illustrate how the continuing GB and a new Scottish market could operate in the event of independence. The Single Electricity Market between Ireland and Northern Ireland and Nordpool in Northern Europe in particular have been cited as examples.
- 1.78 Whilst developments such as the Irish Single Electricity Market and Nordpool have been beneficial to industry and consumers in those areas, these models have taken many years to establish, and neither model has the same level of integration as GB's single market. Crucially, neither the Irish Single Electricity Market nor Nordpool share the full cost of maintaining and strengthening the transmission network investment across borders unlike with the current GB model. These inherent features of the GB market mean that more costly forms of renewables generation in Scotland can be met automatically through unimpeded access to the GB consumer market, and that more remote areas of Scotland can benefit from pooled investment in the transmission network.
- 1.79 In entering a new era of European market integration, there are great opportunities but also obstacles to overcome to achieve greater harmonisation, and it is not clear how a Scottish market would be integrated with the rest of GB under these arrangements. Any models based on the Single Electricity Market or Nordpool would need detailed consideration and would likely take a long time to implement.
- 1.80 Transition is a very important consideration in a market where long-term strategic approaches are essential to guarantee the right levels of investment in infrastructure, generation, manufacturing and other sectors. Establishing a new Energy Partnership

amongst two separate states would require negotiation of uncertain duration. Even assuming that accommodation could be reached, implementation would take a considerable amount of time.

- 1.81 The UK Government's package of Electricity Market Reform, implemented through the Energy Act 2013, is a significant change to the energy market which will transform the UK's electricity sector. This package puts in place a long term market framework to incentivise the £110 billion of further investment in energy infrastructure estimated to be required to maintain security of supply and meet the UK's legally binding decarbonisation and renewables targets. Electricity Market Reform seeks to achieve these objectives in a way which minimises costs to consumers throughout the UK. The reforms provide long term support for all forms of low carbon generation through Contracts for Difference, and establish a capacity market to provide an insurance policy against future blackouts or price spikes. Due to the complexity and competing priorities involved, it took several years to work through the options and successfully negotiate the final package. The energy industry as a whole operates on a very long term basis, requiring considerable certainty, and there is no question that the prospect of re-opening the Electricity Market Reform package would represent a major concern to industry, including companies investing in Scotland.

Conclusion

- 1.82 Scotland is currently an integral part of GB's integrated energy system and enjoys the many benefits of the nationwide approach to managing energy networks and ensuring security of supply. As discussed throughout the chapter, there are a wide range of areas where it appears unclear or unlikely that this level of integration could continue in the event of independence. In its White Paper on independence,⁶⁷ the current Scottish Government has said it would like a level of integration to continue between an independent Scottish state and continuing GB. However, it has provided little detail on how this would work in practice and whether this simply means trading between nations or a more fundamental integration of managing energy needs. What is clear at this stage is that any new Energy Partnership would require negotiation of uncertain duration and there would be pressure on both Scotland and the continuing UK to protect local economic interests. The outcome would therefore be very uncertain, raising doubts over existing levels of financial support for renewables deployment in Scotland and some network upgrades.
- 1.83 In the event of a vote for Scottish independence the current GB energy system could not continue as it is now. There are numerous issues which would need to be considered, including the role of an independent Scottish regulator; whether an independent Scottish state would have its own system operator; how energy supply and demand would be balanced in Scotland; and whether the two states would be prepared to share any of the costs associated with managing energy networks and investment. These would need to be considered before each Government could decide which route offered the best outcomes for its citizens and consumers, as well as their respective energy industries.
- 1.84 Reliable gas and electricity networks are key to ensuring energy security and to facilitating the transition to a low carbon energy mix. Whilst the current system is extremely reliable, huge investment is needed to ensure they continue to be fit for purpose and meet the needs of a changing energy supply and different patterns of demand. As part of GB, Scottish generators currently have unrestricted access to a single market with millions of homes in demand of Scottish generation, and millions of bill payers to spread the necessary costs of electricity and gas infrastructure investment. Access to a large single GB market has enabled increased competition which assists in putting a downward

⁶⁷ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.



pressure on prices and driving up performance. Scotland also depends on the wider network in GB to manage the higher proportion of variable generation in the Scottish electricity supply by drawing on the more balanced and diverse energy mix outside of Scotland to meet any shortfalls.

- 1.85 As explained in more detail in Chapter 2, it is unclear how low carbon deployment would be supported within Scotland in the event of independence. Furthermore, without secure access to the wider and diverse GB energy mix or alternative sources of supply, an independent Scottish state may in fact need to scale back its current low carbon renewables ambition to ensure it has a mix that is more secure, less variable and less dependent on support from a separate country. In addition, an independent Scottish state may also need to create its own mechanisms to ensure there is sufficient incentive for more flexible generation (such as gas) to be built in an independent Scotland.





Chapter 2: Low carbon energy

The current Scottish Government has said that it will greatly increase renewable energy, setting a target of 100 per cent Scottish electricity consumption coming from renewable sources by 2020.¹ As part of the United Kingdom (UK), this is more likely to be achievable, because the cost of supporting renewable energy generation is spread across all UK energy bill payers.

Scotland's place in the UK has been fundamental to the success of the low carbon energy sector, which is thriving. As part of the UK, Scotland benefits from: the UK wide approach to meeting renewable energy targets; financial support provided by all UK energy bill payers; a range of grants and research funding; and an active UK Government promoting the industry at home and abroad.

These benefits provide Scotland with the opportunity to decarbonise its energy system with access to a complementary diverse energy mix (renewables, nuclear and fossil fuels with carbon capture and storage) across other parts of the UK. This framework has underpinned the success of the low carbon industry, and resulted in the UK becoming one of the most attractive destinations for renewable energy investment globally and the most attractive in the world for offshore wind investment.

DECC has recorded private sector announcements of over £34 billion of investment in the renewables industry between January 2010 and February 2014, approximately £14 billion of which is planned to take place in Scotland, with the potential to support around 12,000 Scottish jobs.²

Support paid by UK consumers to renewable generators through the UK's current large scale renewable financial incentive scheme, the Renewables Obligation was around £2 billion in 2012/13. Of this, Scotland received around £560 million, representing 28 per cent of the total UK funding. This is a considerable amount given Scotland only accounts for around 10 per cent of electricity sales in the UK.

¹ The target is to achieve 100 per cent of renewable electricity generation as a proportion of gross consumption. *Renewables revolution aims for 100 per cent*, The Scottish Government, May 2011.

² Figures are based on announcements by industry. Projects recorded will vary and includes projects in the planning process, under construction as well as in operation. Source; Press release on Renewable energy: delivering green jobs, growth and clean energy, Department of Energy and Climate Change, November 2013.

Scotland benefits from other competitions and grants provided by the UK Government and the wider UK consumer and tax base, such as a programme to support the commercialisation of carbon capture and storage and activities of the UK Green Investment Bank which has its headquarters in Edinburgh. In the event of independence, the future of such institutions would remain with the continuing UK.

Scottish independence could risk undermining the success of the low carbon sector in Scotland. The reality of independence is that Scottish low carbon energy projects are unlikely to be able to rely on the current levels of financial support provided by all UK energy bill payers. Consumers in an independent Scottish state are likely to have to contribute more of the cost of Scottish low carbon generation than is currently the case, which could mean a significant increase in consumer bills.

The continuing UK would need to meet its European Union (EU) set renewable energy target. It is difficult to be sure what that target would be in the event of Scottish independence, particularly as an independent Scottish state would have to negotiate the terms of its membership of the EU.³

But in the event of independence, Scotland would have to compete in an international market to sell any excess renewable energy or credits. If the continuing UK were to look beyond its borders for low carbon and renewable energy or credits towards meeting its target, it would need to consider which sources provided the cheapest and most reliable options, with Scottish production being only one of the possible sources.

- 2.1 The UK's low carbon energy sector is thriving with record levels of investment in electricity generation. Bloomberg figures show UK renewable investment is up 20 per cent over the last year while it has halved in the rest of the EU.⁴ Scottish investment is performing particularly strongly. As part of the UK, Scotland has benefitted from the UK wide approach to meeting renewables targets. In particular it has benefited from financial support provided by all UK energy bill payers and the existence of a more diverse energy mix necessary for balancing the variability some renewables bring; a range of grants and research funding; and an active UK Government promoting the industry at home and abroad.

The UK low carbon energy sector

- 2.2 The UK is in the process of decarbonising its energy supply, moving away from a traditional, fossil-fuel based supply to a more diverse mix with a much greater contribution from low carbon technologies such as renewables (for example wind and biomass), nuclear and carbon capture and storage.⁵ The UK Government is committed to this decarbonisation in order to strengthen energy security (by becoming less reliant on imported fossil fuels), reduce the impact on the climate and promote growth.
- 2.3 Moving to a mix of low carbon forms of generation should benefit consumers in the long-term as it helps reduce the UK's exposure to future high and volatile energy prices by reducing its dependence on other nations for its energy supplies, particularly imported fossil fuels. UK and EU targets and obligations have provided an extra impetus for change and strengthen the case for intervention:

³ *Scotland analysis: EU and international issues*, HM Government, January 2014.

⁴ Bloomberg New Energy Finance, Market Size database for New Investment in Biomass & Waste, Geothermal, Marine, Small Hydro, Solar, Wind 2013 (2012 data compared to 2013 rounded to \$bn).

⁵ *Increasing the use of low-carbon technologies*, Department of Energy and Climate Change, October 2012. See Glossary for CCS definition.

- The Climate Change Act 2008 commits the UK to reducing its greenhouse gas emissions by at least 80 per cent below 1990 levels by 2050.⁶ In addition to being covered by the UK Climate Change Act, Scotland is taking forward its own climate change policies. The Climate Change (Scotland) Act 2009 commits Scotland to a 42 per cent reduction in emissions by 2020 and annual reductions between 2010 and 2050; and
 - The 2009 European Union Renewable Energy Directive⁷ target commits the UK to ensuring that 15 per cent of the UK's final energy consumption (including power, heat and transport) is generated from renewable sources by 2020, either by direct generation, supporting projects in other Member States, or by purchasing renewable credits.⁸
- 2.4 In order to accelerate progress towards these targets and stimulate low carbon generation to replace ageing infrastructure, the UK Government has developed financial incentives to provide investors with upfront certainty to invest in low carbon generation.
- 2.5 As part of the UK, Scotland benefits from the UK wide approach: through financial support provided by all UK energy bill payers, a range of grant and research funding and via an active UK Government promoting the industry at home and abroad. Examples of this are the Carbon Capture and Storage Commercialisation Competition, Offshore Renewable Energy Catapult, and UK Carbon Capture and Storage Research Centre (see the Glossary for further details). Scotland's natural resources mean it has significant potential across the low carbon energy sectors which the UK framework is helping to unlock.
- 2.6 The current Scottish Government has set its own ambitious renewables target for Scotland to deliver 100 per cent renewable electricity by 2020.⁹ As of 2013, 34 per cent of all the UK's renewable electricity capacity and 32 per cent of all renewable electricity generation was located in Scotland. Taking the UK as a whole, Scotland accounts for 43 per cent of the UK's wind capacity and 41 per cent of wind generation.¹⁰ Scotland's place in the UK has been fundamental to this success.
- 2.7 Scotland has significant renewable heat¹¹ resource. The Energy Saving Trust estimates that in 2012, around 0.6GW of renewable heat capacity was operational in Scotland, producing an estimated 2.5TWh of useful renewable heat (equating to about 15 per cent

⁶ The Climate Change Act, which came into force in November 2008, legally requires the UK to reduce, via domestic and international action, GHG emissions by at least 80 per cent below 1990 levels by 2050. Under the Act, the UK Government is also required to set five-year binding *carbon budgets*, which will set the course to the 2050 target.

⁷ *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*, European Commission, June 2009.

⁸ The 2009 *European Union Climate and Energy package* obligates the European Union (EU) as a whole to achieve a reduction in GHG emissions of 20 per cent by 2020 compared to 1990 levels. It also obligated specifically that the EU as a whole ensure that by 2020, 20 per cent of its final energy consumption (including that used for power, heat and transport) must be met by renewable sources of generation and that the UK must ensure that by 2020, 15 per cent of final energy consumption must be met by renewable sources of generation.

⁹ *Renewables revolution aims for 100 per cent*, Scottish Government, May 2011.

¹⁰ *Energy Trends*, Department of Energy and Climate Change, March 2014.

¹¹ *Renewable heat action plan for Scotland: a plan for the promotion of the use of heat from renewable sources*, Scottish Government, November 2009, page 4.

of total UK renewable heat consumption in 2012).¹² This equates to over four per cent of Scotland's total forecast of non-electrical heat demand in 2020.¹³

- 2.8 Scotland is home to significant nuclear generation. It has two working nuclear power stations Hunterston B and Torness, which in 2012, contributed 34 per cent¹⁴ towards Scotland's electricity generation. The current Scottish Government does not support nuclear generation continuing into the long term in Scotland and has decided on a policy of not building any new nuclear power stations. However, it has supported the extension for Hunterston B to continue generating for another seven years (until 2023) and would support a similar application from EDF Energy to extend the life of Torness by a minimum of five years subject to maintenance of safety and security.¹⁵ These two nuclear power stations will therefore continue to generate more low carbon electricity for many years to come.
- 2.9 Scotland has benefitted from other competitions and grants provided by the UK Government. For example, the Carbon Capture and Storage Commercialisation Programme and UK Green Investment Bank are underpinned by £1 billion and £3.8 billion of UK Government funding respectively. Carbon capture and storage has the potential to substantially reduce emissions from fossil fuel power stations and will be a vital element of a decarbonised power sector. One of the two lead projects in the UK Government's Carbon Capture and Storage Competition is in Scotland – the Peterhead gas carbon capture and storage project in Aberdeenshire. On 24 February 2014 the UK Government awarded a contract and funding to Shell for Front End Engineering and Design studies of this project. The UK Government has set aside £1 billion for the development of projects in its Carbon Capture and Storage Commercialisation Programme and is making £100 million available now to the Peterhead (Scotland) and White Rose (Yorkshire) projects for engineering and design work ahead of final investment decisions. If Scotland were no longer part of the UK, under the competition criteria it is unlikely Peterhead would be eligible for further funding from the £1 billion available.
- 2.10 Underpinned by the UK Government policy framework and incentive schemes, the burgeoning low carbon sector in Scotland is bringing with it growth, investment and jobs. The industry body, Scottish Renewables, estimates that there were over 11,500 full-time equivalent jobs in renewable energy in Scotland at the end of 2013¹⁶ and that investment in Scotland in 2012 was around £1.5 billion.¹⁷ Between January 2010 and February 2014, Department of Energy and Climate Change recorded announcements of private sector investment in large scale UK renewable electricity projects of over £34 billion supporting over 37,000 jobs. Over £14 billion of this is placed to take place in Scotland, supporting around 12,000 jobs.¹⁸ In the future, Electricity Market Reform will ensure the UK remains a leading destination for investment in the electricity sector and could support as many as 250,000 jobs in the power sector in the UK.¹⁹

¹² In the whole of the UK, 16.4 TWh of renewable heat was consumed in 2012. Source: *Table 6.6, Digest of UK Energy Statistics 2013*, Department of Energy and Climate Change, July 2013, Page 188.

¹³ *Renewable Heat in Scotland, 2012: A report by the Energy Saving Trust for the Scottish Government*, Energy Saving Trust, June 2013, Page 4.

¹⁴ *Energy Trends: Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2009 to 2012*, Department of Energy and Climate Change, December 2013.

¹⁵ *Electricity Generation Policy Statement (EGPS) Report*, Scottish Government, August 2013.

¹⁶ *Scotland's renewable energy sector in numbers*, Scottish Renewables, information available at: www.scottishrenewables.com

¹⁷ *Scotland's Renewable Energy Sector in Numbers*, Scottish Renewables, information available at: www.scottishrenewables.com

¹⁸ *Speech: Address to the Scottish Renewables conference 2014*, Department of Energy and Climate Change, March 2014.

¹⁹ *Electricity Market Reform Delivery Plan*, Department of Energy and Climate Change, December 2013, page 3.

- 2.11 The UK Government works internationally, using its influence and building relationships with key countries to attract investment to the UK and promote UK products and industries and expertise. For example, the UK Government, working in conjunction with the current Scottish Government, are supporting two Scottish marine projects as part of the European's New Entrants Reserve 300 competition, as a result of which Scottish Power Renewables Sound of Islay and Siemens Marine Current Turbines Kyle Rhea are poised to receive €20.7 million and €18.4 million respectively.²⁰ In addition, UK Trade and Investment (UKTI) has established a new Offshore Wind Investment Organisation to attract inward investment to the UK and offer support.²¹ UKTI is also working to export UK renewables expertise abroad. It is currently focussed primarily on offshore wind, and is focussing on the most material markets globally, and developing the knowledge base to enable it to 'best fit' opportunities with UK capability.
- 2.12 Through these UK frameworks and support mechanisms, the low carbon industry, particularly for renewables, is thriving and plays an important role in diversifying the UK energy mix. Recent data shows that the UK remains the most attractive in the world for offshore wind investment, the fourth most attractive in the onshore wind index, the second most attractive in the biomass index and the fifth most attractive for all renewables out of 40 countries,²² with new-build asset finance of \$7.32 billion in 2013, up 59 per cent on 2012.²³ Scotland has benefited from this attractiveness with a number of companies deciding to locate manufacturing facilities in Scotland. For example, in the offshore wind sector Samsung Heavy Industries chose Methil as the site for testing of their first prototype 7MW turbine, constructed in October 2013. The UK Government is working closely with Scottish Development International to support future larger scale manufacturing facilities in Scotland, with companies including Areva and Gamesa having already stated their interest.
- 2.13 In addition Scotland hosts a range of institutions that are supported by UK funding and have helped to develop expertise which can be exported across the world. In 2012, Strathclyde University in Glasgow was chosen to host the headquarters of the Offshore Renewable Energy Catapult. Edinburgh is host to the UK Carbon Capture and Storage Research Centre, which was set up by the Research Council's UK Energy Programme. The UK Carbon Captive and Storage Research Centre has received funding from the Engineering and Physical Sciences Research Council (£10 million over five years), £3 million in funding from Department of Energy and Climate Change and contributions from participants. Edinburgh was also chosen to host the headquarters for the Green Investment Bank which became operational in 2012. In the event of independence, these institutions would remain an institution of the continuing UK.

²⁰ Commission implementing decision of 18.12.2012: Award Decision under the first call for proposals of the NER300 funding programme, the European Commission, December 2012.

²¹ Press release: Boost for inward investment and innovation in offshore wind, Department of Energy and Climate Change, June 2013.

²² Renewable energy country attractiveness index, Issue 40, Ernst & Young Global Limited, February 2014.

²³ The Ernst & Young Renewable Energy Country Attractiveness Indices (RECAI) ranks 40 countries on the attractiveness of their renewable energy investment and deployment opportunities, based on a number of macro, energy market and technology-specific indicators. The technology indices reflect a weighted average across macro, energy market and technology-specific parameters. Each parameter comprises a series of scoring indicators (i.e., datasets), all of which generate a score out of five. The parameter score is therefore the weighted average across the relevant scoring indicators. Each technology is also allocated a weighting based on the ratio of projected dollar spend over the four-year outlook period. Weightings are applied to each parameter and, finally, each driver category, to derive the total RECAI score. Source: RECAI: Updated methodology.

UK financial incentives for renewable deployment

- 2.14 Scotland's place in the UK has been fundamental to the success in deploying low carbon technologies and developing its thriving low carbon sector. As already discussed in Chapter 1, the wider Great Britain (GB) electricity market has enabled the cost of the financial incentives for renewables generation and investment in essential transmission infrastructure to be spread across the wider UK consumer base.
- 2.15 Whilst the UK Government is clear that in the long-run all forms of energy generation must be able to compete without UK Government assistance, currently additional support is needed to ensure investors see a return on their investments; without this support low carbon generation would struggle to compete. This financial support is currently and will be provided through a range of incentive schemes such as the Renewables Obligation, Contracts for Difference, Renewable Heat Incentive and small-scale Feed-in Tariffs for small-scale renewables, which provide medium to long term revenue streams to guarantee a return on up-front investment.²⁴
- 2.16 Both the UK Government and the current Scottish Government's support has encouraged investment in Scotland to come forward. There are current Scottish Government incentives available (£103 million Renewable Energy Investment Fund, Saltire Prize, and additional support to develop next generation offshore wind through a £35 million Offshore Wind Energy Renewables Scotland fund) and these are coupled with the publicly funded UK organisations whose innovation funding for local carbon technologies is around £1 billion between 2011-15.
- 2.17 Contracts for Difference as part of Electricity Market Reform will be the main support mechanism for low carbon generation in the future. Currently, the primary support mechanism for Scottish large scale renewable electricity is the Renewables Obligation (see Glossary for definition). The vast majority of the costs associated with supporting Scottish renewable generation are funded by all UK consumers. Spending via the Renewables Obligation reached £2 billion in 2012-13.²⁵ Of this Scotland received £560 million, which is 28 per cent of the total Renewables Obligation funding.²⁶ This is a considerable amount given Scotland only accounts for around 10 per cent of current electricity sales in the UK.
- 2.18 Whilst the Renewables Obligation has been successful in incentivising renewable electricity deployment, a new market mechanism is now required to provide industry with the framework to make further large scale energy investments at least cost to the consumer. Therefore in its place, the UK Government is introducing the Contracts for Difference mechanism, which will provide long term support for all forms of low-carbon electricity generation – including nuclear, renewables and carbon capture and storage. Such contracts will allow investors to be confident about the returns on their capital in advance of investing billions into new infrastructure, remove exposure to volatile wholesale electricity prices and produce a more competitive market; therefore ensuring electricity remains affordable.

²⁴ See Glossary for details of these schemes.

²⁵ *The Renewables Obligation Buy-Out Fund 2012-13*, Office of Gas and Electricity Markets (Ofgem) E-Serve, October 2013.

²⁶ The overall cost (£1.99 billion) of the Renewables Obligation is calculated as the Obligation (48,915,432 ROCs) multiplied by the buy-out price (£40.71 per ROC), as given in press notice: *Renewables Obligation – total obligation levels for 2012-13*, Office of Gas and Electricity Markets (Ofgem) E-Serve, August 2013. The share of this given to Scottish projects can be estimated by applying the proportion of ROCs presented by suppliers (in meeting the obligation) from Scotland generation projects (28 per cent). ROCs presented data can be found under 'Compliance certificates report' on Certificates by Technology and Country. Each country's sales can be calculated by dividing its overall obligation in terms of ROCs (4,519,537 ROCs) by its obligation per MWh of electricity supplied (0.158 ROCs).

- 2.19 Scotland is set to benefit considerably from the Contracts for Difference scheme, which will apply across the whole of the UK with costs spread across the UK wide consumer base. Access to this scheme will provide the foundation for the continued growth of the Scottish low carbon sector. Electricity Market Reform has been developed with the aim that the approach to incentivising investment in low carbon generation is applicable and usable by all financiers and investors, and beneficial to all UK consumers. It is by harnessing natural resources and technical expertise from across the UK that the required new generation of secure low-carbon power can be delivered.
- 2.20 As part of the Contracts for Difference mechanism, in 2013 the UK Government announced proposals for onshore wind generators located on the Scottish islands (i.e. Shetland, Orkney and the Western Isles) to be granted a higher strike price²⁷ through the Contracts for Difference incentive scheme. There is considerable potential in the Scottish islands to develop large onshore wind projects. The higher strike price was therefore granted to overcome the additional costs faced by generators, mainly because of the need to build transmission links across remote parts of Scotland and under water but also significantly higher operation costs, which otherwise would be unlikely to be commercially viable.
- 2.21 The Renewable Heat Incentive is still in a relatively early phase having only opened in late 2011, as of January 2014, Scottish generators accounted for 17 per cent of the total number of accredited generators, and as of February 2014 around 20 per cent of generation.²⁸ Again, the funding for the Renewable Heat Incentive scheme is drawn from a single GB-wide allocation from UK Government expenditure (not through a specific levy on consumer bills).
- 2.22 With regards to small scale renewables, as of 31 December 2013, over 448,000 installations across GB have been registered under the Feed-in Tariff scheme (launched in April 2010), with a total installed capacity of 2.2GW. Scotland accounts for over 7 per cent of total installations and over 9 per cent of total installed capacity. In Scotland, Solar Photo Voltaics accounts for 53 per cent of installed capacity, with wind (33 per cent) and hydro (13 per cent).²⁹

Prospects of continued funding for the Scottish renewable energy sector

- 2.23 An independent Scottish state would put at risk the UK-wide approach to promoting and incentivising low carbon generation. This approach has been designed on the basis that all parts of the UK work together to meet the country's energy needs and low carbon targets. It is on this basis that the necessary costs of ensuring the low carbon transition are spread across the whole of the UK and that the benefits can be shared at the local and national level. For example, communities in Scotland benefit from renewable energy located there in terms of investment in their local economy and jobs created, while the whole of the UK benefits from the energy supplied and the contribution to the UK's legally-binding renewable and decarbonisation targets.

²⁷ See definition in glossary.

²⁸ *Renewable Heat Incentive (RHI) and Renewable Heat Premium Payment (RHPP) deployment data*, Department of Energy and Climate Change, January 2014.

²⁹ *Sub-regional Feed-in Tariffs statistics: Number of installations and total installed capacity by technology type at the end of the latest quarter*, Department of Energy and Climate Change, January 2014.

- 2.24 The present Scottish Government has stated in its White Paper³⁰ that the continuation of the current GB wide market would ensure Scotland's renewable energy sources continue to support the low carbon ambitions of the continuing UK. This assumes that the UK-wide incentive schemes would continue to be available in an independent Scottish state, that consumers in the continuing UK state would still be willing to pay for Scottish renewables and that the UK would need the energy supply and the contribution to the renewables and decarbonisation targets.
- 2.25 Given the cost of investing in low carbon infrastructure, it is natural that any government would look to ensure that the benefits of such investment (e.g. growth, investment, employment) were felt within its own borders first, before looking to other options such as supporting projects outside its borders or buying renewable credits. As set out in Chapter 1, a common approach between two countries would be difficult to agree. Whilst Scotland has excellent renewable resources, so do other areas of the UK, such as offshore wind off the east coast of England, onshore wind in Wales, and solar in southern England.³¹
- 2.26 Independence would result in the UK-wide approach for incentives in low carbon generation being revisited. Scottish low carbon projects are unlikely to be able to rely on the current levels of financial support provided by all UK energy bill payers that it currently enjoys as part of the UK.
- 2.27 In the absence of a UK-wide approach, the Scottish Government may decide to replicate UK schemes or set up a whole new approach. However, if the cost of providing support for renewable electricity generation was passed on to Scottish electricity consumers, this could have a considerable impact on Scottish consumer bills. This is examined further in Chapter 4.
- 2.28 *Consumer Futures* has suggested that an independent Scottish state could look to use oil revenues through an 'oil fund' to help reduce costs by subsidising the development of new technologies.³² However, as set out in *Scotland analysis: Macroeconomic and fiscal performance*, establishing an oil fund would affect the fiscal choices available to an independent Scottish state and implementing an oil fund in a similar way to Norway would imply very significant tax increases or cuts to public spending.³³ Based on the most recent forecasts of Scotland's fiscal position in 2016-17 by the Centre for Public Policy for Regions, for an independent Scottish state to start an oil fund in 2016-17 from a balanced budget, £8.7 billion (in 2012-13 prices) would be needed. That is equivalent to spending cuts of 13 per cent from current levels, or onshore tax rises of 18 per cent.³⁴
- 2.29 If the continuing UK was not able to meet its own renewable target through its own resources and did need to buy additional renewable energy, it would need to consider all the options available to ensure the best outcome for its citizens. If an independent Scottish state could compete on price, the continuing UK may want to support Scottish renewables or pursue joint projects and the proximity of the two countries may mean that this represents best value for money. However, the continuing UK could equally look elsewhere, including funding projects in other EU Member States or through the purchase

³⁰ *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

³¹ *Renewable energy trends found here: Special feature article – Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2012*, Department of Energy and Climate Change, December 2013, page 49.

³² *Energy policy, constitutional change and consumers in Scotland*, Consumer Futures, July 2013, page 12.

³³ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

³⁴ *Analysis of Scotland's past and future fiscal position*, Centre for Public Policy for Regions, March 2014.

of renewable credits, which in effect would mean supporting additional renewable capacity elsewhere in the EU.

- 2.30 If the UK did look abroad to source renewables, the Renewable Energy Directive allows for this to be achieved by both physical and statistical trading, which could be done with many members in the EU. The UK Government has already agreed a Memorandum of Understanding³⁵ with the Irish Government, which commits both Governments to working together closely to secure economic benefits for both countries through trade in renewable energy. The UK Government believes this may represent a cost-effective way of meeting the existing renewables target.
- 2.31 The continuing UK could also statistically trade³⁶ with other member states to complement the continuing UK's energy generation, either as a contingency measure and/or a means of reducing the costs to energy bill payers if required. Although the price of renewable energy credits in 2020 cannot be known, figures indicate that the EU as a whole is on its trajectory towards the 2020 targets.³⁷ This may mean that there will be renewable energy available for trading across Europe. Prices will depend on supply, but also the overall demand from other Member States who have not met their targets.
- 2.32 In the same way, the Scottish Government may look to other states to trade their renewable electricity and help support their renewable energy industry, including through building interconnectors (see Chapter 1). However, in the absence of specific agreements in advance, an export-focused route for support of Scottish renewables could prove a high-risk strategy if an independent Scottish state deliberately looked to exceed its target on the basis that it could recoup the cost at a later stage from statistical trading with other countries.
- 2.33 Beyond 2020 the continuing UK will need a mix of technologies to ensure it remains on track to meet the legally binding decarbonisation target in 2050. It is currently unclear what the exact mix will be (although the UK Government has developed a tool to explore this),³⁸ but it is likely the UK will need renewables, nuclear and carbon capture and storage. If the continuing UK were to look beyond its borders for low carbon and renewable energy or credits towards meeting its target, it would need to consider which sources provided the cheapest and most reliable options. These could be in the continuing UK or abroad, with Scottish production being only one of the possible sources.
- 2.34 Finally, as set out in UK Government's paper the *Scotland analysis: Devolution and the implication of Scottish independence*, in the event of independence UK institutions (such as UK Carbon Capture and Storage Research Centre) would continue to operate on behalf of the continuing UK.³⁹ An independent Scottish state may want to establish new institutions or significantly expand capacity in existing ones in order to assume these functions. In the event of independence, if Scotland wished to run a full breadth of schemes (such as a Carbon Capture and Storage Commercialisation Programme) on the same scale as present UK schemes to support the low carbon sector, that would add substantially to costs.

³⁵ *Memorandum of Understanding between the Minister for Communications, Energy and Natural Resources of Ireland and the Department of Energy and Climate Change of the United Kingdom on cooperation in the energy sector*, Department of Energy and Climate Change, January 2013.

³⁶ Statistical trading between countries means trading without electricity being physically delivered.

³⁷ *Report to The European Parliament, The Council, The European Economic And Social Committee And The Committee of the Regions: Renewable energy progress report; COM(2013) 175*, EU Commission, March 2013, page 12.

³⁸ *The UK 2050 Calculator*, Department of Energy and Climate Change.

³⁹ *Scotland analysis: Devolution and the implications of Scottish independence*, HM Government, February 2013.

Conclusion

- 2.35 The UK low carbon sector is thriving and the sector is well-placed to consolidate its place as a world-leader and international hub of expertise to export across the globe. Whilst good progress has been made there is still some way to go and the UK is at a critical juncture as it continues to reform the electricity market and deploy new low carbon technologies.
- 2.36 The reality of independence is that Scottish low carbon energy projects are unlikely to be able to rely on the current levels of financial support provided by all UK energy bill payers. Additional costs for Scottish consumers would be inevitable as the shared costs of low carbon generation between consumers in an independent Scottish state and the continuing UK would be unwound.
- 2.37 An independent Scottish state would have to compete in an international market to sell its renewables abroad. If the continuing UK were to look beyond its borders for low carbon and renewable energy, it would need to consider which sources provided the cheapest and most reliable options, with Scottish production being only one of the possible sources.
- 2.38 The continuing UK would need to continue to meet its EU set renewable energy target. It is difficult to be sure what that target would be in the event of Scottish independence, particularly as an independent Scottish state would have to negotiate the terms of its membership of the EU.⁴⁰

⁴⁰ *Scotland analysis: EU and international issues*, HM Government, January 2014.





Chapter 3: Oil and gas

Development of the oil and gas resources of the United Kingdom (UK) Continental Shelf is a success story for the UK. The UK Continental Shelf has been a major contributor to the UK's energy supply, providing some 42 billion barrels of oil equivalent to date and it is a UK-wide industry that has brought widespread economic benefits in terms of jobs and investment.

Critical to this success has been the diverse UK fiscal base and an active UK Government working at home and internationally to promote the industry.

With potentially another 20 billion barrels of oil equivalent still remaining, the UK Government continues to adapt to ensure the competitive appeal of the UK Continental Shelf and make the most of the opportunities that still exist. In June 2013 the UK Government commissioned Sir Ian Wood to undertake a review of the offshore oil and gas industry and is now acting on his recommendations.

The UK Continental Shelf is a relatively mature basin with a challenging environment, where resources are becoming more expensive to extract. Substantial levels of investment by companies are required to boost exploration, sustain or replace ageing infrastructure and deploy advanced technological methods to recover the remaining reserves. With operators pursuing international portfolios, the UK fiscal regime is an essential component to ensure competitiveness with younger basins worldwide.

The UK Government's long term approach has renewed industry confidence in the UK Continental Shelf, illustrated by record levels of investment. The UK Government has provided tax incentives to support extraction as part of its long-term economic plan – including a £3 billion allowance for large and deep fields, a £500 million allowance for large shallow-water gas fields and has provided certainty on decommissioning relief worth £20 billion. The UK Government has also announced a new ultra high pressure, high temperature cluster allowance.

On decommissioning relief alone, an independent Scottish state would have to invest around £3,800 per head – over ten times more than when costs are spread across the UK – to match the £20 billion the UK Government has committed towards decommissioning in the North Sea.

Since devolution, offshore oil and gas receipts amounted to around 1.5 per cent of total UK receipts. For Scotland, North Sea revenues would have been almost 14 per cent of the total. It is uncertain how an independent Scottish state, with a smaller economy and tax base, would manage the challenge of a narrower and more volatile revenue base.

The Scottish Government has stated that in the event of a vote for independence, they would establish an oil fund. Even if an independent Scottish state were able to adjust fiscal policy radically and implement an oil fund, this would not smooth all volatility in Scotland's public finances. It may take considerable time to build up a fund of adequate size to manage volatility in the public finances.

Implementing an oil fund in a similar way to ones established in countries such as Norway would imply very significant tax increases or cuts to public spending, over and above the plans that have been set by the UK Government to repair the impact of the financial crisis.

As part of the UK, Scotland achieves many of the benefits of an oil fund. The UK's integrated fiscal model provides a very stable flow of Scottish expenditure, without the need for Scotland to run the onshore fiscal position required for an oil fund.

- 3.1 The oil and gas extracted from the UK Continental Shelf are major contributors to the UK's energy supply, bringing widespread economic benefits not only in terms of jobs and investment but in developing the UK as a hub of expertise in oil and gas technology. Some 42 billion barrels of oil equivalent have been produced from the UK Continental Shelf since licences were first issued offshore in the mid-1960s with potentially another 20 billion still remaining.¹ In 2012, oil and gas provided some 69 per cent of the UK's total primary energy supply. Production specifically from the UK Continental Shelf was equivalent to 41 per cent of total UK primary energy demand, 67 per cent of oil demand and 53 per cent of gas demand.²
- 3.2 The benefits of the oil and gas industry go well beyond simply meeting the UK's demands for energy. In its 2013 Economic Report, Oil & Gas UK estimated that around 450,000 people were employed directly and indirectly by the sector in 2012. Approximately 36,000 were directly employed by oil and gas companies and major contractors and a further 200,000 were employed in the supply chain.³ Industry estimates that approximately half of the oil and gas industry jobs supported across the UK were based in Scotland with the remaining being spread over other parts of the UK.⁴ This includes not only those directly employed in the industry, but also the wider supply chain, jobs exporting goods and services and jobs induced by the economic activity of employees.⁵
- 3.3 Whilst the UK is pursuing long-term decarbonisation, oil and gas will continue to have a major role in meeting the UK's energy needs. For example, gas will assist the transition away from coal-powered generation and low-carbon transport is unlikely to replace all petrol and diesel vehicles for several decades.⁶
- 3.4 As the UK Continental Shelf matures, oil and gas are becoming more challenging to extract and the UK will have to compete for investment with other younger basins across the world. However, recent record levels of investment are an indicator of how the UK Government's long term approach to the oil and gas industry has renewed confidence in the UK Continental Shelf. The Department of Energy and Climate Change's petroleum licensing system has ensured that exploitation of the UK Continental Shelf has remained

¹ *Oil and gas: field data*, Department of Energy and Climate Change, information available at www.gov.uk.

² *Digest of United Kingdom Energy Statistics 2013*, Department of Energy and Climate Change, 2013, page 29.

³ *Economic Report 2013*, Oil & Gas UK, 2013, page 9.

⁴ *Economic Report 2013*, Oil & Gas UK, 2013, page 58.

⁵ *Economic Report 2012*, Oil & Gas UK, 2012, page 39.

⁶ *UK Oil and gas business and government action: Industrial Strategy – government and industry in partnership*, HM Government, March 2013.

effective with some 42 billion barrels of oil equivalent having been produced so far.⁷ The 27th licensing round⁸ saw a total of 167 provisional new licences being awarded by the Department of Energy and Climate Change covering 330 North Sea blocks.⁹ The UK Government is committed to working in partnership with industry, to maximise the economic recovery of the UK's oil and gas resources and sustain and promote the growth of the UK industry's supply chain, in both domestic and international markets. The UK Government supports the recommendations made by Sir Ian Wood in his review on maximising recovery from the UK Continental Shelf which was published on 24 February 2014.

- 3.5 EY's paper *Grasping the thistle: adding energy to the debate*¹⁰ showed that 37 per cent of senior leaders and decision makers who completed the online survey rated the Scottish referendum as a significant cause of uncertainty in their UK Continental Shelf operations; with 41 per cent ranking this as their fourth, fifth or sixth most important source of uncertainty.

How much oil and gas is there left?

- 3.6 One of the key questions in the Scottish independence debate is how much oil and gas remains and how these resources would be divided in the event of Scottish independence. Although production of oil and gas has been falling since the turn of the century, to around a third of its peak level, the UK Continental Shelf still has substantial oil and gas resources. However, forecasting the ultimate recoverable volume of these resources is highly uncertain and dependent on many factors such as the deployment of new technology, oil and gas prices, pace of exploration and new field development. The Department of Energy and Climate Change estimates there may be 20 billion barrels of oil equivalent still to be recovered from the UK Continental Shelf.¹¹ However, only around half of that (10.7 billion barrels of oil equivalent) is either in production, under development or being considered for investment.¹²
- 3.7 In the event of a vote for independence, an independent Scottish state and the continuing UK would need to negotiate and agree their international maritime border. There would be two options as to how to decide the delimitation of the continental shelf – bilateral negotiation between an independent Scottish state and the continuing UK leading to agreement, or in the event of failure to agree, through an international judicial settlement mechanism. International agreements on maritime borders can often take years or decades to resolve, and failure to agree through bilateral negotiation can result in protracted costly outcomes. These issues are examined in more detail in the UK Government's paper *Scotland analysis: Borders and citizenship*.¹³

⁷ *Economic Report 2013*, Oil & Gas UK, 2013, page 8.

⁸ Department of Energy and Climate Change's licensing system covers oil and gas within Great Britain, its territorial sea and on the UK Continental Shelf. These licences grant exclusive rights to search and bore for, and later produce petroleum in specific North Sea blocks.

⁹ *North Sea oil and gas licensing round bonanza*, Department of Energy and Climate Change, available at www.gov.uk.

¹⁰ *Grasping the thistle: Adding energy to the debate*, EY, November 2013, page 8.

¹¹ Available at Department of Energy and Climate Change website www.gov.uk.

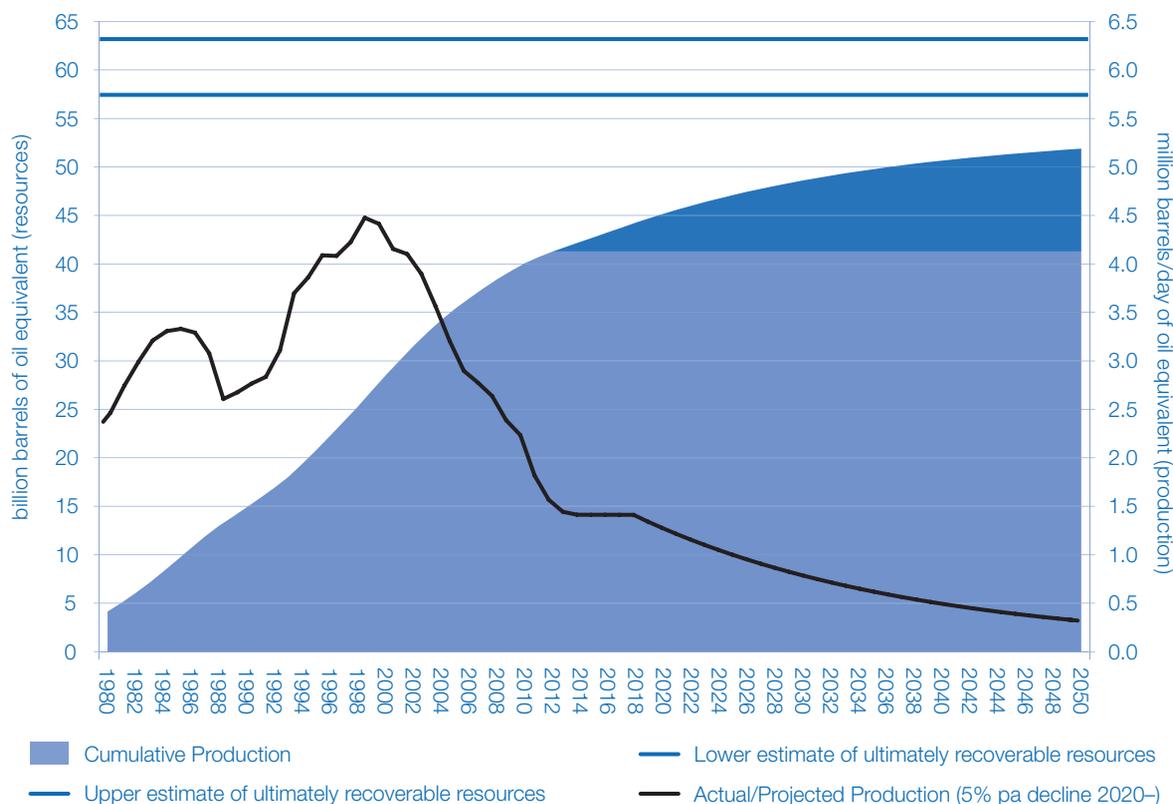
¹² *Activity Survey 2014*, Oil & Gas UK, February 2014.

¹³ *Scotland analysis: Borders and Citizenship*, HM Government, January 2014.

The large UK economy and fiscal base

3.8 Oil and gas are valuable resources with much still to offer the UK. However, as outlined above and in Chart 3A, the UK Continental Shelf oil and gas resources are in decline and becoming more challenging and expensive to extract.

Chart 3A: Chart showing UK oil and gas reserves and production¹⁴



3.9 The uncertainty of estimating the extent of remaining UK Continental Shelf oil and gas resources adds to the difficulty of forecasting total North Sea tax revenues. Exchequer revenues from taxes on profits from UK oil and gas production have a critical dependence on a range of factors that are difficult to predict, including oil and gas prices, exchange rates, production levels and the level of investment.¹⁵ While higher oil prices result in higher revenues, this increase is unpredictable and limited as higher product prices are generally associated with increases in industry costs.

3.10 As part of the UK, the Scottish Government's budget would be unaffected by forecast errors due to the benefits of pooling resources. An independent Scottish state would need to fund all its spending from its own resources, so would need to increase borrowing or taxation, or cut spending, in response to over-optimistic forecasts. These issues are discussed more fully in the UK Government's paper *Scotland analysis: Macroeconomic and fiscal performance*.¹⁶

3.11 The Scottish Government's figures show that since devolution Scotland's geographic share of North Sea revenues has fluctuated between £2 billion and £12 billion.¹⁷ In addition, since devolution, offshore oil and gas receipts amounted to around 1.5 per cent

¹⁴ Chart combines DECC's resource estimates and production projections, available at www.gov.uk/oil-and-gas-uk-field-data.

¹⁵ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

¹⁶ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

¹⁷ *Government expenditure and revenue: Scotland 2012-13*, Scottish Government, March 2014.

of total UK receipts. For Scotland, North Sea revenues would have been almost 14 per cent of the total receipts. Shortfalls in North Sea revenues would need to be offset by borrowing in financial markets (to avoid spending cuts or tax rises). There are therefore clear risks from depending on such a volatile source of revenue for such a large proportion of tax revenues.¹⁸

- 3.12 The UK economy, with its broader and more diverse tax base shields the Scottish economy from the damaging effects of economic volatility. Instead of facing the challenge of managing this volatility, Scotland continues to benefit from stable public spending, which is consistently 10 per cent per head higher than the UK average. This high degree of fiscal integration across the UK means that fiscal resources can easily be deployed in response to shocks in individual parts of the UK.
- 3.13 In the last year alone, the Office for Budget Responsibility has revised down oil and gas tax revenues by £8 billion over the next five years. Furthermore, since Budget 2010 the Office for Budget Responsibility has revised down these tax revenues over the five years to 2015-16 by £21 billion. During the same period, the Scottish Government has benefitted from an additional £2.2 billion of funding from the UK Government.¹⁹
- 3.14 As set out at the recent Autumn Statement 2013, while most UK departments will be required to make savings between now and 2015-16, the Scottish Government budget will increase by more than £300 million, despite the Office for Budget Responsibility reducing its forecast for North Sea revenue by almost £4 billion for this period.²⁰
- 3.15 Tax on the North Sea oil and gas industry is an important factor for companies making investment decisions, especially where the economics of projects are marginal. Oil & Gas UK's report has revealed the positive effect tax allowances have had on driving investment on the UK Continental Shelf.²¹
- 3.16 The UK Government has introduced new and extended field allowances to support the industry as extraction becomes more difficult. This included: a doubling of the value and criteria for the small field allowance (taking this to a £150 million allowance); a £3 billion allowance to support investment and exploration in large and deep fields, aimed particularly at West of Shetland; a £500 million allowance for large shallow-water gas fields; and a 'brown field allowance' to promote investment in commercially marginal projects in existing fields.²² The UK Government has also announced a new ultra high pressure, high temperature cluster allowance, building on the recommendations of the Wood Review, that will be introduced following consultation on the details.²³
- 3.17 The Oil & Gas UK Activity Survey 2014 noted that "new field allowances have encouraged investment in opportunities that would otherwise have been unattractive at prevailing fiscal and market conditions", estimating that "in 2013, around half of the £14.4 billion of investment was in some way incentivised by an allowance and this proportion will almost certainly increase in 2014".²⁴

¹⁸ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

¹⁹ *Budget 2014*, HM Treasury, March 2014.

²⁰ *Autumn Statement 2013*, HM Treasury, December 2013.

²¹ *Activity Survey 2014*, Oil & Gas UK, February 2014.

²² *Oil and Gas: taxation*, Department of Energy and Climate Change, available at www.gov.uk.

²³ *Budget 2014*, HM Treasury, March 2014.

²⁴ *Activity Survey 2014*, Oil & Gas UK, February 2014, page 24.

- 3.18 The Finance Act 2013 introduced the necessary legislation to underpin a contractual approach giving companies greater certainty on decommissioning tax relief.²⁵ Companies are legally required to decommission equipment such as platforms, pipeline and other facilities at the end of a field's life and the total cost of decommissioning is currently estimated by industry to be between £30 billion to £40 billion.²⁶ Oil & Gas UK Activity Survey 2014 states that "when looking out to 2040, it is anticipated that decommissioning expenditure will total about £40.6 billion, of which £37 billion will be to decommission existing installations and those that have already been approved and a further £3.6 billion to decommission new fields yet to be installed." It notes that "decommissioning expenditure is expected to average £1.3 billion per year over the remainder of the decade, peaking at £1.7 billion in 2016".²⁷
- 3.19 In October 2013, the UK Government signed the first deeds with industry which guarantee the level of tax relief a company can expect to receive when decommissioning assets in the future. The aim is to provide operators and licence owners with certainty to invest and to minimise the risk of companies failing to meet their obligations and the cost of decommissioning falling to the tax payer. The industry has already decommissioned 10 per cent of the 618 installations and 25,000 kilometres of pipelines on the UK Continental Shelf. The scale and value of future decommissioning work provides a significant opportunity to support economic growth.²⁸
- 3.20 The Scottish Government in their White Paper on *Scotland's Future: Your guide to an independent Scotland*²⁹ claimed that post-independence decommissioning relief would be provided in the manner and at the rate currently provided through the current fiscal regime. However, it is uncertain how an independent Scottish state, with its smaller economy, would be able to support the industry in the long-term as reservoirs become more challenging to extract and reserves begin to deplete. An independent Scottish state would have to invest around £3,800 per head – over ten times more than when costs are spread across the UK – to match the £20 billion the UK Government has committed towards decommissioning in the North Sea. This issue was considered in more detail in the UK Government's paper *Scotland analysis: Macroeconomic and fiscal performance*.³⁰
- 3.21 The Scottish Government has also stated that the current licensing and regulatory regimes in operation would continue, and existing energy licences would continue to be in force in an independent Scottish state. However, setting up new regulatory bodies and rules, even if designed to mirror those currently in place, would inevitably take time to establish. This would also create new uncertainties for investors. The energy licences are not purely regulatory but are also partly contractual. As such, any transfer to an independent Scottish state would be among the matters to be negotiated with the government of the continuing UK in the event of a vote for Scottish independence.

Oil fund

- 3.22 The Scottish Government has drawn parallels with Norway where oil and gas revenues form a substantial proportion of the economy. However, there are some fundamental differences between Norway and the UK Continental Shelf that make comparison difficult, including the existence of Statoil (the Norwegian state-controlled operator). Production

²⁵ *Annual Energy Statement 2013*, Department of Energy and Climate Change, October 2013, page 40.

²⁶ *Annual Energy Statement 2013*, Department of Energy and Climate Change, October 2013, page 49.

²⁷ *Activity Survey 2014*, Oil & Gas UK, February 2014, page 36.

²⁸ *Annual Energy Statement 2013*, Department of Energy and Climate Change, October 2013, page 49.

²⁹ *Scotland's Future: Your guide to an independent Scotland*, Scottish Government, November 2013.

³⁰ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

forecasts have typically been more consistent with actual production, and with less volatility in gas prices, this has meant fluctuations have been easier to predict. Data recently published by Wood Mackenzie³¹ illustrates the significant difference in profile, with Norway showing higher levels of successful exploration and greater production volume.

- 3.23 In the event of independence, an independent Scottish state would be directly exposed to a narrower tax revenue base and more volatile fiscal position. The Scottish Government's White Paper on independence has stated that in the event of a vote for independence, a Scottish Energy Fund would be established which would be both a stabilisation and long-term investment fund into which a portion of tax revenues would be invested when fiscal conditions allow.³²
- 3.24 As set out in *Scotland analysis: Macroeconomic and fiscal performance*, establishing such a fund would affect the fiscal choices available to an independent Scottish state. In the absence of shared public finances, in 2009-10 – in the aftermath of a halving of North Sea oil and gas revenues – Scotland would have faced a choice between implementing immediate spending cuts of £6 billion, increasing other taxes by this amount or absorbing this volatility in its budget deficit. Implementing an oil fund in a similar way to ones established in countries such as Norway's would imply very significant tax increases or cuts to public spending, over and above the plans that have been set by the UK Government to repair the impact of the financial crisis.
- 3.25 Even if an independent Scottish state were able to radically adjust fiscal policy and implement an oil fund, this would not smooth all volatility in Scotland's public finances. It may take considerable time to build up a fund of adequate size to manage volatility in the public finances. As part of the UK, Scotland achieves many of the benefits of an oil fund: the UK's integrated fiscal model provides a very stable flow of Scottish expenditure, without the need for Scotland to run the onshore fiscal position required for an oil fund.

Collaborative working

- 3.26 As set out earlier, the UK Continental Shelf is a relatively mature basin, which has to compete for investment with younger basins and regions where the technical and economic barriers of extraction are less challenging. The global competition for investment, buoyed by high oil and gas prices, is stronger than ever and the UK Government is committed to working with industry to ensure a collaborative approach in order to continue attracting investment in the UK Continental Shelf.
- 3.27 One such forum for engagement between the UK Government and industry is PILOT,³³ the established partnership between the UK Government and industry which aims to maximise the economic recovery of the UK's offshore resources of oil and gas. It is chaired by the Department of Energy and Climate Change Secretary of State and comprises the Secretary of State for Scotland, representatives from the Scottish Government, the UK oil and gas industry and the Scottish Trade Union Council. Work commissioned by the UK Government and industry is taking place to identify gaps in the current capability and new opportunities for UK business. This work is supported by the PILOT Supply Chain Code of Practice³⁴ which is well established and fully endorsed by more than 200 companies spanning the

³¹ *The North Sea: How does the UK compare*, Wood Mackenzie, Information available at www.oilandgasuk.co.uk.

³² *Scotland's Future: Your Guide to an Independent Scotland*, Scottish Government, November 2013.

³³ PILOT is the oil and gas taskforce which is a unique partnership between the UK oil and gas industry and Government working in cooperation to deliver quicker, smarter and sustainable energy solutions to secure the long-term future of the UKCS.

³⁴ Information available at www.gov.uk.

spectrum of participants in the basin. The code outlines a set of best practice guidelines for the UK Continental Shelf oil and gas industry to improve performance, eliminate unnecessary costs add value and boost competitiveness.³⁵

3.28 The UK Government has also established the Oil and Gas Fiscal Forum, which is designed to encourage constructive discussion on tax issues with the oil and gas sector. The Forum is used by Ministers and representatives from companies across the oil and gas industry to discuss a range of fiscal issues, including on-going work on decommissioning tax relief and encouraging investment in marginal fields.

3.29 The oil refining sector³⁶ is facing challenges and the UK Government is working with industry to ensure that the refining and imports sectors work effectively and continue to deliver fuel resilience to the UK market. The review of the refining and fuel imports sector recently completed by the UK Government sets out a package of actions which taken together could help improve the operating environment for the refining and import sectors. These actions have been developed across three themes; a partnership approach with industry, removing market distortions and tackling regulatory burden.³⁷

3.30 In 2013, the UK Government launched its oil and gas sector strategy. This industrial strategy identified priorities that government and industry will work on together in a long-term partnership with industry. It aimed to: maximise the economic production of the UK's offshore oil and gas resources; sustain and promote the growth of the UK industry's supply chain, in both domestic and international markets; and promote purposeful collaboration across industry and between industry and government. The strategy worked to put government and industry on the right path to ensure future decades of investment and production in the North Sea. It supports the shared objective of maximising economic recovery of oil and gas from the UK Continental Shelf and a dynamic supply chain which sustains high quality jobs in the UK.³⁸ The aims of the strategy have been further reinforced by Sir Ian Wood's review of the offshore oil and gas industry.

3.31 The UK Government is committed to maintaining momentum in the industry and making the most of the opportunities that exist. On 10 June 2013 the UK Government announced a review of UK offshore oil and gas recovery, led by Sir Ian Wood.³⁹ As part of the UK Government's commitment to supporting the UK oil and gas industry work has been on-going for many years to understand the changing needs of the maturing UK Continental Shelf and Sir Ian Wood's report is an important element of this. The final report was published on 24 February 2014 and had four key recommendations:

- The need for a new tripartite strategy for Maximising Economic Recovery from the UK Continental Shelf (MER UK), involving HM Treasury, industry and a new Government Regulatory body;
- A new independent regulator with additional powers and resources (such as supervising licencing and ensuring maximum collaboration between companies to explore, develop and produce oil and gas);

³⁵ *Industrial Strategy: Government and industry in partnership – UK oil and gas business and government in action*, HM Government, March 2013.

³⁶ Refiners convert crude oil into finished oil products for the UK market and for export, as well as importing some finished products.

³⁷ *Review of the refining and fuel import sectors in the UK*, Department of Energy and Climate Change, April 2014.

³⁸ *Industrial Strategy: Government and industry in partnership – UK oil and gas business and government in action*, HM Government, March 2013.

³⁹ *UKCS maximising recovery review: Final report*, Sir Ian Wood, February 2014.

- The need for clear commitments from Industry to collaborate and work to the MER UK strategy; and
 - The need to develop sector strategies to underpin the delivery of MER UK.
- 3.32 The UK Government supports these recommendations and announced in February 2014 that it would move the stewardship of the UK Continental Shelf to a new arm's-length body, funded by industry and with new resources and any necessary statutory powers to meet that challenge. The next steps in taking this forward will be:
- the Department of Energy and Climate Change will launch a competition for the CEO designate, with the aim of having someone in place by July 2014;
 - the CEO will steer the set up of the interim body over the summer, which government plans to have up and running in October 2014; and
 - the government then plans to establish the maximising economic recovery UK principles in legislation in the 4th session of the current Parliament and, subject to the Parliamentary timetable, these could be in force from spring 2015.
- 3.33 Sir Ian's report states that full implementation of the recommendations in the report will have the potential to deliver an additional 3-4 billion barrels of oil equivalent over the next 20 years.
- 3.34 The UK Government has also confirmed it will review the UK's oil and gas fiscal regime to ensure it continues to incentivise economic recovery as the basin matures, working with the new arm's length body. It will report back at Budget 2015 with its finding and recommendations.⁴⁰
- 3.35 This highlights that whilst the near-term prospects are positive, overall UK Continental Shelf oil and gas resources are declining and will become more challenging and expensive to extract from difficult reservoirs and deeper water. The size and diversity of the UK economy enables the UK Government to provide tax reliefs and fiscal certainty to support the industry as extraction becomes more difficult. The UK's broad and diverse economy also means it is able to absorb the shocks of oil price volatility which may become more acute going forwards.

Championing the industry abroad

- 3.36 Scotland benefits from the UK Government's international network and influence in the world which includes promoting the oil and gas industry abroad. The UK Government works to attract investment in the UK promoting expertise and the supply chain; and negotiating favourable regulatory outcomes in Europe and other international fora. The UK Government is recognised as a strong and influential actor internationally, with one of the most extensive, well respected diplomatic and trade networks in the world. The UK's diplomatic global network employs over 14,000 people in 267 Embassies, High Commissions and Consulates in 154 countries and 12 Overseas Territories around the world, working to promote and protect economic interests of businesses based in all parts of the UK. Scottish-based businesses currently benefit from access to and promotion by this network with focussed support from UK Trade and Investment's (UKTI) 169 offices in over 100 countries. UKTI's role is discussed more generally in the UK Government's paper *Scotland analysis: EU and international issues*.⁴¹

⁴⁰ *Budget 2014*, HM Treasury, March 2014.

⁴¹ *Scotland analysis: EU and international issues*, HM Government, January 2014.

- 3.37 The UK Government works to promote foreign direct investment in the UK. Working through UKTI, the UK Government actively identifies business opportunities for the UK around the world and supports businesses throughout the UK in trading internationally. UKTI is specifically focussed on building strong government to government relationships with potential overseas customers; using promotional tools and a programme of inward and outward missions, seminars and attendance at international exhibitions and conferences, to articulate the UK oil and gas offer and facilitate introductions for UK companies to key decision makers; and providing relevant diplomatic support for specific UK bids.
- 3.38 UKTI is involved in a steady flow of 20-25 oil and gas inward investment projects a year, many of which are from traditionally strong markets such as Canada, USA and Norway. UKTI also works to export UK expertise abroad. It is currently focussing on the most material (volume and value of business opportunity) markets globally where there is best fit with UK capability and there is appetite to engage in the UK supply chain through a number of High Value Opportunity campaigns in key markets including Australia, Brazil, Iraq, Kazakhstan, Mexico, Libya and Saudi Arabia. UKTI has also worked with Petrobras to set up a number of platforms,⁴² which have allowed UK business to showcase their products. In addition, in 2013 UKTI assisted 271 companies.⁴³
- 3.39 Much of oil and gas regulation is subject to international agreement, whether it be at the European level or other international bodies, such as the Oslo and Paris Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention).⁴⁴ which broadly governs the UK's international obligations on decommissioning. The UK as a member of these bodies is able to use its influence on the international scene and use its existing relationships with other nations to ensure favourable outcomes.
- 3.40 In the aftermath of the Deepwater Horizon accident in the US Gulf of Mexico in April 2010, the European Commission reviewed the existing Member States' safety frameworks for offshore operations and proposed new legislation to guarantee that the world's highest safety, health and environmental standards apply everywhere in the EU. The UK Government actively supported moves to improve regulations across Europe and to bring them into line with the UK's existing regime. However, it was concerned that the initial proposal to do this through a European regulation (which, once passed would apply directly to the UK industry) risked undermining the UK's world class levels of safety and environmental protection.
- 3.41 The UK Government, in conjunction with industry and trade union representatives, argued that the new requirements should instead be implemented via an EU Directive. A directive rather than regulation means improvements in offshore oil and gas regulation will build upon the UK's existing robust safety and environmental regime, whilst also ensuring the EU can ensure stringent controls are consistently enforced across all Member States. On the 28 June 2013, the European Commission published the Directive on the safety of offshore oil and gas operations.⁴⁵

⁴² Oil and Gas Sector in Brazil, UK Trade and Investment, available at: www.ukti.gov.uk.

⁴³ Assistance means attendance at UKTI missions and seminars here and abroad, recipient of a UKTI report on sectoral activity and expertise, assistance arising from a meeting with a local UKTI office or International Trade advisor or a direct intervention from a commercial officer in a British Embassy.

⁴⁴ OSPAR is the common name for the Convention for the Protection of the Marine Environment of the North East Atlantic, to which the UK is one of 16 contracting parties. Under the OSPAR Convention, these structures, with a few practical exceptions, must be dismantled and brought back on to land for recycling or disposal.

⁴⁵ *Directive 2013/30/EU on safety of offshore oil and gas operations and amending Directive 2004/35/EC*, European Commission, June 2013.

3.42 This level of access and support to these networks would change for businesses based in an independent Scottish state, who would lose access to the UKTI global network and the political weight the UK can bring to champion them. While an independent Scottish state would develop its own relationships and international identity, its influence could be diminished and it would be likely to become more dependent on alliances with other states. The UK would have no obligation, as it does now, to negotiate for and deliver on Scotland's interests.⁴⁶ The Scottish Government proposes a much smaller overseas network of 70-90 offices, scaling back Scotland's existing overseas representation by at least two thirds. This has a practical impact on companies in Aberdeen and the surrounding area, where long term success is increasingly focussed on exports of supply chain expertise to other oil producing parts of the world, many of which are difficult markets requiring support from the diplomatic and trade network. With strategic economic priorities for this part of industry centred on greater internationalisation, cutting back overseas presence on this scale would be a retrograde step, resulting in less influence in vital emerging markets.

Conclusion

- 3.43 The exploitation and extraction of oil and gas from the UK Continental Shelf is a major success story for the UK but as a relatively mature region, it now must compete for investment with other younger basins across the world, many of which have fewer technical and economic challenges associated with extraction. The UK Government is committed to help increase the competitive appeal of the UK Continental Shelf and is working in partnership with industry, to maximise the economic recovery and production of the UK's offshore oil and gas resources and to sustain and promote the growth of the UK's oil and gas supply chain, in both domestic and international markets.
- 3.44 Industry reports have highlighted increased investment in UK oil and gas production following the recent efforts by the UK Government to provide certainty through key measures such as decommissioning tax relief. This boost to the industry shows that, whilst in the longer term the level of production and associated revenues are declining, the UK Continental Shelf still has much to offer. However, this cannot be taken for granted and the UK Government commissioned a review to better understand the changing needs of the maturing UK Continental Shelf. The final report was published in February 2014 and the UK Government is taking forward all the main recommendations of Sir Ian Wood's review, to maximise recovery of oil and gas from the UK Continental Shelf.
- 3.45 Scottish independence risks undermining the very features of the oil and gas regime that has brought it such success. An independent Scottish state would lose access to the UKTI global network and the political weight the UK can bring to champion the sector internationally. In the event of a vote for independence the UK would have no obligation, as it does now, to negotiate for and deliver on Scotland's interests.
- 3.46 The loss of the wider UK fiscal base could lead to an independent Scottish state being excessively dependent on oil and gas revenues, risking tax increases or spending cuts in order to provide the Scottish Government of an independent Scottish state with additional income. If an independent Scottish state was able to radically adjust fiscal policy and implement an oil fund, this would not smooth all volatility in Scotland's public finances. It may take considerable time to build up a fund of adequate size to manage such volatility. As part of the UK, Scotland achieves many of the benefits of an oil fund: the UK's integrated fiscal model provides a very stable flow of Scottish expenditure, without the need for Scotland to run the onshore fiscal position required for an oil fund.

⁴⁶ *Scotland analysis: EU and international issues*, HM Government, January 2014.



Chapter 4:

Effects on businesses and consumers

Keeping energy bills affordable is a key priority for the United Kingdom (UK) Government. The UK Government is working hard to reduce bills for householders and businesses, recognising the pressures created by rising bills.

The analysis in this paper shows that energy bills for homes and businesses in Scotland would be likely to rise in the event of a vote for Scottish independence. Without unrestricted access to the integrated Great Britain (GB) market, the costs of supporting Scottish investment in networks, renewables and supporting consumers in remote areas would fall on Scottish bill payers alone.

These costs are substantial and include, for instance:

- up to around £6 billion (2009/10 prices) over the period 2013/14-2020/21 of investment into the electricity transmission network in Scotland;
- under the current UK Renewables Obligation system some 28 per cent of the support – around £560 million – of a £2 billion total in 2012/13 went towards funding Scottish renewables projects even though only around 10 per cent of UK electricity sales are in Scotland;
- around £92 million (2009/10 prices) between 2014/15-2020/21 of approved spending for supplying gas to remote Scottish communities under the Statutory Independent Undertaking arrangements; and
- annual support for the infrastructure needed to distribute electricity over remote and sparsely populated areas in the north of Scotland under the Hydro Benefit Replacement Scheme, which in 2013/14 totalled around £54 million.

The costs of transmitting electricity and gas and support for remote communities and small-scale renewables in Scotland are shared across GB wide schemes. If these costs were paid solely by Scottish energy consumers, this would add at least £38 to annual household energy bills and around £110,000 to energy costs for a medium-sized manufacturer in 2020 (2012 prices). This is the minimum likely increase, with scope for it to be higher (eg. up to £60 for households and £179,000 for a medium-sized manufacturer), in line with the potential investment levels particularly in networks.

In addition, if the full costs of supporting large scale Scottish renewables fell to Scottish bill payers the total potential increase would rise considerably up to £189 for households and £608,000 for a medium sized manufacturer in 2020 (2012 prices).

The extent of the impact on Scottish consumer bills would depend on how much of the cost of incentivising the Scottish Government's ambitions for 100 per cent renewable electricity generation could be recuperated from the sale of renewable energy credits to EU Member States. It is not possible to predict what the price of renewable credits will be as it will depend on supply and the overall demand from Member States who have not met their renewable energy targets in 2020. It would therefore be high-risk for an independent Scottish state to rely on the sale of credits given the potential for it to be highly burdensome for consumers in Scotland.

Bills could rise even further depending on an independent Scottish state's share of other energy market costs and historic energy liabilities and how these are paid for. These costs are currently funded by the UK Government or through the UK or GB consumer base, and include:

- the costs of balancing supply and demand across the GB transmission network. In the first half of 2013/14, total constraint costs stood at £161 million, of which £77 million related to the England-Scotland boundary and a further £31 million were incurred within Scotland, totalling 67 per cent of all constraint payments;¹
- the costs of establishing an independent regulator;
- the loss of the benefits of the larger single integrated energy market which brings with it a larger number of players in the market and therefore increased competition. Reducing the size of the market increases the risk that the levels of competition could be adversely affected with a consequent impact on bills.
- the historic liabilities associated with nuclear power generation in Scotland of around £3.5 billion;
- the Scottish element of the £620 million GB historic liabilities associated with the coal industry; and
- the £20 billion the UK has committed to support decommissioning North Sea oil and gas infrastructure that is no longer in use.

The current Scottish Government claims that bills would be lower in an independent Scottish state, because some costs currently met by consumers that support energy efficiency and provide help to the most vulnerable would be transferred to Scottish taxpayers. This proposal would cost approximately £175 million each year and would need to be met from central resources through increased taxation or reductions in other spending commitments.

¹Monthly Balancing Services Summary, National Grid, September 2013.

Moreover, the Scottish Government proposal does not take account of recent initiatives by the UK Government which reduce household bills on average by £50. On 2 December 2013 the UK Government announced measures to reduce household energy bills in Scotland and the rest of the UK. This includes reducing the costs of the Energy Company Obligation, an energy efficiency scheme delivered by major energy suppliers, saving consumers £30-35 on their bills in 2014 with further savings continuing to 2017,² as well as providing a rebate saving the average customer £12 on their bill in 2014 and 2015. In addition, electricity distribution network companies are taking voluntary action to reduce network costs in 2014/15, leading to a further one-off reduction of an average of around £5 on electricity bills.

In addition the UK Government announced changes to the Carbon Price Floor at Budget 2014, which resulted in the Carbon Price Support rate being capped at £18 per tonne of carbon dioxide from 2016-17 to 2019-20.³ These changes are expected to reduce household energy bills by £15 and business bills by 3 per cent in 2020. Moreover there is more scope to take action of this sort in a larger, more diverse economy. It is uncertain how an independent Scotland, with its smaller economy, would be able to offer similar support into the future without causing increases in taxation.

The analysis in this paper therefore shows that Scottish consumers would end up paying more, possibly considerably more, for energy infrastructure in an independent Scottish state than they do as part of the UK.

- 4.1 UK households pay some of the lowest prices for gas and electricity in Europe.⁴ However, while domestic energy prices compare well with other European Union members, over the last decade energy prices have risen. In recent years, these have been largely driven by international fossil fuel prices; at least 60 per cent of the rise in household energy bills between 2010 and 2012 was due to the increases in wholesale energy costs.⁵
- 4.2 Whilst the UK Government has limited influence over global energy market prices, consumer affordability is a key priority. Investing now to build a diverse, low carbon energy mix and improve energy efficiency will help to protect consumers from international fuel price volatility in the long term.
- 4.3 A package of policies from the UK Government to replace ageing power stations with lower carbon sources of electricity generation, expand energy infrastructure, maintain security of supply and improve energy efficiency will ensure that energy bills remain more stable, and lower than they would have been otherwise. Analysis by Department of Energy and Climate Change shows that by 2020 UK households on average will save 11 per cent (£166) on their energy bills compared to what they would have paid in the absence of the UK Government's energy and environmental policies.⁶

² The precise reduction in individual households' bills will depend on their energy supplier.

³ *Budget 2014*, HM Treasury, March 2014.

⁴ *Quarterly Energy Prices: March 2014*, Department of Energy and Climate Change, March 2014, Section 5.

⁵ *Estimated impacts of energy and climate change policies on energy prices and bills 2013*, Department of Energy and Climate Change, March 2013.

⁶ *Estimated impacts of energy and climate change policies on energy prices and bills 2013*, Department of Energy and Climate Change, March 2013. This does not take account of additional measures taken to reduce bills since March 2013.

- 4.4 The Scottish Government's White Paper *'Scotland's Future: Your guide to an independent Scotland'* has said that, in an independent Scottish state, it would transfer responsibility for delivering energy efficiency and fuel poverty measures away from suppliers to Scottish taxpayers, meeting the cost through central resources, and that this would result in a saving of £70 on average energy bills per household.⁷ This proposal would cost approximately £175 million each year and would need to be met from central resources through increased taxation or reductions in other spending commitments.
- 4.5 The Scottish Government proposal also does not take account of recent initiatives by the UK Government which will result in immediate reductions in household bills on average by £50 as set out in the UK Government's Autumn Statement of 2 December 2013. This includes reducing the costs of the Energy Company Obligation, an energy efficiency scheme delivered by major energy suppliers, saving consumers £30-35 on their bills in 2014 with further savings continuing to 2017,⁸ as well as providing a rebate saving the average domestic customer £12 on their bill in 2014 and 2015. In addition, electricity distribution network companies are taking voluntary action to reduce network costs in 2014/15, leading to a further one-off reduction of an average of around £5 on electricity bills.
- 4.6 The UK Government also announced changes to the Carbon Price Floor at Budget 2014, which resulted in the Carbon Price Support rate being capped at £18 per tonne of carbon dioxide from 2016-17 to 2019-20.⁹ These changes are expected to reduce household energy bills by £15 and business bills by 3 per cent in 2020. Moreover there is more scope to take action of this sort in a larger, more diverse economy. It is uncertain how an independent Scotland, with its smaller economy, would be able to offer similar support into the future without causing increases in taxation.
- 4.7 The current Scottish Government has also stated that an independent Scottish state would continue to participate in a GB wide energy market. However, if Scotland becomes an independent state, the current integrated GB energy market could not continue as it is now. In particular, it is unlikely that consumers in the continuing UK would be willing to continue to support the development of energy infrastructure – both generation assets and networks – in Scotland. Given the importance of energy prices to households and businesses, a more likely scenario is that the continuing UK would retain full discretion over its energy policy, allowing it to rely on domestic generation or – if required – to import from other countries on the basis of value-for-money for consumers. It is therefore difficult to see any inducement for the continuing UK to enter into a proposed Energy Partnership, as described by the current Scottish Government.

Energy bills

- 4.8 Keeping energy bills affordable is central to the UK Government's energy policy and, as highlighted in Chapter 1, the GB energy market has ensured that households pay some of the lowest prices for gas and electricity in Europe. The latest figures show UK prices including tax for medium use domestic gas and electricity consumers were the lowest and fifth lowest in the EU 15 respectively.¹⁰

⁷ *Scotland's Future: Your guide to an independent Scotland*, Scottish Government, November 2013.

⁸ The precise reduction in individual households' bills will depend on their energy supplier.

⁹ *Budget 2014*, HM Treasury, March 2014.

¹⁰ *Quarterly Energy Prices: March 2014*, Department of Energy and Climate Change, March 2014, Section 5.

- 4.9 Scottish consumers, as part of the GB market, benefit from a number of schemes and funding arrangements which help provide protection from higher energy bills. For instance, the costs of transmitting and distributing electricity and gas and support for low carbon energy in Scotland is shared across GB and UK wide schemes. This means that Scottish consumers currently benefit from the size of the UK consumer base in order to spread the significant costs of energy infrastructure and support for projects in Scotland. How these investments would be delivered and how their costs would be met by an independent Scottish state is unclear. However, in the event of independence, additional costs for Scottish consumers would be inevitable as the shared costs of network investment and low carbon generation between consumers in an independent Scottish state and the continuing UK would be unwound.

Transmission costs

- 4.10 Electricity transmission infrastructure development in Scotland is expanding at a faster rate than the rest of the GB. As discussed in Chapter 1, investments are being made to expand the capacity of the transmission connection between Scotland and England,¹¹ and existing infrastructure in Scotland is being renewed. The majority of the costs associated with investment in electricity transmission networks are shared with consumers across GB, including Scotland, via Transmission Network Use of System Charges.
- 4.11 Currently the Scottish electricity transmission owners plan to invest up to £6 billion (2009/10 prices) over the period 2013/14-2020/21 for all of these electricity transmission projects,¹² including those under construction and planned, with the majority of costs spread across the whole of GB consumer base for a period of up to forty-five years. Based on the potential range of capital investment, if the costs of network investments in Scotland were only recovered from consumers in an independent Scottish state, this would result in an additional cost of between £30-50 (2012 prices) on household bills and £91,000 to £154,000 for a medium-sized manufacturer's electricity bill in Scotland in 2020 depending on the eventual level of investment.
- 4.12 In addition to the investment in electricity transmission, the total expenditure for gas transmission networks across GB is £5.5 billion between 2013 and 2021.

Electricity balancing costs

- 4.13 As outlined in Chapter 1, the costs of balancing the electricity system are currently shared evenly between generators and suppliers on a 'per unit of electricity generated or supplied' basis. This means that the costs are shared across the whole of GB and consumers pay broadly similar amounts per unit of consumption regardless of their location and typically these costs account for around 1 per cent of the average household bill. Total balancing costs in 2012/13 was £601 million, of which around one quarter was incurred in managing constraints in the network.
- 4.14 The largest share of constraint payments are associated with the most congested part of the network in GB at the boundary between England and Scotland, partly resulting from the high levels of wind generation in Scotland. In the first half of 2013/14, total constraint costs stood at £161 million, of which £77 million related to the England-Scotland boundary and a further £31 million were incurred within Scotland – which together total 67 per cent of all constraint payments. In the event of a vote for independence, the current integrated GB energy market could not continue as it is now and so it cannot be determined whether

¹¹ Details of Transmission Owner major projects are available at: www.gov.uk

¹² *RIO-T1: Initial Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd*, Ofgem, February 2012.

these constraint costs would still be incurred and who would pay for them. At present, even though the cost of covering the charges is spread between generators and suppliers across the whole of GB, the cost is largely associated with transmitting Scottish generated electricity.

- 4.15 While it is difficult to forecast how these charges are likely to change over coming years, it is likely that Scottish consumers would face higher costs from balancing demand and supply across the electricity transmission system in Scotland. Increased deployment of renewable generation is likely to increase this cost to the system due to generation characteristics. The high projected deployment of renewables in Scotland means that, should there be a vote for independence and if costs are recovered more cost reflectively from the separate countries, Scottish consumers would bear more of these costs.

Distribution costs

- 4.16 Scotland also benefits from a number of other schemes which support the costs of supplying gas and electricity to Scottish customers who live in more remote areas. In particular, the costs are currently shared across the whole of the GB consumer base, which adds only a relatively small extra cost to energy bills overall, but makes a huge difference to the Scottish consumers receiving the benefit. For example:

- The Statutory Independent Undertakings are five remote gas networks (with a sixth Statutory Independent Undertakings in Wales) which supply Scottish customers in Stornoway, Wick, Thurso, Oban and Campbeltown liquefied natural gas by road tanker or liquefied petroleum gas by ship and road tankers, as they are not connected to the main GB gas network or national transmission system. The cost of supplying liquefied natural gas and liquefied petroleum gas to these off grid networks is supported through a charge levied on gas shippers using the National Transmission System by National Gas Grid, which is then paid to gas network operators and relevant gas shippers in order to facilitate continuation of the arrangements. This means that the higher transport cost to supply more remote Scottish gas customers is shared across all GB gas customers and, consequently, the Statutory Independent Undertakings consumers in Scotland do not suffer from prohibitively expensive charges. Scotia Gas Networks is obliged to transport gas to the Scottish Statutory Independent Undertakings and is expected to receive approximately £92 million (2009/10 prices) between 2014/15-2020/21.
- The Hydro Benefit Replacement Scheme protects consumers in the north of Scotland from the high costs of distributing electricity over a remote and sparsely populated area. In 2013/14 assistance through this scheme totalled around £54 million (2013/14 prices), providing an annual saving of around £36 to 690,000 domestic consumers in the north of Scotland, with the remainder giving bill savings to the 70,000 non-domestic consumers. The scheme is paid for by all domestic and non-domestic consumers across GB, costing households less than £1 a year on average.

- 4.17 In the event of Scottish independence the government of an independent Scottish state would need to decide whether it would continue providing the support schemes which are specifically designed to assist remote Scottish communities since these would be for the benefit of consumers in what would become a separate state. The Government of an independent Scottish state would need to decide whether it would continue providing the support and how it would be funded. The analysis suggests that if the costs associated with the Hydro Benefit Replacement Scheme and the Scottish Statutory Independent Undertakings were spread over Scottish consumers alone, this would add an additional £5 and £3 (2012 prices) respectively onto Scottish household energy bills and £16,000 and

£3,000 respectively to energy bills for medium-sized manufacturers in 2020.

Support for renewable energy development

- 4.18 As set out in Chapter 2, financial incentives have been developed to provide investors with the support they need to invest in renewable energy, such as via the Renewables Obligation and the forthcoming Contracts for Difference. Under the current UK Renewables Obligation system some 28 per cent of the support in 2012/13 – around £560 million of a £2 billion total - went towards funding Scottish renewables projects even though only around 10 per cent of UK electricity sales are in Scotland.
- 4.19 The current Scottish Government has not set out how these financial incentives would be funded or delivered in the event of a vote for independence but has a specific ambition to deliver the equivalent of 100 per cent renewable electricity as a share of annual gross electricity consumption in 2020. If Scottish electricity consumers (households and non-domestic) had to pay for all of this renewable generation in 2020 at the levels of support currently envisaged then the estimated total cost to be met in 2020 could be around £1.8 billion (2012 prices).¹³ The analysis shows that if these support costs were paid solely by electricity consumers (households and non-domestic) in Scotland instead of being shared across the larger UK consumer base, it would result in up to an additional £129 on household bills and £429,000 on the bill for a medium-sized manufacturer in Scotland in 2020 (2012 prices).
- 4.20 As outlined in Chapter 2, the Scottish Government may look to trade renewable electricity with other EU Member States if they had capacity to do so, in order to offset the estimated £1.8 billion of costs in 2020 that could arise from delivering their 100 per cent renewable electricity target. It is not possible at this stage to estimate what the price of renewable credits will be as it will depend on supply and the overall demand from Member States who have not met their renewable energy targets in 2020. In the absence of specific agreements in advance, such a reliance on the sale of credits would clearly be a high-risk strategy for an independent Scottish state and as demonstrated above, if unsuccessful, it would be highly burdensome for consumers in Scotland.
- 4.21 In the event of independence, Scottish consumers could also potentially see an impact on household bills as a result of the support costs paid for small-scale Feed in Tariffs.¹⁴ Based on estimated spend on Feed-in Tariffs in 2020, if Scottish electricity consumers (households and non-domestic) had to pay for the support costs associated with Scotland's share of deployment, the impact on energy bills is likely to be negligible at the lower end of the range, or at the top end result in around an additional £2 to average household bills and £6,000 on bills for medium-sized manufacturer in Scotland in 2020 (2012 prices).

Overall impact on bills

- 4.22 As set out in tables 4A and 4B below, the analysis shows that without unrestricted access to the integrated GB market, the costs of supporting Scottish energy network investment, small-scale renewables and programmes to support remote consumers would fall on Scottish bill payers alone, adding at least £38 to annual household energy bills and around £110,000 to energy costs for a medium-sized manufacturer in 2020 (2012 prices). This is the minimum likely increase, with scope for it to rise to £60 for households and

¹³ DECC Modelling. The methodology used to calculate this estimate is described in the technical annex.

¹⁴ The Feed-in Tariff scheme is a government programme designed to promote the uptake of a range of small-scale renewable and low-carbon electricity generation technologies (including solar PV, wind, hydro, micro-CHP and anaerobic digestion).

£179,000 for medium sized manufacturers for these areas of cost, in line with the potential investment levels particularly in networks.

4.23 In addition, if the full costs of supporting large scale Scottish renewables fell to Scottish bill payers the total potential increase would rise considerably up to £189 for households and £608,000 for a medium sized manufacturer in 2020 (2012 prices). This could rise even further depending on Scotland's share of historic energy liabilities and how these are paid for as outlined in the following section.

Table 4A: Estimated household energy bill impacts in Scotland in 2020 (£, 2012 prices)

Cost Component	Low	High
Electricity Transmission Network Costs	£30	£50
Hydro Benefit Replacement Scheme	£5	£5
Statutory Independent Undertakings (SIUs)	£3	£3
Small-scale Feed-in-Tariffs	£0	£2
Renewable Obligation and Contracts for Difference Support Costs	n/a ¹⁷	£129
Total	£38	£189

Source: DECC Modelling.

Table 4B: Estimated medium-size manufacturer energy bill impacts in Scotland in 2020 (£, 2012 prices)

Cost Component	Low	High
Electricity Transmission Network Costs	£91,000	£154,000
Hydro Benefit Replacement Scheme	£16,000	£16,000
Statutory Independent Undertakings (SIUs)	£3,000	£3,000
Small-scale Feed-in-Tariffs	£0	£6,000
Renewable Obligation and Contracts for Difference Support Costs	n/a	£429,000
Total	£110,000	£608,000

Source: DECC Modelling.

Other costs

4.24 There are also other costs that would fall to Scottish taxpayers or bill payers, which are currently funded by the UK Government or through the entire UK or GB consumer base which have not been included in the estimates of the impact on consumer bills above. These are significant and include:

- the £20 billion the UK has committed to support decommissioning North Sea oil and gas infrastructure that is no longer in use (see Chapter 3 for more detail);
- the historic liabilities associated with nuclear power generation in Scotland of around £3.5 billion (see Chapter 5 for more detail);
- the Scottish element of £620 million GB historic liabilities associated with the coal industry (see Chapter 5 for more detail);
- the costs of establishing an independent regulator; and

¹⁵ It is not possible to estimate a low end of the range for policy costs associated with RO and CfD support payments due to the uncertainty around renewables trading in 2020.

- loss of the benefits of the larger more single integrated energy market which brings with it a larger number of players in the market and therefore increased competition. Reducing the size of the market increases the risk that the levels of competition could be adversely affected with a consequent impact on bills.

Tackling fuel poverty and improving household energy efficiency

- 4.25 The devolved administrations are able to measure fuel poverty in their own way. In England a household is said to be fuel poor if they have required fuel costs that are above average¹⁶ and, were they to spend that amount they would be left with a residual income below the official poverty line. In Scotland, the definition used is if a household would need to spend more than 10 per cent of its income in order to keep warm. Fuel poverty is largely tackled in the UK through increased household energy efficiency, grant schemes and market regulation. The UK Government contributes with UK-wide market regulation, while the current Scottish Government has the devolved powers to tackle fuel poverty through localised funding and grant schemes.
- 4.26 Improving energy efficiency in Scotland and the UK protects consumers by lowering exposure to international energy market price rises and volatility. Energy efficiency also brings with it economic benefits and opportunities for growth. The energy efficiency sector in the UK already supports around 136,000 jobs, (with 9,500 of these in Scotland) and had sales of £18.3 billion in 2011/12 (£1.3 billion in Scotland). Sales in this sector have grown by over four per cent per year in the UK since 2007/08, and are projected to grow by around five per cent per year between 2010/11 and 2014/15.¹⁷
- 4.27 Scotland, like the rest of the UK, faces considerable challenges in improving energy efficiency, particularly of its housing stock. Approximately one third of the housing stock in Scotland is over 67 years old, meaning that installing retrofitted insulation and other energy efficiency measures is crucial to improving its overall condition. 63 per cent of Scotland's housing stock has an average or worse level of energy efficiency¹⁸ and 27.1 per cent of Scottish households are fuel poor.¹⁹
- 4.28 The UK and Scottish Governments work collaboratively under an overarching framework with shared objectives, to driving energy efficiency and combatting fuel poverty. This approach:
- allows for economies of scale and greater efficiencies helping to reduce costs to industry and consumers;
 - provides a single regulatory regime, which reduces complexity and bureaucracy and administrative costs for industry, which in turn reduces energy bills for consumers; and
 - provides a more attractive commercial prospect for energy efficiency businesses looking to operate across GB through schemes like the Green Deal, as they only have to meet one set of standards.
- 4.29 As part of the UK, Scotland benefits from the programmes of both the UK and Scottish Governments to drive energy efficiency. The UK Government, largely through market regulation, is able to require energy suppliers to take action to drive up energy efficiency standards and improve competition to help reduce energy bills, across the whole of GB.

¹⁶ Average is defined here as the national median level.

¹⁷ *Low carbon environmental goods and services: Report for 2011/12*, Department for Business Innovation and Skills, July 2013.

¹⁸ *Scottish House Condition Survey: Key Findings 2011*, Scottish Government, December 2012.

¹⁹ *Scottish House Condition Survey: Key Findings 2012*, Scottish Government, December 2013.

At the same time, the current Scottish Government takes action to encourage energy efficiency and tackle fuel poverty through measures such as grant schemes and direct funding for improvements. This two-tier approach provides an efficient and comprehensive means of tackling these issues, drawing on the collaboration, resource and experience of both Governments, and it serves as a very positive example of how devolution can work well to tackle social problems.

- 4.30 The UK Government is taking action through GB schemes such as the Green Deal, Energy Company Obligation, Warm Home Discount, Winter Fuel Payments and Cold Weather Payments. These are discussed in more detail below. The current Scottish Government can develop policy to combat fuel poverty outside of that framework and has introduced complementary schemes such as the Energy Assistance Scheme which is a capital expenditure domestic energy efficiency programme funded by the Scottish Government.
- 4.31 In the event of Scottish independence, the current GB-wide schemes managed by the UK Government and overseen by Ofgem are likely to be lost, as Scotland would become a separate country with its own regulator. The government of an independent Scottish state could look to replicate existing UK Government schemes in Scotland or introduce new schemes of its own. However, this raises questions around what would happen to existing financial commitments, particularly those made by householders under the Green Deal, and the support currently provided by the existing UK Government schemes such as Winter Fuel Payments and Warm Home Discount.
- 4.32 A new set of separate, duplicate Scottish schemes is also likely to mean efficiencies and economies of scale are lost and risks introducing unwelcome complexity and bureaucracy for businesses and industry, which for many would now be dealing with two separate regimes instead of one. This could lead to a decline in the competitiveness of the energy efficiency market in Scotland as industry may opt to focus operations in the continuing UK which has known standards, schemes, regulation and larger market place.
- 4.33 There are a number of examples of issues relating to specific energy efficiency policies which could occur in the event of independence which are outlined below.

The Warm Home Discount

- 4.34 Low income and vulnerable households in Scotland currently benefit from arrangements under the GB Warm Home Discount scheme which requires domestic energy suppliers to provide direct and indirect support arrangements to fuel poor customers (the Warm Home Discount Scheme is divided into four different elements). The funding comes from the participating energy suppliers which they pass on to all domestic consumers through energy bills. In 2013/14 105,525 Scottish households received an automatic rebate of £135 off their energy bills as part of the 'core group'²⁰ element of the scheme. This is approximately 9 per cent of the total number of automatic rebates given out through the scheme and means that almost one in ten pensionable age households in Scotland receive a rebate.
- 4.35 Operating the scheme on a GB-wide basis brings benefits to Scottish consumers. Firstly, undertaking the design, implementation and administration of a scheme of this scale is best done for a larger area in order to take advantage of the arising economies of scale. Secondly, the qualifying criteria for the 'Core Group' element use the GB-wide benefits system, administered by the Department of Work and Pensions, to identify eligible consumers, so suppliers are able to use information already held by the UK Government

²⁰ The Core Group is the largest element of the Warm Home Discount and includes pensioner who receive Pension Credit Guarantee Credit.

to deliver additional support to those most in need. In addition, due to the impact of projected slower growth in the working age population in Scotland, and the projected increase in its pensioner population, the cost of operating the benefits system both now and in the future can be better pooled through the broader population and tax base. This is discussed in detail in the UK Government's paper *Scotland analysis: Macroeconomic and fiscal performance*.²¹

- 4.36 In addition, the operating costs for a benefits system in an independent Scottish state are likely to be higher than its relative share of a GB-wide system. This will be discussed in forthcoming papers in the Scotland analysis series. A unified, GB-wide framework is more efficient and benefits from economies of scale. Divergence could also lead to uncertainty amongst consumers who currently access support provided by the existing GB schemes such as Winter Fuel Payments and the Warm Home Discount. It may also deter new entrants to the market altogether or mean they choose to operate in one market, and given the much larger scale of the GB market this may mean Scotland loses out. For example, many businesses will have planned on the basis of being able to access a full GB market, but in the event of independence, this may no longer be the case.

The Green Deal

- 4.37 The Green Deal is a scheme that helps people make energy saving improvements to homes and businesses, without having to pay all the costs in advance. The costs of these improvements are paid back over time (covered by the savings on bills) because the Green Deal provides a loan not a grant. The Green Deal operates across England, Scotland and Wales using a single authorisation and oversight framework, covering accreditation of participants, control of the Green Deal Quality Mark, and ensuring compliance with the scheme requirements. This reduces the administrative burden, the associated costs and is beneficial to business as the Green Deal standards for the energy efficiency sector are consistent throughout the scheme. This enables authorised companies to carry out work in Scotland, England and Wales as part of a GB-wide scheme adhering to the same standards.
- 4.38 In addition, Green Deal repayments are tracked via a central charging database, set up through legislation and accountable to the UK Government. This database keeps a record of all Green Deals taken out across GB and is accessible by all Green Deal providers and energy companies. If Scotland were no longer part of the UK, the ability for Green Deal charges in Scotland to be registered in the central charging database would need to be considered. This risks creating unwelcome uncertainty on the future of the scheme in Scotland for both consumers and industry.

Smart meters

- 4.39 The UK Government requires energy suppliers to rollout smart electricity and gas meters to homes and smaller businesses across GB. The roll out will bring important benefits to consumers in Scotland, England and Wales. The near real-time information provided by smart meters will enable consumers throughout Scotland, England and Wales to better manage their energy consumption and have greater control of their energy bills. Smart meters also give suppliers remote access to accurate data for billing, removing the need to manually read meters and will provide a platform for the development of a 'smart grid' which supports sustainable energy supply. It is a requirement on all EU Member States to ensure that at least 80 per cent of domestic electricity consumers have smart meters

²¹ *Scotland analysis: Macroeconomic and fiscal performance*, HM Government, September 2013.

by 2020.²²

- 4.40 The rollout of smart meters is a complex, large scale undertaking. Last year the UK Government granted a licence to a company (the Data and Communications Company) which will provide a common communications platform for the secure transmission of smart meter data and messages across GB. A key advantage of having a single body to perform this role is to facilitate smoother switching between energy suppliers for all customers, which will promote competition in the GB retail energy market. The smart metering system also includes GB-wide contracts with communications and data service providers to provide the communications network over which smart metering data will be transmitted. The communications contract which covers the North of England and Scotland is worth £625 million over 15 years. The UK Government has also put in place a new industry Smart Energy Code that establishes a regulatory and contractual framework between the Data and Communications Company and its users, overseen by the regulator Ofgem.
- 4.41 These arrangements are designed to deliver optimum efficiency, benefits and coverage through the introduction of market-wide industry arrangements and central service provision where appropriate. Consequently, an independent Scottish state would need to consider a range of issues such as whether a new regulator would enforce licence conditions and the arrangements for the Data and Communications Company and service provider contracts.

Delivering through market regulation

- 4.42 The UK Government delivers energy efficiency measures through schemes which are enforced via the licence conditions on licensed energy businesses participating in gas and electricity markets. The licensing system is administered and enforced by Ofgem. Retail companies of a certain size are required to achieve certain levels of carbon reduction as a condition of their licence to participate in the market. This unified administrative and regulatory regime across the large integrated GB electricity and gas markets is beneficial for energy companies and is an effective means of delivering policies.
- 4.43 Should Scotland become an independent state, the current Scottish Government have said that a separate regulator would be established to serve the independent Scottish energy market. Whilst it is possible that the Government of an independent Scottish state or a Scottish energy regulator may look to create similar licencing conditions, including requiring market participants of a certain size to achieve certain carbon reductions, this would be separate from the continuing market in England and Wales. This may increase the cost for energy companies who also wish to participate in the energy markets in an independent Scottish state and the continuing UK due to the need to comply with a separate or divergent set of licence conditions.

Conclusion

- 4.44 The current Scottish Government have stated that in the event of independence it would transfer responsibility for energy efficiency and fuel poverty measures away from suppliers to Scottish taxpayers, estimating that this could reduce bills for Scottish households by £70, or around five per cent. This proposal would cost approximately £175 million each year and would need to be met from central resources through increased taxation or reductions in other spending commitments.
- 4.45 The Scottish Government proposal also does not take account of recent initiatives by the

²² Directives 2009/72/EC and 2009/73/EC require this, where an impact assessment shows a positive benefit of smart meter roll out as is the case in GB.

- UK Government which will result in immediate reductions in household bills on average by £50 as set out in the UK Government's Autumn Statement of 2 December 2013.
- 4.46 In addition, the UK Government also announced changes to the Carbon Price Floor at Budget 2014, which resulted in the Carbon Price Support rate being capped at £18 per tonne of carbon dioxide from 2016-17 to 2019-20. These are expected to reduce household energy bills by £15 and business bills by 3 per cent in 2020.
- 4.47 The analysis in this paper demonstrates that additional costs for Scottish consumers would be inevitable in the event of independence as the shared costs of network investment and low carbon generation between consumers in an independent Scottish state and the continuing UK would be unwound.
- 4.48 If these costs were paid solely by Scottish energy consumers, rather than continue to be shared with consumers across the whole of GB or the UK, this would add at least £38 to annual household energy bills and around £110,000 to energy costs for a medium-sized manufacturer in 2020 (2012 prices). This is the minimum likely increase, with scope for it to be higher, in line with the potential investment levels particularly in networks.
- 4.49 In addition, if the full costs of supporting large scale Scottish renewables fell to Scottish bill payers the total potential increase would rise considerably up to £189 for households and £608,000 for a medium sized manufacturer in 2020 (2012 prices). The extent of the impact on Scottish consumer bills would depend on how much of the cost of incentivising the Scottish Government's ambitions for 100 per cent renewable electricity generation could be recuperated from the sale of renewable energy credits to EU Member States. The price of renewable credits in 2020 is impossible to predict and consequently relying on the sale of credits would be high-risk for an independent Scottish state given the potential for it to be highly burdensome for consumers in Scotland.
- 4.50 These estimates do not take into account the additional costs associated with, for example, balancing demand and supply across the Scottish/English border and the establishment of a new regulator. If Scotland were to become an independent state, the Scottish Government would also need to continue to fund their share of historic liabilities from the nuclear, coal, oil and gas industries.
- 4.51 In addition, in the event of Scottish independence, an independent Scottish state would need to fund schemes such as those aimed to address energy efficiency in buildings, Winter Fuel Payments and Warm Home Discount.
- 4.52 Were a new set of separate, duplicate Scottish schemes to arise this would likely result in loss of efficiencies and economies of scale, potentially creating unwelcome complexity and bureaucracy for businesses and industry. This could lead to a decline in the competitiveness of the energy efficiency market in Scotland as the industry may opt to focus operations in the continuing UK which has known standards, schemes, regulation and larger market place.
- 4.53 The analysis in this paper therefore shows that Scottish consumers would end up paying more, possibly considerably more, for energy infrastructure in an independent Scottish state than they do as part of the UK.



Chapter 5: Energy liabilities

The cost of managing energy liabilities across the whole of the United Kingdom (UK), including Scotland, is substantial. The cost of decommissioning the three non-operational nuclear sites in Scotland is estimated to be £3.5 billion. The UK is responsible for an estimated financial liability of some £620 million relating to the coal mining industry. In addition, the total cost of oil and gas decommissioning is currently estimated by industry to be between £30 billion and £40 billion.

In the event of independence, attempting to divide the current coal liabilities between an independent Scottish state and the continuing UK would be very complex. It is not clear on what basis the liabilities would be allocated, but the Government of an independent Scottish state would be expected to take a share.

The current Scottish Government has stated that post-independence oil and gas decommissioning relief would be provided in the manner and at the rate currently provided through the current fiscal regime. However, it is uncertain how an independent Scottish state, with its smaller economy, would be able to support the industry in the long term as reservoirs become more challenging to extract and reserves begin to deplete (see Chapter 3).

The current Scottish Government has stated that in an independent Scottish state, the decommissioning costs of Scotland's three non-operational sites (Dounreay, Hunterston A and Chapelcross) would continue to be met from the public purse.

The current Scottish Government states that it does not support nuclear generation continuing into the long term in Scotland and has a policy of not building any new nuclear power stations. There are currently two nuclear power stations operating in Scotland.

The Scottish Government has supported the extension of one of its nuclear power stations (Hunterston B) to continue generating until 2023 they have also said they would support extending the life of the other power station (Torness). Scotland will therefore continue to generate more low carbon nuclear electricity and the associated waste for many more years.

In the event of independence, the Government of an independent Scottish state would need to ensure the Scottish nuclear sites undergoing decommissioning and the operational power stations have access to waste and spent fuel management currently provided by Sellafield and Low Level Waste Repository near Drigg in West Cumbria.

The current UK policy requires that waste and nuclear materials arising from reprocessing should be returned to the country of origin. It is not clear how the policy of returning nuclear waste would be applied in the event of a vote for independence.

There is also a question about how nuclear liabilities would in practice be divided in the event of independence – this would depend on negotiations between an independent Scottish state and the continuing UK.

- 5.1 Energy generation from coal, nuclear and, oil and gas has played an important role in the UK's electricity mix. However, using these resources comes with associated clean up and certain health liabilities, as well as on-going commitments to former employees. These liabilities are large, so tackling them safely, securely and cost-effectively, whilst minimising the burden for taxpayers, is important.
- 5.2 Coal liabilities mainly result from the health problems suffered as a result of mining activities; the continuing fulfilment of employee entitlements such as pensions; and above ground structural problems associated with the presence of underground mines. Nuclear liabilities arise due to the very long-term activity of spent fuel; nuclear waste; and materials arising from decommissioning which must be managed and protected for many decades. Oil and gas liabilities result from the need to safely stop production in fields that have reached the end of their lives, dismantle the infrastructure and ensure there are no long term environmental or other impacts.
- 5.3 Currently all coal and most nuclear liabilities are dealt with using funding from the UK Government and are managed via a combination of UK Government departments and agencies, such as the Coal Authority and the Nuclear Decommissioning Authority. The Ministry of Defence is responsible for military activity nuclear liabilities. Offshore oil and gas installation decommissioning is regulated by the Department of Energy and Climate Change.
- 5.4 If Scotland became an independent state, discussions would need to take place to determine how to split the current, past and future liabilities between an independent Scottish state and the continuing UK.

Oil and gas liabilities

- 5.5 When an oil and gas field ceases production, the final phase is decommissioning. This broadly involves the plugging and abandonment of all wells, cleaning of manifolds and pipelines, and the removal of topsides and subsea facilities and the steel supporting structures to shore.¹ The total cost of decommissioning is currently estimated by industry to be between £30 billion and £40 billion.²
- 5.6 To continue attracting investment in the UK Continental Shelf, the UK Government signed the first deeds with industry which guarantee the level of relief a company can expect to receive when decommissioning assets in the future. If the licensee receives less relief than this amount, the UK Government is obliged to make up the shortfall. It is uncertain how an independent Scottish state, with its smaller economy, would be able to support the oil and gas industry in the long-term as reservoirs become more challenging to extract and reserves begin to deplete. An independent Scottish state would have to invest around £3,800 per head – over ten times more than when costs are spread across the UK. This is discussed in more detail in Chapter 3.

¹ *Economic Report 2011, Oil & Gas UK, 2011, page 17.*

² *Annual Energy Statement 2013, Department of Energy and Climate Change, October 2013, page 49.*

Coal liabilities

- 5.7 Coal liabilities are an important part of the UK's energy legacy that need to be actively managed now and in the future. Scotland has played and continues to play a significant role in the UK's coal industry. Seven surface coal mines³ are located in Scotland and in 2013, 2.8 million tonnes of coal were mined in Scotland.⁴ Coal produced 25 per cent of Scotland's electricity generation in 2012.⁵
- 5.8 Coal liabilities arise due to the method of extraction rather than due to the materials themselves and fall into two broad categories: health liabilities and non-health liabilities. Non-health liabilities relate to the ex-employee (i.e. pensions and concessionary fuel allowances) and environmental/public safety liabilities which are mainly based around the safety of old mines and their effect on the water supply. Health liabilities relate to common law compensation claims from former British Coal employees for Noise-Induced Hearing Loss, asbestos-related conditions and conditions formerly compensated under the two schemes Vibration White Finger and Chronic Obstructive Pulmonary Disease which have now closed.

Box 5A: Nature of coal related liabilities

Health compensation

In 1998 the health compensation liabilities of British Coal (the nationalised corporation) were transferred to the UK Government. The UK Government as successor to the corporation introduced two schemes to deal with compensation payments for Vibration White Finger (VWF) and Chronic Obstructive Pulmonary Disease (COPD) where it had been established that the nationalised coal industry was negligent. Both these schemes have now closed to new claims. By 2011 approximately £4 billion had been paid out in compensation, of which £295 million had gone to former miners who were residents in Scotland when they made their claim.⁶

Although these two compensation schemes have completed the UK Government continues to deal with common law compensation claims from former British Coal employees. These claims are for Noise-Induced Hearing Loss, asbestos-related conditions and conditions formerly compensated under the two schemes now closed (VWF and COPD). In addition British Coal and National Coal Board employees affected by pneumoconiosis can claim compensation through the Coal Workers Pneumoconiosis Scheme. In the financial year ending March 2013 the UK Government paid out £11.5 million in compensation and costs of which £0.4 million was for Coal Workers Pneumoconiosis Scheme. The forecast at 31 March 2013 is that the estimated outstanding liability for the UK Government is around £170 million.⁷

³ Details available at the Coal Authority webpage: www.coal.decc.gov.uk.

⁴ Information available at the Coal Authority webpage: www.coal.decc.gov.uk.

⁵ *Energy trends: Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2009 to 2012*, Department of Energy and Climate Change, December 2013.

⁶ *Chronic Obstructive Pulmonary Disease compensation scheme statistics (final version as at June 2011)*, Department of Energy and Climate Change (www.gov.uk) *Vibration White Finger compensation scheme statistics (final version as at June 2011)*, Department of Energy and Climate Change (www.gov.uk) and *Coal health claims handling agreements*, Department of Energy and Climate Change (<http://webarchive.nationalarchives.gov.uk>).

⁷ *Annual Energy Statement 2013*, Department of Energy and Climate Change, October 2013, page 48.

National Concessionary Fuel Scheme

The Coal Act 1994 also made provision in relation to the fuel benefit entitlements of British Coal employees. The National Concessionary Fuel Scheme was set up to fulfill this entitlement by which all eligible ex-employees of British Coal and their widows receive solid fuel or a cash allowance in lieu. The current annual cost to this scheme to the UK Government is around £50 million. The forecast as at 31 March 2013 is that the estimated outstanding liability for the UK Government is about £450 million. As of June 2013, the total number of scheme beneficiaries was over 69,000 of which some 5400 are based in Scotland representing around 8 per cent of the total beneficiaries.

Pensions

The Coal Industry Act of 1994 contained detailed provisions to enable the break up and privatisation (in part) of the coal industry to take place. The two pension schemes that operated under British Coal, the Mineworkers' Pension Scheme and the British Coal Staff Superannuation Scheme, were separated from British Coal and are now guaranteed by the UK Government to ensure that the schemes are always able to pay the benefits as set out originally. The pension schemes and National Concessionary Fuel Scheme have expected life spans of around 50 years.

- 5.9 Under current arrangements, the cost of employment related coal liabilities is predominantly funded by the UK Government. Based on 31 March 2013 forecasts it is estimated that the cost of health liabilities are around £170 million and the outstanding liability for the National Concessionary Fuel Scheme is about £450 million.⁸ In the event of a vote for independence, attempting to divide the current coal liabilities between an independent Scottish state and the continuing UK would be very complex. It is not clear on what basis the liabilities would be allocated but the Government of an independent Scottish state would be expected to take a share of the costs. There would be complex negotiations, especially as many of the liabilities are managed via long term contracts with third parties.
- 5.10 Scottish independence would also raise complex issues for the two pension schemes which would have to be negotiated between the governments of the continuing UK and an independent Scottish state. Reaching a final agreement on the division of responsibilities would be difficult and the sums involved will be significant.
- 5.11 Coal liabilities are costly and effective management is vital for the quality of life of ex-miners and for those who live in proximity to old mines. The current Scottish Government has not set out how it would manage them efficiently, cover the costs and meet the needs of those affected.

⁸ *Annual Energy Statement 2013*, Department of Energy and Climate Change, October 2013, page 48.

Benefits of a single regulatory regime

- 5.12 The UK Government has established a strong regulatory framework for managing coal liabilities. Currently there are several bodies that deal with coal liabilities across Great Britain (GB):
- the Department of Energy and Climate Change;
 - the Coal Authority: a non-departmental public body sponsored by Department of Energy and Climate Change, established in 1994, which owns, on behalf of the country, the vast majority of the coal in GB, as well as former coal mines; and
 - the Health and Safety Executive.
- 5.13 The Scottish Government has responsibility for environmental protection issues which are managed by the Scottish Environment Protection Agency.
- 5.14 The Coal Authority is responsible for the licensing of coal and the meeting of the environmental and public safety liabilities arising from coal mining. The Coal Authority has also played an advisory role during the recent restructuring in both the English and Scottish coal industries; and where necessary has provided flexibility to temporarily alleviate some financial obligations due to it. On public safety, the Coal Authority had completed 50,000 mine entry inspections as at the end of March 2014 and is on track to meet its target of inspecting all mine entries (56,620) in the urban environment by the end of December 2014.
- 5.15 The Coal Authority's budget is centrally funded by the UK Government and in 2012/2013 was £33.7 million.⁹ Independence risks adding bureaucracy and associated cost to the current single regulatory regime. For example, the Coal Authority had cash based administration costs (including salaries) of £14.9 million and staff costs of £6.5 million in 2012/13.¹⁰
- 5.16 As set out in *Scotland analysis: Devolution and the implications of Scottish independence*, bodies that support the UK now would continue to operate on behalf of the remainder of the UK on the same basis as before Scottish independence. Any requests by an independent Scottish state to make use of them would require the agreement of the continuing UK and would need to form part of the negotiations process. In the event of independence the Coal Authority would remain in the continuing GB. A new Scottish body responsible for licencing, coal mining and other regulatory functions would potentially lose the current economies of scale and access to the specialist expertise that would remain with the Coal Authority.

Nuclear

- 5.17 Nuclear energy has been an integral part of the GB's electricity mix for over 40 years. 98.5 per cent of nuclear liabilities are civil liabilities resulting from fuel used in power stations to supply electricity and decades of research and development. Scotland has not only benefitted from electricity produced from nuclear but has also gained from the employment in the nuclear energy sector. In 2013 there were over 5,000 jobs across the civil nuclear supply chain in Scotland.¹¹

⁹ *Annual report and accounts 2012-13*, Department of Energy and Climate Change, June 2013, page 104.

¹⁰ *Annual report & accounts 2012-2013*, The Coal Authority, July 2013, page 19.

¹¹ *Industry maps*, Nuclear Industry Association available at: www.niauk.org.

- 5.18 There are 37 nuclear sites located throughout GB; 30 civilian and seven military. Scotland currently has two operational power plants – Hunterston B and Torness, which in 2012 contributed 34 per cent¹² towards Scotland's generation. These sites are owned and operated by EDF Energy.
- 5.19 There are three sites in Scotland undergoing decommissioning which are designated responsibility of the Nuclear Decommissioning Authority (Chapelcross, Dounreay and Hunterston A):
- Chapelcross and Hunterston A – Activities include decommissioning of the former Magnox reactor power station. The Nuclear Decommissioning Authority has strategic responsibility for the sites, although operations on the site are carried out by the site licensee, Magnox Limited, under contract with the Nuclear Decommissioning Authority;
 - Dounreay – Activities include decommissioning of former reactors and fuel cycle support plants; and the remediation of waste disposal facilities. The Nuclear Decommissioning Authority has strategic responsibility for the site, although operations on the site are carried out by the site licensee, Dounreay Site Restoration Limited, under contract with the Nuclear Decommissioning Authority.
- 5.20 As at 31 March 2013, the total discounted cost of decommissioning and clean-up of the 17 sites in the Nuclear Decommissioning Authority's UK estate and the planned geological disposal facility for nuclear waste¹³ was estimated to be around £59 billion.¹⁴ The majority of the Nuclear Decommissioning Authority's nuclear liabilities relate to Sellafield, which is a national facility that provides services to sites across the UK. The estimated cost of decommissioning the three sites in Scotland is estimated to be £3.5 billion.¹⁵

The GB system

- 5.21 Robust, efficient and independent regulation is vital to ensure that the nuclear industry operates to high safety, security, safeguards and environmental standards.¹⁶ The current systems for dealing with nuclear issues are well established and run by a network of bodies (including the Nuclear Decommissioning Authority, Health and Safety Executive, Office for Nuclear Regulation, Civil Nuclear Police Authority and Civil Nuclear Constabulary)¹⁷ many of which operate on a UK-wide basis, and are funded by the UK Government.
- 5.22 The Nuclear Decommissioning Authority is a non-departmental public body with statutory responsibility for the decommissioning and clean up of designated civil public sector nuclear facilities; ensuring that all waste products (both radioactive and non-radioactive) are safely managed; scrutinising decommissioning plans of the eight operational nuclear power stations owned by EDF Energy; and implementing UK Government policy on long-term management of nuclear waste. It is funded by the UK Government through grant in aid (£2.3billion in 2013/14) in addition it also gains income from commercial assets (projected to be £0.9billion in 2013/14).¹⁸

¹² *Energy trends: Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2009 to 2012*, Department of Energy and Climate Change, December 2013.

¹³ Refer to glossary for information on geological disposal facility.

¹⁴ *Nuclear Decommissioning Authority: Annual report & accounts 2012/2013*, Nuclear Decommissioning Authority, June 2013, page 23.

¹⁵ Information available at www.nda.gov.uk.

¹⁶ *Chief nuclear inspector's annual report 2013*, Office for Nuclear Regulation, November 2013.

¹⁷ See glossary for further information on the differing bodies.

¹⁸ Information available at www.nda.gov.uk.

- 5.23 The Office for Nuclear Regulation regulates nuclear safety and security at various nuclear licensed sites in GB.¹⁹ It is also responsible for radioactive materials transportation and helping to ensure that the UK's international safeguards obligations are met. The Office for Nuclear Regulation began operating as a statutory body on 1 April 2014. Environmental protections outside nuclear licensed sites are regulated by the UK's various environmental regulators. The Scottish Environment Protection Agency is a non-departmental public body, accountable through Scottish Ministers to the Scottish Parliament, and is responsible for regulating the environmental impacts of Scottish nuclear sites, including the disposal of radioactive waste.
- 5.24 The transportation of radioactive material, including irradiated or spent nuclear fuel, is governed by the stringent internationally-agreed standards recommended by the International Atomic Energy Agency, an agency appointed by the United Nations to oversee all aspects of the peaceful uses of atomic energy worldwide. The safety of such transports by road and rail is regulated in the UK by the Office for Nuclear Regulation – Radioactive Materials Transport team and by the Civil Aviation Authority and Maritime and Coastguard Agency for transport by air and sea respectively.
- 5.25 The transportation of spent nuclear fuel is also carried out in a secure manner in accordance with stringent security regulations set out in the Nuclear Industries Security Regulations 2003 (as amended). These regulations are enforced by the Office for Nuclear Regulation – Civil Nuclear Security.
- 5.26 The Civil Nuclear Constabulary is a specialist police force with a GB-wide remit focusing on the protection of civil nuclear material on licensed sites and during transportation. The Scottish Government has stated that in the event of independence, the functions of the Civil Nuclear Constabulary in Scotland will be integrated into Police Scotland. The Civil Nuclear Constabulary is significantly different from a traditional Home Office Constabulary and officers are not currently interchangeable in roles. The UK Government consider that moves to integrate the Civil Nuclear Constabulary with Police Scotland, which has a wider remit and limited expertise in guarding nuclear material, would risk reducing operational effectiveness and consistency with Civil Nuclear Constabulary work in England and Wales.
- 5.27 Emergency planning for nuclear incidents exist at site level, in local areas and across GB. The immediate operational response to any emergency is managed locally, with coordination across Whitehall departments at national level. The Nuclear Emergency Planning Delivery Committee includes representatives from all main actors that would be involved in a nuclear emergency including the UK and Scottish Governments. The comprehensive membership of the Nuclear Emergency Planning Delivery Committee means that expertise and lessons learnt can be shared throughout the UK.
- 5.28 Scottish liabilities being managed within the GB regulatory regime enables the pooling of the wide range of resources, facilities and expertise. Were Scotland to become a separate state, the Health and Safety Executive would continue to operate on behalf of the continuing UK.²⁰ Scotland would need to establish its own safety and security regulator equivalent to the Office of Nuclear Regulation. Although, some functions of the Office for Nuclear Regulation may not need to be replicated in an independent Scottish state, duplication of regulators roles would naturally lose benefits gained from economies of scale. The UK's single regulatory regime for nuclear safety and security has fostered the growth of expertise that has been built up within these organisations over decades. It would be important to consider whether the necessary expertise could be retained in a

¹⁹ *Information about ONR*, Office for Nuclear Regulation, www.hse.gov.uk.

²⁰ *UK public bodies that serve in Scotland*, HM Government, June 2013, www.gov.uk.

country where no new nuclear build is currently planned.

Scotland's decommissioning liabilities

- 5.29 Management of the nuclear liabilities in the UK is a complex interconnected process. The current Scottish Government has stated in their White Paper on *Scotland's Future: Your guide to an independent Scotland* that in an independent Scottish state the decommissioning costs of Scotland's three non-operational sites (Dounreay, Hunterston A and Chapelcross) will continue to be met from the public purse.
- 5.30 These facilities are owned by the Nuclear Decommissioning Authority which has been given designated responsibility for managing and decommissioning these facilities under the Energy Act 2004.
- 5.31 As set out in *Scotland analysis: Devolution and the implications of Scottish independence*, in the event of Scottish independence the Nuclear Decommissioning Authority (and its subsidiary companies) would continue to operate on behalf of the continuing UK. In the event of a vote for Scottish independence the Scottish Government may need to create a new organisation with a similar remit to the Nuclear Decommissioning Authority. If the government of an independent Scottish state wanted the Nuclear Decommissioning Authority to operate in an independent Scottish state, it would require the agreement of the continuing UK as part of the negotiation process. The expected lifetime costs (total discounted nuclear liability)²¹ to manage the Scottish sites is expected to total £3.5 billion.²²
- 5.32 Scotland as part of the UK has access to shared facilities across the UK, in particular at Sellafield, in Cumbria. Sellafield is a large, complex nuclear chemical facility which includes reactors undergoing decommissioning, fuel production facilities, nuclear materials storage, spent fuel storage ponds, reprocessing plants, waste treatment plants and waste storage facilities.²³ The Low Level Waste Repository near Drigg in West Cumbria has operated as a low level waste disposal facility since 1959.
- 5.33 On 21 February 2013 the Nuclear Decommissioning Authority announced that it would remove the remainder of the exotic materials²⁴ from Dounreay (established in the mid-1950s as a research reactor site with fuel production and processing facilities) and relocate them to Sellafield in order to increase the efficiency of the Dounreay closure both in terms of operations and security. This, together with previous announcements, has allowed the scheduled closure of Dounreay to be accelerated from 2030 to 2022-25.
- 5.34 In the event of a vote for independence, the Scottish Government would also need to ensure these nuclear sites undergoing decommissioning have access to the waste and spent fuel management and disposal services currently provided by Sellafield and Low Level Waste Repository. Sellafield currently reprocesses spent fuel for a number of overseas customers and it therefore may be possible for contractual arrangements to be agreed allowing access to the continuing GB facilities. However, the current UK policy requires that waste and nuclear materials arising from reprocessing should be returned to the country of origin. This is necessary to prevent disposal of overseas waste in the UK.

²¹ The costs of discharging the nuclear liability will be incurred over a significant period of time. To take account of the time value of money, the costs are "discounted" back to a present value. Effectively this is the amount that would need to be invested today, at a set rate of interest (the discount rate) in order to pay for the liability in the future as it falls due.

²² Information available at www.nda.gov.uk.

²³ Information available at www.hse.gov.uk.

²⁴ *Exotic fuels and nuclear materials – Dounreay (preferred option gate B)*, Nuclear Decommissioning Authority, February 2013.

5.35 It is not clear how the policy of returning nuclear waste would be applied if Scotland were to become an independent state. However, if the current UK policy of returning waste and reprocessed nuclear materials were applied to waste and spent fuel from an independent Scottish state, then the Scottish Government would have to identify a site or sites for the long term management of this material.

Scotland's operational nuclear site and their future liabilities

5.36 The current Scottish Government does not support nuclear generation continuing into the long term in Scotland and has a policy of not building any new nuclear power stations. However, it has supported the extension for Hunterston B to continue generating for another seven years (until 2023) and would support a similar application from EDF Energy to extend the life of Torness by a minimum of five years.²⁵ These two nuclear power stations will therefore play an important part in meeting Scottish energy demands and continue to generate more waste for many years to come.

5.37 Currently all spent fuel²⁶ from operating nuclear reactors in Scotland is sent to Sellafield, under contract between EDF Energy and Sellafield, for storage and reprocessing, where potentially re-usable uranium and plutonium are separated from radioactive waste.²⁷ The separated plutonium, the high level waste²⁸ which is produced from reprocessing and any spent fuel that isn't reprocessed are currently held at Sellafield in long term storage. EDF Energy also has a contract with the Low Level Waste Repository at Drigg for the disposal of low level waste from its power stations, including Hunterston B and Torness.²⁹

5.38 It is important to recognise the extra complexity that could arise from the introduction of an international border and that automatic use of facilities in the continuing UK state would not be guaranteed. As set out earlier, Sellafield currently reprocesses spent fuel for a number of overseas customers and it therefore may be possible for contractual arrangements to be agreed allowing access to the continuing UK facilities. However, it is not clear how the policy of returning nuclear waste would be applied if Scotland were to become an independent country.

5.39 The current Scottish Government's current policy is that higher activity nuclear waste should be stored or disposed of at near-surface facilities close to where the waste was originated, which is known as the 'proximity principle'. This differs from the UK Government's policy on the long-term management of higher activity radioactive waste that geological disposal, preceded by safe and secure interim storage, is the best approach. However, the current Scottish Government's policy is based on the existing UK arrangements whereby spent fuel from operating Scottish nuclear stations is managed as a privately owned asset under existing commercial contracts with Sellafield rather than being managed as a waste material in Scotland.

²⁵ *Electricity generation policy statement – 2013*, The Scottish Government, June 2013, page 20.

²⁶ Spent nuclear fuel is fuel removed from a reactor after final use.

²⁷ *Strategy: Effective from April 2011*, Nuclear Decommissioning Authority, April 2011.

²⁸ High level waste is the heat generating waste that has accumulated primarily from the reprocessing of spent nuclear fuel.

²⁹ Information available at: www.edfenergy.com.

- 5.40 If the current UK policy of returning waste and reprocessed nuclear materials were applied to waste and spent fuel from an independent Scottish state, then the Scottish Government would have to identify a site or sites for the long term management of this material and then meet the full costs of constructing, operating and decommissioning these facilities. The cost and time associated with this would be dependent on the facility, the siting process and if there were any contractual agreements in place for use of the Sellafield facilities.
- 5.41 The current Scottish Government has also stated in their White Paper on independence that in an independent Scottish state the costs of decommissioning Scotland's two operational sites (Hunterston B and Torness) will be met by the private operators of those sites.
- 5.42 Currently the Nuclear Liabilities Fund provides funding for the eventual decommissioning of the eight nuclear power stations currently operated by EDF Energy in GB.³⁰ The Nuclear Liabilities Fund manages assets that it received previously, including at the time of the sale of British Energy to EDF Energy in 2009, and EDF Energy also makes fixed quarterly payments into the Fund. In the event that the Nuclear Liabilities Fund's assets are insufficient to meet the liabilities the UK Government is responsible for the remaining liabilities.³¹ In the event of Scottish independence it is unclear how the assets held by the Nuclear Liabilities Fund would be divided. In the continuing GB, the UK Government would continue to be responsible for remaining liabilities in the event that the Nuclear Liabilities Fund were insufficient, but it is unclear what the position would be in relation to nuclear sites in Scotland. The current Scottish Government have not provided any information on how this would operate in an independent Scottish state.
- 5.43 The current Scottish Government has stated in their White Paper on independence that in an independent Scottish state the decommissioning costs of Scotland's three non-operational sites (Dounreay, Hunterston A and Chapelcross) would continue to be met from the public purse. This assumes that nuclear liabilities would be split on a geographical basis. However, the question of how nuclear liabilities would in practice be divided in the event of independence would depend on negotiations between an independent Scottish state and the continuing UK. As highlighted in *Scotland analysis: Devolution and the implications of Scottish independence*, these questions could only be resolved after the referendum in negotiations.

³⁰ Information available at www.nlf.uk.net.

³¹ *Annual report for the year ended 31 March 2012*, Nuclear Liabilities Fund, March 2012, page 17.

Conclusion

- 5.44 Over the years the UK's energy industry has evolved in a way that did not differentiate between activities in Scotland and activities elsewhere in the UK. As one country there is collective responsibility for managing energy liabilities and the burden is shared across the whole country's resources.
- 5.45 To continue attracting investment in the UK Continental Shelf, the UK Government signed the first deeds with industry which guarantee the level of relief a company can expect to receive when decommissioning assets in the future. If the licensee receives less relief than this amount, the UK Government is obliged to make up the shortfall. It is uncertain how an independent Scottish state, with its smaller economy, would be able to support the oil and gas industry in the long-term as reservoirs become more challenging to extract and reserves begin to deplete. An independent Scottish state would have to invest around £3,800 per head – over ten times more than when costs are spread across the UK.
- 5.46 Coal liabilities are costly and effective management is vital for the quality of life of ex-miners and for those who live in proximity to old mines. The Scottish Government has not set out how it would manage them efficiently, cover the costs and meet the needs of those affected. In the event of independence, attempting to divide the current coal liabilities between an independent Scottish state and the continuing UK would be very complex.
- 5.47 Scotland as part of the UK has access to shared nuclear facilities across GB. In the event of independence, the Scottish Government would need to ensure the nuclear sites located in an independent Scottish state have access to the waste and spent fuel management and disposal services currently provided by Sellafield and Low Level Waste Repository.
- 5.48 It may be possible for contractual arrangements to be agreed allowing access to the continuing UK facilities. However, the current UK policy requires that waste and nuclear materials arising from reprocessing should be returned to the country of origin. It is not clear how the policy of returning nuclear waste would be applied if Scotland were to become an independent country.



Annex: Glossary

Balancing costs – Balancing costs relate to the services that National Grid – in its role as electricity System Operator – needs to procure in order to balance electricity supply and demand on the transmission system. These balancing actions are taken to manage system events such as surges in demand (for example, during TV commercial breaks); sudden generation loss; and network congestion (known as ‘transmission constraints’).

Carbon Capture and Storage Commercialisation Competition – One of the two lead projects in the carbon capture and storage commercialisation competition is in Scotland. The project, led by Shell with SSE (formerly Scottish and Southern Energy plc), involves capturing 85 per cent of the carbon dioxide from part of the existing gas fired power station at Peterhead before transporting it and storing it in a depleted gas field beneath the North Sea. On 24 February 2014 the UK Government awarded a contract and funding to Shell for the Front End Engineering and Design studies.

Civil Nuclear Constabulary (CNC) – In the UK the Civil Nuclear Constabulary is a specialised force with the jurisdiction to provide armed policing at civil nuclear sites and during the transport of certain categories of nuclear material. The CNC is significantly different from a traditional Home Office constabulary and officers are not currently interchangeable in roles.

Civil Nuclear Police Authority (CNPA) – The Civil Nuclear Police Authority is an executive non-department public body of Department of Energy and Climate Change which employs police officers of the Civil Nuclear Constabulary and ensures that the Constabulary operates effectively and efficiently.

Climate Change Agreements (CCAs) – In Budget 2011 the UK Government announced the extension of CCAs to 2023. CCAs provide Energy Intensive Industries tax discounts (worth £165 million a year) in return for committing to improve energy efficiency; on average sectors have committed to improve energy efficiency by 11 per cent by 2023. Currently, CCAs covers over 9000 facilities across the UK

Coal Authority – The Coal Authority, owns on behalf of the country, the vast majority of the coal in GB, as well as former coal mines, has statutory responsibilities for licensing coal mining in GB. The Authority works to protect the public and the environment in mining areas in England, Wales and Scotland, and manages the effects of past coal mining in order to promote public safety and safeguard the landscape – now and for future generations.

Consumer Futures – Consumer Futures is the operating name for the New National Consumer Council, a statutory organisation created through the merger of energywatch, Postwatch and the National Consumer Council (including the Scottish and Welsh Consumer Councils) by the Consumers, Estate Agents and Redress Act 2007. In April 2014 Consumer Futures will become part of the Citizens Advice service.

Contracts for Difference (CfD) – The Contracts for Difference (CfD) is one of the four main elements of the Electricity Market Reform (EMR) programme and offers long-term contracts to encourage investment in new, low carbon generation. CfD is a long-term private law contract that pays the generator the difference between a measure of the market price for electricity (the ‘reference price’) and a measure of the long-term price needed to bring forward investment in a given technology (the ‘strike price’).

CfDs work by stabilising the prices received by low carbon generation, reducing the risks they face, and ensuring that eligible technology receives a price for its power that supports investment. This reduces generators’ long-term exposure to electricity price volatility, substantially reducing the commercial risk and encouraging investment in low-carbon generation at least cost to consumers. CfDs also reduce costs to consumers by capping the price that consumers pay for low carbon electricity, requiring generators to pay money back to consumers when electricity prices are high.

CRC Energy Efficiency Scheme – The CRC incentivises 2000 large private and public sector energy users to prioritise investment in energy efficiency. It requires participating organisations to report on their energy usage, buy and surrender allowances for that energy use, and publishes the progress of participants annually. It is projected to deliver 16Mt carbon dioxide reduction by 2027. CRC participants represent approximately 10 per cent of UK carbon emissions. It is designed to target energy use not already covered by Climate Change Agreements and the EU ETS.

Electricity Distributors – Electricity distributors own and operate the distribution network of towers and cables that bring electricity from the national transmission network to homes and businesses. They do not sell electricity to consumers.

Electricity Generators – Electricity generators produce electricity from coal, gas, oil and nuclear power plants and from renewable sources. Electricity cannot be stored efficiently so is generated as needed.

Electricity Suppliers – Supply and sell electricity to consumers. They use the transmission and distribution networks to pass the electricity to homes and businesses.

Energy Performance Certificate (EPC) – Energy Performance Certificates energy efficiency rating certificates needed for whenever a property is built sold or rented. An EPC contains information about a property’s energy use and typical energy costs based on an energy efficiency rating from A (most efficient) to G (least efficient), and valid for 10 years. It also provides recommendations about how to reduce energy use and save money.

EU Emission Trading System (EU ETS) – The EU Emissions Trading System is a cap-and-trade system which covers electricity generators and energy intensive industrial sectors (such as iron and steel, cement and chemicals) across the EU. A ‘cap’ is set on the total greenhouse gas emissions allowed by all participants and this cap is converted into tradable emission allowances. Participants must monitor and report their emissions each year and surrender enough emission allowances to cover their annual emissions.

EU Third Energy Package – The Third Energy Internal Market Package agreed in March 2009 aims to integrate markets by facilitating more cross-border trading and incentivising investment in interconnections through creating common cross-border regulation, which will enable the EU energy market to meet the challenges of decarbonisation whilst maintaining energy security more efficiently. This should lead to greater integration and interconnection, as companies start doing business in neighbouring markets; more competitive prices; and enhanced energy security.

European's New Entrants Reserve (NER) 300 competition – “NER300” is a financing instrument managed jointly by the European Commission, European Investment Bank and Member States. The NER 300 competition is established under Article 10a(8) of the EU ETS Directive 2003/87/EC on establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. This contains the provision to set aside 300 million allowances (rights to emit one tonne of carbon dioxide) in the New Entrants' Reserve of the European Emissions Trading Scheme for subsidising installations of innovative renewable energy technology and carbon capture and storage (CCS).

Feed-in Tariffs (FITs) – The Feed-in Tariff scheme, which provides support for small-scale low carbon generation, including solar photovoltaic, hydro and wind. Under the scheme, accredited installations receive a guaranteed payment from an electricity supplier for the electricity they generate as well as a guaranteed payment for surplus electricity they export to the local network. The cost of providing this support is spread across all GB-consumers through their electricity bills.

Geological Disposal Facility – Geological disposal involves placing radioactive wastes deep within a suitable rock formation where the rock formation provides long-term protection by acting as a barrier against escape of radioactivity and by isolating the waste from effects at the surface such as climate change. There is no facility currently available in the UK.

In October 2006, the UK Government accepted the Committee on Radioactive Waste Management's (CoRWM) recommendations that the UK's higher activity waste should be managed in the long term through geological disposal; and the continuing need for safe and secure interim storage until geological disposal is available.

Gigawatt (GW) – A unit of electrical power, equal to 10^9 watts, the conventional unit to measure a rate of flow of energy. One watt amounts to 1 joule per second.

Health and Safety Executive (HSE) – The Health and Safety Executive is the body responsible for the enforcement of health and safety law on nuclear sites in GB. Health and Safety Executive is the licensing authority for nuclear installations in GB and through its Nuclear Installation Inspectorate (NII) regulates the nuclear, radiological and industrial safety of nuclear installations.

High Level Nuclear Waste (HLW) – Contains high levels of radioactivity that generate heat and so require cooling as part of safe storage prior to disposal. High Level Nuclear Waste is less than 0.1 per cent of the UK's radioactive waste by volume but it accounts for around 95 per cent of all radioactivity. This waste is converted to a solid glass form via a vitrification.

Intermediate Level Nuclear Waste (ILW) – Has the same or lower levels of radioactivity as High Level Waste but does not generate the same level of heat (an important consideration for storage or disposal facilities). Intermediate Level Nuclear Waste makes up about 7 per cent of the UK waste by volume and represents around 5 per cent of total radioactivity. Is mostly packaged in cement-based materials.

Legacy nuclear materials – This includes plutonium and uranium recovered from reprocessing in forms such as powders, metal coupons, pellets and pins.

Low Level Nuclear Waste (LLW) – Has a much lower potential hazard than other categories. LLW makes up around 93 per cent of the UK’s radioactive waste legacy by volume but contains less than 0.1 per cent of the total radioactivity.

National Grid – National Grid as the System Operator manages the transmission system and ensures the electricity and gas systems are balanced (ensuring there is sufficient supply to meet demand). This is particularly important for electricity transmission as electricity cannot be easily stored. It is therefore necessary to match supply and demand on a minute-by-minute basis to enable maintenance of a stable and safe frequency to avoid power surges. Users of the electricity network are subject to three elements of transmission charges which are set by National Grid acting under the conditions set out in their licence by Ofgem; connection charges; transmission network use of system charges; and balancing services use of system charges.

National Transmission Electricity Network – National transmission electricity network is owned by National Grid and maintains the flow of generated electricity through to the regional distribution networks.

Nordpool – Nordpool is the market for buying and selling power in Europe operating in Norway (28.2 per cent), Sweden (28.2 per cent), Finland (18.8 per cent), Denmark (18.8 per cent), Estonia (2 per cent), Latvia (2 per cent) and Lithuania (2 per cent). Transmission system operators in each of these countries have responsibility for both the high-voltage grid and security of supply.

Nuclear Decommissioning Authority (NDA) – The Nuclear Decommissioning Authority is a non-departmental public body which owns the 19 sites and associated civil nuclear liabilities and assets of the public sector, previously under the control of the UK Atomic Energy Authority and British Nuclear Fuels plc. Its purpose is to deliver the decommissioning and clean-up of the UK’s civil nuclear legacy in a safe and cost-effective manner, and where possible to accelerate programmes of work that reduce hazard. The Nuclear Decommissioning Authority reports to the Department of Energy and Climate Change and, for some aspects of its functions, to Scottish Ministers.

Office for Nuclear Regulation (ONR) – The Office for Nuclear Regulation began operating as a statutory body on 1 April 2014. The Office for Nuclear Regulation is responsible for regulating nuclear safety and security at locations and the transport of radioactive material by road and rail. The Office for Nuclear Regulation is also responsible for helping ensure that the UK’s international safeguard obligations are met.

Offshore Renewable Energy (ORE) Catapult – In 2012, Strathclyde University in Glasgow, was chosen to host the headquarters of the Offshore Renewable Energy Catapult. Working alongside its second site at the National Renewable Energy Centre in north east England, it will bring business and academia together to work collaboratively on the development of the offshore renewables sector, helping it compete more effectively for contracts both in UK and overseas.

Ofgem – Ofgem provides the regulatory oversight of the electricity and gas market. Ofgem’s responsibilities include helping to secure GB’s energy supplies by promoting competitive gas and electricity markets – and regulating them so that there is adequate investment in the networks, they contribute to the drive to curb climate change and work aimed at sustainable development. For example, helping the gas and electricity industries to achieve environmental improvements as efficiently as possible; and taking account of the needs of vulnerable customers, particularly older people, those with disabilities and those on low incomes.

Ofgem, as the regulator, sets price controls for the companies that operate GB’s gas and electricity networks. Price controls set the maximum amount of revenue which energy network

companies can earn through charges they levy on suppliers who then pass these costs on to customers. The revenues have to be set at a level which covers the companies' costs and allows them to earn a reasonable return subject to them delivering value for consumers, behaving efficiently and achieving their targets set by Ofgem.

Renewable Heat Incentive (RHI) – The Renewable Heat Incentive (RHI) is the UK Government's principal mechanism for driving forward the deployment of renewable heat over the coming decades. Under the schemes, accredited installations receive a payment for each kilowatt hour of renewable heat produced. The scheme operates across GB. Whilst heat policy is broadly speaking a devolved policy area in Scotland, the Scottish Government opted to join the UK Government scheme, recognising the value of a single, consistent scheme across GB and unrestricted access to a GB funding.

Renewable credits – The EU's Renewable Energy Directive allows for some flexibility in meeting the target through 'flexibility mechanisms', designed to allow those Member States with lower renewable generation potential or higher costs to partially fulfil their renewables targets in or with other countries. One of the flexibility mechanisms included within the Directive includes Statistical transfers (Article 6): whereby one Member State with an expected surplus of renewable energy can trade it statistically to another Member State. A statistical transfer allows a Member State to buy or sell a unit of renewable energy credit from or to another Member State without having to physically transfer that unit of energy.

Renewable Energy Directive – The 2009 Renewable Energy Directive is the European Union's Climate and Energy package that obligates the European Union (EU) as a whole to ensure that by 2020, a mandatory target of 20 per cent of its final energy consumption (including that used for power, heat and transport) must be met by renewable sources of generation.

It also obligates specifically that the EU as a whole achieve a reduction in GHG emissions of 20 per cent by 2020 compared to 1990 levels. On this basis, the target set for the UK is a 15 per cent share of final energy consumption to come from renewable sources of generation by 2020.

Renewables Obligation (RO) – The Renewables Obligation (RO) places a mandatory requirement on licensed UK electricity suppliers to source a specified proportion of electricity they supply to customers from renewable sources. The RO system works on the basis of three complementary obligations, one covering England and Wales, and one each for Scotland and Northern Ireland. Whilst the Northern Ireland Executive and Scottish Government can vary the level of support available within their territories, in practice the three obligations have largely been aligned and importantly, the cost of providing support is spread across the whole of the UK. Going forward, the RO scheme will be phased out to new entrants and replaced by Contracts for Difference.

RIIO (Revenue=Incentives+Innovation+Outputs) process – RIIO is Ofgem's framework for setting price controls. Under RIIO, Ofgem asks companies to submit business plans detailing how they intend to meet the RIIO framework objectives. Ofgem reviews these plans to determine whether the company's new price control settlements can be agreed. There are three separate price controls that apply to the different areas of energy transportation:

Transmission (RIIO-T1) – This price control relates to the high voltage transmission of electricity and high pressure transmission of gas.

Gas Distribution (RIIO-GD1) – This price control relates to the companies that transport gas at a lower pressure to homes and companies for domestic and commercial use.

Electricity Distribution (RIIO-ED1) – This price control relates to the companies that transport electricity at a lower voltage to homes and companies for domestic and commercial use.

Scottish Environment Protection Agency (SEPA) – Is responsible in Scotland for the enforcement of environmental protection legislation in the context of sustainable development. It authorises and regulates radioactive and non-radioactive discharges and disposals to air, water (both surface water and groundwater) and land. The equivalent body in England is the Environment Agency and in Wales it is Natural Resources Wales.

Single Electricity Market in the Republic of Ireland and Northern Ireland – The Single Electricity Market is the wholesale electricity market operating in the Republic of Ireland and Northern Ireland. As a gross mandatory pool market operating with dual currencies and in multiple jurisdictions, the Single Electricity Market represents the first market of its kind in the world. It has approximately 2.5 million customers; 1.8 million in Republic of Ireland and 0.7 million in Northern Ireland. The Single Electricity Market is operated and administered by the Single Electricity Market Operator, a joint-venture between the transmission system operators in Ireland and Northern Ireland. They are collectively responsible for coordination, direction and flow of electricity on the transmission network.

Spent Fuel – This is the nuclear material produced as a result of nuclear power generation. The material is termed as spent fuel if it has further use, for example where it is intended to be reprocessed for recovery of nuclear materials. If it has no further use it is termed waste.

Subsea Industry – Subsea technology is allowing the UK's oil and gas reserves to be extracted more cost effectively and in deeper waters than if platforms had to be built to access each accumulation.

The technology offers significant advantages over fixed production platforms particularly in remote offshore locations where deep water, strong ocean currents and harsh weather conditions may occur, or where export pipelines are difficult to install or uneconomic to run.

Transmission constraints – Transmission constraints occur where there is insufficient transmission network capacity between two locations at a particular point in time to transmit all the available electricity generation from where it is produced to where the demand for it is situated. Constraint payments provide compensation to generators for costs incurred in changing the amount of planned output in order to help resolve a constraint.

UK Carbon Capture and Storage Research Centre (UK CCS RC) – Launched in April 2012 by the Engineering and Physical Sciences Research Council, the UKCCS RC brings together over 100 of the UK's top CCS academics to promote and coordinate UK CCS research capability, and increase academic collaboration with industry. The virtual Centre is being led and coordinated by the University of Edinburgh and includes new capture testing facilities based near Sheffield; at Cranfield University and; a mobile testing unit based at Edinburgh.

UK Green Investment Bank (GIB) – In 2012, Edinburgh was chosen, to host the Green Investment Bank, which is the world's first investment bank solely dedicated to greening the economy. The Green Investment Bank's mission will be to provide financial solutions to accelerate private sector investment in the green economy. The Green Investment Bank will play a vital role in addressing market failures affecting green infrastructure projects in order to stimulate a step up in private investment.