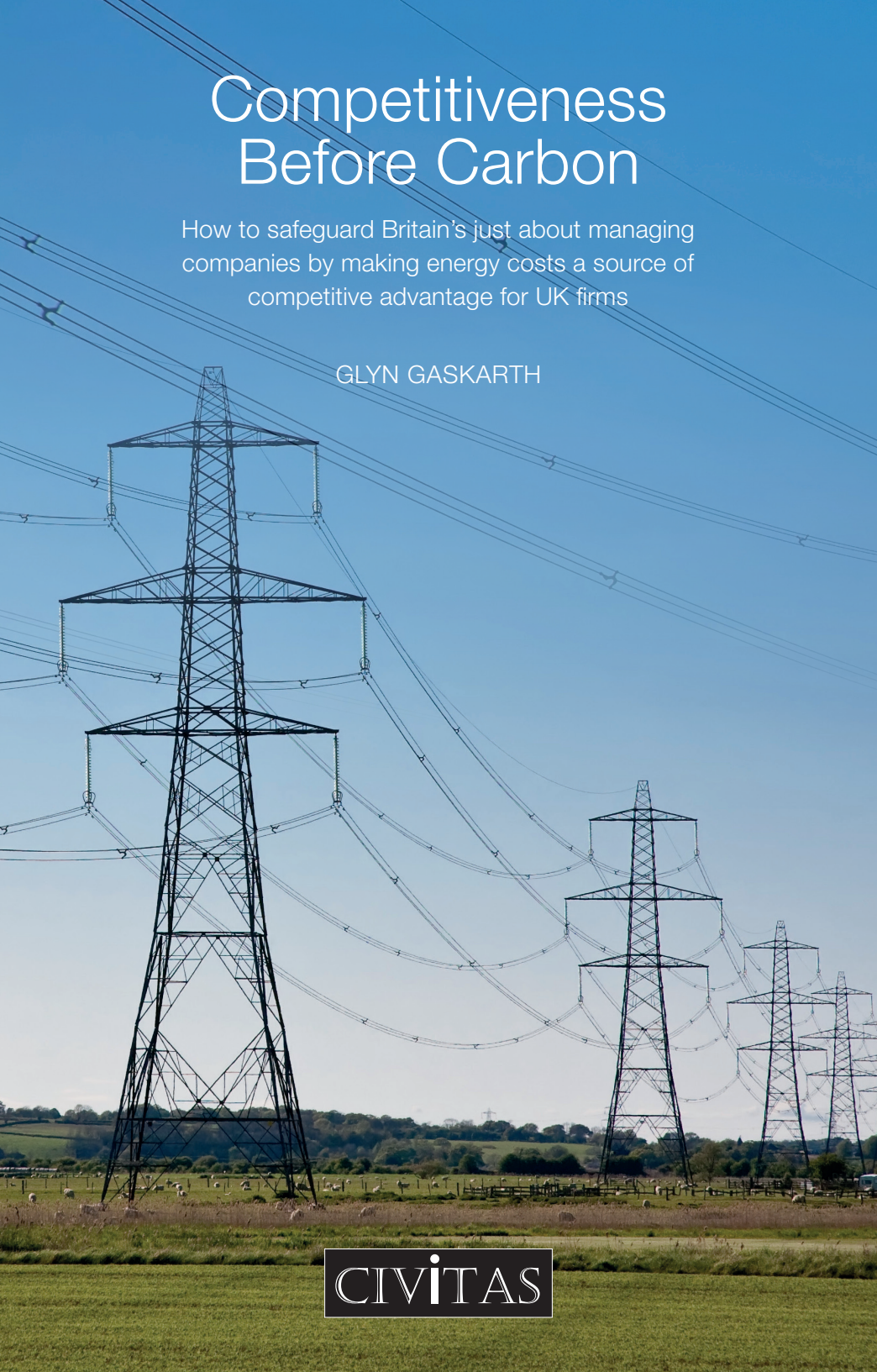
Competitiveness Before Carbon

How to safeguard Britain's just about managing companies by making energy costs a source of competitive advantage for UK firms

GLYN GASKARTH



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First published March 2017

55 Tufton Street
London SW1P 3QL

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ISBN 978-1-906837-84-6

Designed and typeset by Typetechnique, London

Printed in Great Britain by
4edge Limited, Essex

Contents

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Acknowledgements

Thank you to each of the individuals interviewed to inform this report for their assistance and to David Green, Director and Chief Executive of Civitas, for his comments on the text.

Glossary

BIS – Department for Business, Innovation and Skills

BEETR – Business Energy Efficiency Tax Review

CCS – Carbon Capture and Storage

CCA – Climate Change Agreements

CCL – Climate Change Levy

CfD – Contracts for Difference

CHP – Combined Heat and Power

CPF – Carbon Price Floor

CPSM – Carbon Price Support Mechanism

CRC – Carbon Reduction Commitment Energy Efficiency Scheme

DBEIS – Department for Business, Energy & Industrial Strategy

DECC – Department for Energy & Climate Change

DGCCRF – French Directorate General for Competition Policy, Consumer Affairs and Fraud Control

EC – European Commission

ECAs -Enhanced Capital Allowances

ECO – Energy Company Obligation

ECOFYS – German Ministry of Economic Affairs and Energy

EDR – Electricity Demand Reduction

EII – Energy Intensive Industries

EMR – Electricity Market Reform

EPA – Environmental Protection Agency

EPS – Emission Performance Standard

ESC – Electricity Settlements Company

ESOS – Energy Savings Opportunity Scheme

ETD – Energy Tax Directive

EU ETS – The European Union Emissions Trading Scheme

FCEA – French Council of Economic Analysis

FITs – Feed-in-Tariffs

GDP – Gross Domestic Product

GHG – Greenhouse Gases

GWPF – Global Warming Policy Foundation

IEA – International Energy Agency

IPCC – Intergovernmental Panel on Climate Change

LCF – Levy Control Framework

LCPD – Large Combustion Plant Directive

MWh – Megawatt hour

NAO – National Audit Office

NIC – National Infrastructure Commission

OECD – Organisation for Economic Co-operation and Development

ONS – Office of National Statistics

PPA – Power Purchase Agreements

R&D – Research & Development

RO – Renewables Obligation

SES – Special Equilisation Scheme

SMEs – Small and medium sized enterprises

UN – United Nations

UNFCCC – United Nations Framework Convention on Climate Change

Executive summary

Energy prices are damaging the competitiveness of UK firms. It does not need to be this way. The UK has substantial fossil fuel resources that could be used to make UK energy prices a source of competitive advantage for UK firms. The regulations that curtail the use of UK fossil fuels need to be abolished. A new UK energy policy should be adopted that prioritises securing low and stable energy prices for energy consumers.

Whatever side you take in the controversy about man-made global warming, the Government response is making UK energy prices high and this is making UK firms uncompetitive. Carbon leakage is a real problem. Our high energy prices result in energy-intensive economic activity moving to countries that, often, operate less carbon efficient means of production. This de-industrialises the UK and increases global per capita emissions, making climate change worse. The Government, and UK firms, should not prioritise reducing emissions in the UK when emissions can be reduced more cost effectively elsewhere.

Instead, the Government should introduce a different approach to reduce carbon emissions. This means investing in decarbonisation projects in developing countries provided those projects provide secure energy supplies. Government investment should also focus on increasing battery technology power and energy efficiency and these efforts should include the

development of specific prize funds to address key policy challenges. UK carbon budgets should include the carbon intensity of UK imports because UK climate change policy should not incentivise UK de-industrialisation. Some UK energy tax revenues should be earmarked for research into how to make fossil fuel use cleaner given that it is a major part of energy generation.

In chapter 1 I identify how UK energy policy has prioritised increasing renewable electricity generation and carbon emissions reduction over delivering stable low-cost energy to UK firms. This has imposed substantial costs on UK firms in excess of those of their global competitors. It has created an electricity supply that is unstable and difficult to manage. Many of the policy changes made since 2000 have been detrimental. Tinkering with them is not enough. They need to be rescinded. Instead, UK energy policy should ensure that as much energy-intensive economic activity as possible can occur in the UK.

In chapter 2 I analyse the policy approaches of three major UK competitors – France, Germany and the United States. Each of these countries shelters its producers from the costs of renewable energy. France provides its large firms with discounts for the bulk purchase of power. Germany restricts its tax base for renewable taxes so domestic consumers and small businesses pay for the promotion of renewable electricity and not large industrial producers. The US has recently elected as its next president Donald Trump, who has a radically different approach to energy policy. If he implements his declared policy approach the US will further reduce its energy prices and add to the existing competitive advantage it enjoys. The UK's energy price competitiveness issues are set to get worse.

In chapter 3 I explore three energy intensive sectors of the UK economy – steel, chemicals and aluminium. For each sector the Government misidentifies the cost of its policy measures because they do not consider the profits these firms make. Firms with high revenues but a small profit margin can have their profit wiped out by cost increases that are a small percentage of revenue or total costs. UK energy policy adds costs to a UK steel industry already in difficulties. Profitable UK aluminium plants have been forced to close due to EU legislation designed to curb emissions. The chemicals sector is becoming uncompetitive as high energy prices increase the price of the feedstock that many firms rely upon. UK firms are closing due to high energy costs and action is needed to address this now.

In chapter 4 I develop five guiding priorities that should help to ensure UK energy becomes price competitive with our major competitors in future. I explain how the Department for Business, Energy & Industrial Strategy (DBEIS) should provide a secure, stable and reliable energy supply. It should keep energy prices low. It should build a competitive energy generation market and provide a stable predictable energy policy in the UK. It should maximise the extraction of UK fossil fuel resources and secure the maximum possible economic return to the UK from their extraction. It should promote energy efficiency because a focus on this rather than decarbonisation will achieve a higher level of industry support and still help the cause of decarbonisation.

These five priorities are supported by fifteen policy recommendations that undo the bad policy developments that have occurred since 2000. I advocate

the abolition of the targets to generate a proportion of UK energy from renewables because the Government should not favour any particular form of technology. I also suggest that the calculation of the UK national carbon budget should include the emissions created to produce UK imports. There should be no incentive to offshore emissions. The overall UK target should be advisory not legally binding. A technology-neutral energy policy will mean the abolition of feed-in tariffs and the contracts-for-difference auctions. Generators of power will receive the market price for their product and not a guaranteed strike price. All requirements for firms to conduct energy audits and to conclude Climate Change Agreements with the Government should end. If firms deem these investments to be prudent then they will make them.

Next, the architecture of the new UK energy system, assembled since 2000, needs to be dismantled because it is not fit for purpose. Each of the policies and taxes that increase UK energy prices such as the UK Carbon Price Floor, the Carbon Price Support Mechanism and the Climate Change Levy needs to be abolished. The Levy Control Framework should be retained but reduced to zero to end the subsidisation of renewable energy. The Capacity Market will need to be retained because existing renewable electricity generation will continue to operate and the power supply will continue to need to be balanced. The life of existing conventional power stations may need to be extended to meet any fallback in investment in electricity generation capacity. The UK's membership of the European Union Emissions Trading Scheme should be placed under review and if the EU will not agree tariff-free access to the Single

Market for British firms then UK membership of the EU ETS should end.

The Government should then make commitments to curtail its interventions in the energy market and to provide a more stable and predictable energy policy in future. The main pledge should be that all regulation costs on the energy sector imposed by Government for the next 10 years would have to be financed by the Government and not by consumer bills. The Government should introduce a 'fair competition commitment' prohibiting Government subsidy for the deployment of any specific form of electricity generation to the grid. If the Government wishes to lead by example in cutting carbon emissions it should do so by making the Government sector carbon neutral first.

Knowing the cost of different policy choices is vital. The opportunity cost that local government obstruction of energy extraction projects creates should be recognised. A new legal duty on all local authorities to conduct a Local Economic Growth Opportunity Impact Assessment before they can refuse a request to drill or mine a natural resource should be introduced. Lastly, all individual consumers should know how much the policy support for decarbonisation is costing them. To achieve this the Government should introduce a renewable price support consumer transparency clause so all consumer bills show the cost to the individual consumer of renewable policy support payments.

Each of these changes should help restore a functioning private electricity generation market in the UK. This could provide stable and low prices as firms exploit the opportunity to invest in the cheapest and most efficient forms of power generation. Energy firms would enjoy

low and stable profits. Firms in the wider UK economy and particularly energy-intensive industries would benefit from lower energy prices. Investment can then be diverted to more profitable activities that will increase UK productivity.

Guiding priorities and policy recommendations

Here I list the five fundamental priorities that should guide future UK energy policy. I also list the fifteen policy recommendations that should help restore UK energy policy to a more competitive position.

Five guiding priorities for UK energy policy

1. Provide a secure, stable and reliable energy supply.
2. Keep energy prices low.
3. Build a competitive energy generation market and provide a stable, predictable energy policy in the UK once the policy recommendations outlined here are implemented.
4. Maximise the extraction of UK fossil fuel resources and secure the maximum possible economic return to the UK from their extraction.
5. Promote energy efficiency. Part of the tax revenues generated from fossil fuel extraction should be earmarked to set up a new UK energy efficiency fund.

Fifteen policy recommendations to improve UK energy competitiveness

1. End the commitment to generate a proportion of UK energy from renewables.

2. The Climate Change Act should be substantially amended to remove the legal requirement to reduce carbon emissions. It should also be changed to include emissions imports in the UK national emission target.
3. The Government should commit to having the lowest industrial electricity prices in the EU28 (lower than all the EU27 after the UK withdraws from the EU) within five years.
4. The UK should immediately convene a new UK Energy Competitiveness Review to examine how to ensure the UK has the most competitive energy prices it can.
5. End the Contracts-for-Difference auctions (CfD) with immediate effect.
6. End the Feed-in Tariff financial support for renewable power generation with immediate effect and the new Power Purchase Agreements for independent renewable generators contained within the 2013 Electricity Market Reform.
7. Abolish the UK Carbon Price Floor and Carbon Price Support Mechanism and the Climate Change Levy with immediate effect.
8. Reduce the Levy Control Framework cap on expenditure to zero for all new renewable energy support agreed from this point onwards with immediate effect.
9. Make the UK's continued membership of the EU ETS conditional on tariff free access to the EU market.
10. Extend the life of existing power plants as necessary to meet any fallback in initial investment in power-generation capacity. Retain the Capacity Market.

11. Introduce a new 'fair competition commitment' prohibiting Government subsidy for the deployment of any specific form of electricity generation to the grid.
12. Introduce a new 'Consumer Price Protection Clause' to require any future regulatory costs imposed on the energy sector for the next 10 years to be met directly from Government revenues with a prohibition on passing them through to consumers through their bills.
13. Create a new energy efficiency prize fund and end the requirement for firms to conduct energy audits and conclude Climate Change Agreements (CCA).
14. The Government should commit to making the public sector carbon neutral by 2040 and to create a new legal duty on all local authorities to conduct a Local Economic Growth Opportunity Impact Assessment before they can refuse a request to drill or mine a natural resource.
15. Introduce a renewable price support consumer transparency clause so consumers can see how much they are paying, individually, to subsidise renewable energy generation.

Introduction

The energy policy the UK should have

It is easy to outline what an effective UK energy policy would involve. Energy prices should be a source of UK competitive advantage for UK business. The UK has extensive domestic sources of fossil fuels, these fuels are freely accessible on world markets and the UK is a stable country with an established power generation system. Non-energy businesses should be able to access power that is no more expensive than their overseas competitors and, where possible, lower than the competition.

Providing power requires long-term investment and planning so the Government should provide a predictable regulatory framework that enables investors to feel confident making the required investment. Government interventions should ensure the energy market remains competitive and prevent firms abusing their dominant market position to generate excessive profits. Policy should ensure that investment in the sector remains attractive and profitable to efficient providers.

The National Grid should act to ensure power supply meets demand and to manage the system on a daily basis. The system should incentivise investment in predictable energy generation that can cheaply respond at short notice to increased demand. Taxpayers should not be expected to subsidise electricity generation because firms investing in generation should be expected to accept the

inherent risk in making an investment as do investors in any other private economic activity.

Energy generation should be a stable business capable of generating a fair, but unexciting, dependable financial return that is attractive in these uncertain times. In short, energy policy should be stable, boring and predictable. Until recently it was, then around the early 2000s the Government decided it knew best what the energy generation mix should be. The UK's liberalised energy market that had been the envy of many of our competitors was forced to accept a greater degree of state control and direction. This set the UK on the path to higher energy prices.

The energy policy the UK has

Energy policy is now subject to frequent change. Investors are required to guess the future intentions of the relevant, frequently changing, secretary of state. Each new state intervention has created problems, which further state intervention then seeks to solve. The alleged underinvestment in renewable electricity generation has been identified as a market failure but, actually, this form of generation is expensive and unreliable. Private investors are sceptical about its investment value because the lack of cheap battery storage technology means it is difficult to match the supply of renewable electricity with market demand.

UK energy policy has created a huge demand for new investment in electricity generation that the Government estimates to be £110 billion between 2013 and 2020.[1] But this investment need is partly, though not exclusively, due to the policy decision of the Government to close

fossil fuel power plants. Lower investment would be required if the life of existing generation capacity were extended. The investment difference would otherwise be invested in the wider UK economy, which is an economic opportunity cost not included in Government estimates of its policy costs.

The financial return on investment in the UK energy sector is reliant on a complex web of Government financial incentives that can be, and frequently are, changed at any point without notice. Government has intervened to fix electricity prices by guaranteeing generators a fixed price for their electricity irrespective of existing market prices and through taxing carbon emissions. This has locked the UK into permanently higher energy prices.

Energy use is now taxed to provide short-term revenue for the existing Government. Until 2015 it was the aim of the Government to increase the proportion of tax revenues derived from environmental taxes.[2] These taxes discourage investors from locating energy intensive industries (EII) in the UK. The main economic costs of this – the jobs not created and the tax revenues not generated – are invisible. However, visible costs can be observed in the jobs lost as EII close or relocate outside the UK. Redundant workers require welfare and healthcare support whose long-term cost to the taxpayer is likely to be higher than the short-term revenues energy taxes generate.

The price of electricity in the UK is now substantially higher than that of many of the UK's major competitors. This puts UK firms at a disadvantage. All UK firms are affected but EII are affected most, and among the EII the effects of policy are more readily apparent. Energy policy has slowly destroyed the UK's EII, contributing

to the deindustrialisation of Britain. The geographic location of the EII means their closure exacerbates the existing regional wealth divide within the UK. It damages the Government's attempts to spread wealth and opportunity across Britain. It reduces UK exports and boosts UK import demand, making the UK's huge trade deficit, which is mostly a goods deficit, worse.

UK energy policy requires that functioning, cheap and effective existing fossil fuelled power plants and the domestic coalmines that supply them, are closed down. It makes it financially attractive to import wood from thousands of miles away to be burnt in the repurposed coal-fired plants, making the UK the biggest importer of wood pellets in the world. It requires that the UK leave substantial coal resources, and the wealth they could generate, in the ground. Simultaneously, the UK's membership of the EU Customs Union applies a tariff to the importation of the lowest-cost forms of renewable technology, such as Chinese solar panels, produced outside the EU.[3]

The promotion of renewables in electricity generation creates a complex two-way power exchange where power users can consume and generate power. An increasing percentage of the UK electricity supply is generated intermittently, which creates wild swings in the energy price between a net cost of almost zero when renewables generate power and a huge price increase when they do not. Power generation is now based on weather patterns rather than when demand requires. The Government has had to intervene to smooth price swings through the Carbon Price Floor and Contracts for Difference that both, effectively, set limits on how low energy prices can go.

The unpredictable and disbursed nature of renewable power generation requires extra investment in the power system to accommodate unexpected surges in power supply. It makes it costly and difficult to manage the electricity network. The system has to pay generators to stop generating power at times of peak power supply. It pays other generators to remain on standby mode during non-peak periods. Neither of these payments would be necessary with fossil fuels, which can increase or reduce power generation by burning more or less fuel as required.

Renewable electricity generation requires a solution as to how to match power generation and demand. Existing storage technologies are, presently, too expensive to allow energy to be cheaply stored for later use. Government policy imposes double taxation on them, taxing them when the energy is generated and then again, following its storage, when electricity is supplied to the market. Rationing by turning off power to large-scale industrial consumers at times of peak demand to smooth power demand is one Government solution. Another is to distribute new smart meters to consumers to allow, mostly, power consumers to respond in real time to power price increases by switching their lights off.

Increasing UK energy prices is a very poor way of achieving the primary objective of Government policy – to reduce carbon emissions. The reason emissions are being controlled is because of their effect on the global climate. However, Government policy commits to making these emissions reductions primarily in the UK, where they are expensive to achieve. By doing this it encourages firms to invest in, or relocate their activities to, countries with more carbon intensive means of

production. This increases global carbon emissions even as it reduces UK national emissions.

Energy use is now viewed as a negative and low energy prices a problem. Higher energy prices encourage the adoption of energy efficiency measures. Low energy prices make renewable energy more expensive compared with fossil fuels. If the price of fossil fuels were to decrease consumers would face a large bill because of the promises Government has made to support renewable energy prices. If market prices are higher than the strike prices agreed with renewable energy suppliers then there is no such liability and the generator must pay the surplus back.

UK energy policy since 2000 has gone seriously wrong and it needs to change.

1

An energy market that works for everyone

The UK policy context – how energy prices fit in with the wider Government objective to build a country that works for everyone

The UK's high energy prices need to be placed in a wider context. Whether politicians refer to the 'squeezed middle',[1] 'alarm clock Britain' or the 'just about managing' classes, most politicians agree that many Britons have experienced stagnant wages and rising fixed costs in recent years. The decline in the UK's energy intensive industries (EII) has resulted in a big wealth divide within the UK along geographic lines. In the referendum on Britain's EU membership, Britain's former industrial heartlands voted overwhelmingly for Brexit. Lord Ashcroft's polling suggests Leave voters were more likely to believe that, 'for most children growing up in Britain today, life will be worse than it was for their parents' and that British life is worse than it was 30 years ago.[2] Raising the low productivity of British regions outside London and the South East of England is essential to build a more united country.

Theresa May has set a clear objective to spread jobs and wealth more equitably across Britain. In July 2016, in her first speech as prime minister, Mrs May promised to

lead a Government that worked in 'the interests of' the 'just managing'.[3] The 'just about managing' phrase was developed by James Frayne, then Director of Strategy and Policy at Policy Exchange, and the groups it refers to were outlined in his report 'Overlooked But Decisive: Connecting With England's Just About Managing Classes'.[4] In October 2016, in her first Conservative Party Conference speech as prime minister, Mrs May pledged to build an 'economy that works for everyone'.[5] To help achieve this a 'comprehensive industrial strategy is being introduced, overseen by the new Department for Business, Energy & Industrial Strategy.[6] In the 2016 Autumn Statement the Chancellor, Philip Hammond, established a new National Productivity Investment Fund to invest in innovation and infrastructure to address productivity concerns.[7]

What is productivity?

Productivity is a measure of how inputs in the form of labour or capital are converted into outputs in the form of goods or services. For the Government productivity appears to mean 'infrastructure' investment. The stated funding seeks to improve the UK road network, broadband infrastructure and affordable housing supply. The funding seeks to address the fact that the UK has the widest productivity gap with other G7 countries since records began in 1991.[8] Output per hour was eighteen percentage points below that of the average of the other G7 members in 2014.[9] In July 2015, the Treasury's 'Fixing the Foundations' report estimated that matching the United States output per hour worked figures would increase UK GDP by 31 per cent, this would mean

£21,000 per annum extra per household.[10] The French worker produces 27 per cent more per hour worked and the German worker 28 per cent.[11]

Why is there a productivity gap?

The productivity gap is, partly, due to the composition of the UK economy where manufacturing is less than half the percentage of UK GDP that German manufacturing is of German GDP.[12] Between 2000 and 2010 the UK manufacturing sector declined by half as a proportion of UK GDP from 22 per cent to 11 per cent.[13] Research and development investment is mainly conducted by the UK manufacturing sector. In 2012, it constituted sixty-nine percent of total UK R&D expenditure.[14] Despite constituting 79 per cent of UK economic activity the service sector contributed just 27 per cent of R&D expenditure.[15] Increasing UK R&D requires the UK grow its manufacturing sector and/or encourage higher R&D investment in the services sector. R&D investment is a key source of future productivity growth.

Britain has had a continuous and substantial trade deficit since 1998.[16] This deficit is due to the UK's deficit in traded goods (£120 billion in 2015) exceeding the UK's trade surplus in the services sector (£90 billion in 2015).[17] The majority of imported goods are manufactured goods (56 per cent in 2014).[18] The UK needs to import foreign capital to make up for its current account deficit. These foreign investments help increase UK standards of living and can finance new plant that increases UK productive capacity. However, where foreign capital purchases existing UK assets the future profit from those assets will flow abroad reducing UK national

wealth. The UK's productivity problems seem heavily linked with the relative decline in UK manufacturing and the effect this has had on the composition of the UK economy. This report highlights how high energy costs have contributed to the UK's manufacturing decline.

Why is productivity important?

Economist Paul Krugman states that: 'Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.'[19] Increasing real wages requires an increase in UK productivity. This can be achieved by reducing the inputs needed to achieve an output. Public investment in infrastructure is a part of this, as is lowering taxation and deregulation. The decline in the value of the Pound Sterling will help make UK components and labour cheaper reducing input costs even if the increases in the national minimum wage will undo some of these benefits. Wages like energy prices are input costs for business. This report concentrates on the impact of energy policy on energy prices. It seeks to make energy pricing a source of UK competitive advantage. This does not indicate that keeping UK wages, taxation and regulation competitive are not also important. Each of these is vital to a competitive UK manufacturing sector. However, energy costs are vital to keeping UK manufacturing competitive and a healthy UK manufacturing sector is key to increasing UK productivity.

Are UK energy prices high compared to our competitors?

In his Autumn Statement the Chancellor did little to address how high energy prices reduce UK competitiveness. Lower production costs can lower prices, increasing demand for and investment in UK EII. Low energy prices allow more production per unit of input increasing productivity (provided energy use is included in the calculation of productivity along with labour and capital costs). Government energy policies have increased UK energy prices, however. Between 2013 and 2015 UK industrial electricity prices increased substantially. They are now the second highest in the EU up from ninth in 2013.[20] In the EU, only Italy has higher industrial electricity prices. Germany, Ireland, Greece, Cyprus, Lithuania, Malta and Slovakia have lower industrial electricity prices than the UK but in 2013 each of these countries had higher prices.[21] The Department for Energy & Climate Change (DECC) put electricity prices for large users at 60 per cent over the EU average.[22] While gas prices are low compared to Western Europe they are high compared to America, Russia and countries in the Middle East. UK gas prices have increased by 90 per cent since 2004.[23] High energy costs make all UK firms less competitive but affect manufacturing firms most because of the energy intensity of production.

What signals has the new Conservative administration sent on energy policy?

The new Department for Business, Energy & Industrial Strategy (DBEIS) combines DECC, and the Department for

Business, Innovation and Skills (BIS). The amalgamation of these two departments could signal an energy policy shift from promoting renewables in the energy generation mix to keeping prices low. Environment Secretary Andrea Leadsom, formerly an energy minister at DECC, has published proposals through the Fresh Start Group of MPs to not make any commitments to increase the proportion of renewables in the UK energy generation mix post 2020.[24] The report advocated that low carbon policies post 2020 put a greater emphasis on gas, nuclear and carbon capture and storage.[25] This report suggested that 80 per cent of UK legislation on environmental affairs emanated from the EU.[26] This gives some hope that the case for low energy costs may be made within the Government. In addition, the European Commission in its recent Winter Package of policy proposals did not propose setting binding national renewable energy targets post 2020, but did propose an EU wide figure of 27 per cent by 2030.[27] So, the UK could rollback its post 2020 renewables ambitions.

However, while 'climate change' has been dropped from the title of a Government department, Theresa May still signed the Paris climate deal.[28] From 2020 the UK will be legally obliged to continue the production of carbon reduction plans under the Treaty, separate to the previous UK legal commitment in the Climate Change Act 2008. The UK is signed up to limit global temperatures to a rise of less than 2°C and to zero net emissions by the end of the century.[29] This could be the third Government (the Labour Government, the Coalition Government and the present Conservative Government) to prioritize increasing the proportion of renewables in the UK energy mix above low energy

prices. For example, the new Secretary of State for Business, Energy and Industrial Strategy, Greg Clark, has suggested that the threat the growth of intermittent renewables poses to managing the UK electricity supply is overblown and his writings, such as 'Conservatism in a Changing Climate' suggest the prioritisation of carbon emission reduction will continue.[30]

Does reducing carbon emissions require increasing the proportion of renewables in the energy generation mix?

Increasing the proportion of renewables is different to 'reducing carbon emissions' because it is possible to reduce the latter in the UK without increasing the former globally. The UK has a wide variety of policy options it could adopt that would make a decisive impact on carbon emissions without making energy prices more expensive. Encouraging dense urban housing developments rather than building in the suburbs could reduce carbon emissions without increasing the percentage of renewables.[31] The electrification of transport through the use of electric cars would reduce carbon emissions and decrease local air pollution, provided carbon emissions created by any fossil fuels used to provide electric power were captured and stored. The UK could financially support developing countries to build their new electricity grids using renewable technologies at a lower cost than closing UK fossil fuel generators and replacing them. UK emissions are a small part of global emissions and how developing countries generate their power in future will be more decisive in determining future global emissions.

The UK, largely, met its carbon emission reduction targets under the Kyoto Treaty by switching from coal to gas, which is not a renewable energy source. Between 1990 and 2010 gas generation increased from almost zero per cent of electricity generation to 46 per cent of electricity generation.[32] The decision of France and Germany to adopt renewables at the expense of their existing nuclear capacity will increase emissions in the period while this changeover is made.[33] The drive to ration carbon and promote renewables needs to be seen in a broader policy context. Climate change reduction is being achieved through introducing the key features of a planned economy in the energy market. The proposed solutions are to tax energy use and empower state agencies to distribute subsidies and issue fines according to state determined emission allowances. These policy approaches have not traditionally been associated with rapid economic growth. While higher domestic energy prices may encourage investment in more energy efficient processes they can also divert production to areas where energy costs are lower but production processes are less carbon efficient.

Why is the Government prioritising the reduction of carbon emissions and are the suggested policies likely to achieve their objective?

The Intergovernmental Panel on Climate Change (IPCC) is a body that is focused on climate science. It wants Governments to commit to ensuring the global climate does not warm more than 2°C above pre-industrial levels. They warn that warming in excess

of 4°C could lead to catastrophic effects. The Paris Agreement on Climate Change commits the UK and other signatory countries to set and enforce national carbon emission reduction targets. Bjorn Lomberg, President of the Copenhagen Consensus Center, estimates that by increasing energy costs and slowing world GDP growth these commitments will cost between $1 trillion to $2 trillion per annum by 2030.[34] These measures will create a smaller world economy with fewer resources to invest in mitigating climate change and developing emission reduction technologies.

According to Bjorn Lomberg, the United Nations acknowledges that if every country keeps its commitments to cut carbon emissions between 2016 and 2030 CO_2 emissions would be cut by only one per cent of the reductions needed to keep temperature rises below 2°C – its stated objective.[35] The OECD suggests that the worldwide carbon prices that do exist are 88 per cent too low to protect the environment.[36] In September 2016 the United Nations Framework Convention on Climate Change (UNFCCC) stated that 'in the member countries of the Organisation for Economic Co-operation and Development (OECD) and in Brazil, the Russian Federation, India, Indonesia, China and South Africa (referred to as BRIICS countries), it was found that still 60 per cent of carbon dioxide (CO_2) emissions from energy use are subject to no tax, and that only 10 per cent of emissions from energy use are taxed at EUR 30/t CO_2 or above.'[37] Leading competitors have not adopted the UK's energy policy approach and so it amounts to an act of national self-harm.

Successive Governments have believed that the UK's reduction in carbon emissions will show leadership and

encourage other nations to follow. However, the Labour Government in 2009 stated that: 'even if developed countries could reduce emissions to zero, the world as a whole would still not avoid temperature increases above 2°C' because of the growth in emissions in the developing world.[38] A 2011 independent report for DECC recognised that: 'between now and 2020, 546 GW of new coal-fired power generation is planned in Asia – more than double that currently deployed in the EU. China and India lay claim to the world's third and fifth largest coal reserves respectively, yet they are consuming coal faster than they can develop domestic mines.'[39] In 2013, DECC justified UK Carbon Budgets by stating: 'in the absence of a budgetary framework – and the legal requirement to set carbon budgets three budget periods ahead – it would be more challenging to galvanise the collective action needed domestically and internationally.'[40] However, it is not clear that the creation of the UK Carbon Budgets, nine years ago, has achieved a decisive shift in world policy, though the costs to UK business are clear.

What is wrong with the UK setting a very demanding carbon emissions reduction target and leading the world on this?

Setting national carbon reduction commitments may have the perverse effect of increasing global emissions. A phenomenon called 'carbon leakage' refers to the redirection of investment and production to areas of the world where climate change policy costs are lower but the carbon emissions required to make an item are higher. As Vivid Economics describe: 'there is a strong consensus that carbon leakage is a real effect,

that it varies between sectors, and that it increases with carbon prices.'[41] Following the UK referendum on EU membership the UK may be able to conclude free trade deals with developing countries. We would urge the UK to do so as this will greatly benefit all concerned. However, it will expose UK firms to competition with countries with lower labour and energy costs and policies that do not prioritise carbon reduction. A preferable UK carbon policy would be to focus on the carbon intensity of demand rather than on the location of production. This would require that we include imports within the estimates of national carbon emissions. If a good is produced in China to be sold to a UK consumer the carbon content should be included in our national carbon budgets. This would mean there would be no net benefit to the Government policy of carbon reduction from offshoring emissions. In fact, because overseas production is more carbon intensive it would be a net negative.

But doesn't the prioritisation of carbon reduction enjoy widespread support among the UK public who accept the economic costs it involves?

Actually, there is little UK public support for the prominence given by the Government to the reduction in carbon emissions. In 2012, Chatham House surveyed the opinions of the general British public and compared them with a group they designated as 'opinion formers'. They found 'there is little general public support for the government's policies to tackle climate change' and, perhaps more surprisingly they found that 'these issues are not ranked highly by opinion formers either'.[42] In 2016,

YouGov surveyed seventeen countries and found that the United Kingdom was among the least concerned about climate change (fifteenth most concerned out of seventeen nations).[43] The UK public does not rate reducing carbon emissions as a key national priority in contrast to existing Government policy which rates it highly.

There is widespread UK public opposition to increasing energy prices to reduce climate change. A 2015 poll conducted by ComRes for *The Independent on Sunday* found that only 23 per cent agreed with the statement: 'I would be prepared to pay more for energy bills in order to reduce climate change', 57 per cent disagreed.[44] While there is a niche consumer market for green electricity there is less demand for end products produced with renewable energy. Steel, chemicals and aluminum are bought and sold based on quality and price, not the carbon intensity of their production. This makes it perplexing that energy policy is primarily concerned with carbon emissions reduction and increasing the proportion of renewables in the electricity generation mix rather than keeping prices low and stable.

Below I describe some of the main Government policies that affect the price of energy.

So, what is UK energy policy and how does it increase energy costs for industry?

(i) Promoting renewable energy and setting a legally binding limit on carbon emissions

EU policy requires all member states to increase the proportion of their electricity that comes from renewables and ensure grid operators purchase it. In 2001, the EU Directive on the promotion of electricity produced from

renewable energy sources (2001/77/EC) set national targets for EU member states consistent with a European Union commitment to achieve a 22 per cent target for electricity generated from renewable energy sources by 2010.[45] Under this Directive Member States had to set ten-year targets for the promotion of renewable energy technologies and update this every five years. The EU Climate and Energy Package 2008 includes a binding target for the proportion of EU wide energy consumption from renewables of 20 per cent by 2020 and for the UK to achieve a national target of 15 per cent by 2020.[46] The EU 20/20/20 strategy adopted in 2009 committed the EU to generate 20 per cent of EU total energy consumption from renewable sources by 2020, cut EU emissions to 20 per cent below the 1990 level by 2020 and increase EU energy efficiency by 20 per cent.[47] In 2009 EU Directive 2009/28/EC granted renewable generators guaranteed access to the electricity grid ensuring the power they generated could be sold.[48]

Successive Governments have followed the same approach. In 2000, the Utilities Act gave the secretary of state the power to require electricity suppliers to provide a specified proportion of their total sales in the UK from electricity generated from renewables. In 2002, the Labour Government introduced the Renewables Obligation (RO). This forced electricity suppliers to purchase a proportion of their electricity from renewable electricity generators. In 2010, Feed-in-Tariffs (FITs) were introduced to encourage the growth of small-scale renewable generation. Under FITs, as of October 2015 782,000 installations (4.0 GW capacity) have been implemented, of which 99 per cent of the installations were solar powered schemes.[49] Between 2013 and 2015

the Green Deal allowed businesses and homeowners to install green technologies on their premises and pay for them through their reduced future energy bills. In 2013, under Electricity Market Reform Power Purchase Agreements (PAA) were created to allow independent renewable generators to more easily access the electricity network.

The former Labour Government set the first legally binding carbon budgets in the world. Under the Climate Change Act 2008, the UK is required to reduce carbon emissions by 34 per cent by 2020 and 80 per cent by 2050 (compared to 1990 levels).[50] To achieve this the Government is required to set legally binding five year carbon budgets. Under the act, three five-year carbon budgets representing 15 years ahead must always be in place. If the targets are not met fines are applied. The Act made a commitment in law to obtain 15 per cent of UK energy (not just electricity) from renewable sources by 2020, consistent with the EU specified target.[51] This was the largest percentage increase in the renewable component of total energy use of any EU member state.[52] Policy measures to force the purchase of renewable energy and subsidizing investment in its generation increased renewable electricity generation from 1.8 per cent of the total in 2002 to 19.1 per cent in 2014.[53] In the third quarter of 2015 23.5 per cent of electricity was generated from renewables compared to a 30 per cent target by 2020.[54] DECC now predict that by 2020 the UK will exceed its target and 35 per cent of electricity will come from renewables.[55]

This is not a case of the EU forcing a reluctant UK to act. In 2013, the Government was pushing the EU to increase its emissions reduction target to 30 per cent by

2020 and said the EU should 'adopt a unilateral EU wide greenhouse gas emissions reduction target of 40 per cent for 2030; and make an offer to move to a target of up to 50 per cent in the context of a global comprehensive agreement on climate change.'[56] Following the EU Referendum the then energy secretary, Amber Rudd, set a target of a 57 per cent cut in UK emissions by 2030, compared to 1990 levels, in the fifth carbon budget.[57]

(ii) Taxing energy use at prices, often above the European average and rationing emissions through applying a cost to them
In 2001 the Climate Change Levy (CCL) was introduced as a tax on the supply of energy delivered to UK businesses designed to encourage them to implement energy efficiency measures. The Business Energy Efficiency Tax Review (BEETR) stated that the CCL ensured the UK: 'fulfils its EU obligations under the Energy Tax Directive (ETD).'[58] The CCL sets a different rate per unit of energy used for electricity, gas, coal and liquefied petroleum gas. In April 2019, the rates for each will be changed to incentivise a reduction in the use of gas.[59] Until the 2015 July budget renewables were exempt from this. The decision to drop the exemption for renewables drops the pretence that the tax is designed to incentivise clean energy. This is now a tax on energy use. The sudden reversal means renewable generators face an unexpected £490 million cost in 2015/16, rising to £910 million in 2020/21.[60]

In 2005 the *European Union Emissions Trading Scheme* (EU ETS) began and the UK signed up. This is a form of cap and trade rather than a tax. It set a declining cap on the emissions from large industrial producers. In 2009, the Labour Government described it as 'the

single most important policy to reduce UK emissions.'[61] It covers just under half of EU emissions (45 per cent) and includes 11,000 high energy users. It is predicted to reduce emissions from heavy industry and power generation by 21 per cent by 2020, from 2005 levels.[62] It allows companies to trade the right to emit and thereby establishes a carbon price. Initially individual national caps on emissions were set but this became a single EU ETS cap in 2013. Power generators have had to purchase their emissions allowances since 2013, with the exception of eight member states that gained an exemption to allow them to continue granting free allowances to power generators until 2019.[63]

In 2013 the *UK Carbon Price Floor (CPF)* was introduced to top up the minimum carbon price. A high carbon price encourages power generators to invest in low carbon generation allowing emission reductions to be made where they are cheapest within the thirty-one countries in the EU ETS. Although, users can purchase international credits for emission reductions made in worldwide projects outside the EU ETS signatory countries.[64] The EU ETS carbon price has fallen substantially. The price of EU ETS allowances fell from 30 €/tCO_2 in 2008 to less than 5€/tCO_2 in 2013.[65] The carbon price in November 2016, a six month high, was just €6.62.[66] The carbon price fell 15 per cent the day following the UK's EU referendum result.[67] The EU's competitors have not replicated the EU ETS. So, the carbon price is a cost met by EU producers that is not met by most non-EU producers. In addition, the CPF adds a cost to carbon that makes it more expensive for UK firms than other EU firms.

In 2013 the UK specific *Carbon Price Support Mechanism (CPSM)* was introduced as a mechanism to implement

the CPF. Its price is the difference between the CPF set by the Government and the EU ETS carbon price. The CPSM was introduced as a fee payable by power generators in addition to the carbon price on the EU ETS market to ensure the price of carbon reached the level set by the CPF. Ofgem state that the CPF now 'comprises the largest share of carbon costs to power generators, at around £18/t.'[68] It was meant to increase from £30 a tonne in 2020 to £70 a tonne in 2030.[69] In 2014 the Chancellor froze the charge until 2020. Chancellor Phillip Hammond confirmed in the Autumn Statement 2016 that the CPF would be frozen and would remain until 2020/21 when it would increase with inflation.[70] The Centre for Policy Studies [CPS] describes the CPF as being introduced as a 'relatively easy way for the Treasury to raise £2 billion of extra revenue a year' [not one the CPS necessarily approve of].[71]

(iii) Creating a bureaucracy to regulate energy efficiency schemes

In 2010 the *Carbon Reduction Commitment Energy Efficiency Scheme (CRC)* was introduced. It covered large public and private bodies based on their electricity usage. It requires that they produce standardised reports on their emissions and buy allowances for the carbon they emit. Participants include supermarkets, water companies, banks, local authorities and all central government departments.[72] Emissions covered by Climate Change Agreements (CCA) or the EU ETS are not covered by this scheme. The EU Climate and Energy Package 2008 created separate carbon prices, one for the traded sector (the EU ETS) and one for the non-traded sector (emissions not covered by the EU ETS).[73] These are set

to remain separate until 2030 when the EU hope a single carbon price will exist in a global carbon market.

Since 2013 under the *EU Effort Sharing Decision* the UK has an annual emissions cap for the non-traded sector.[74] The right carbon price for the non-traded sector is difficult for the Government to determine because it involves both economic and scientific projections over multiple decades. As noted by DEFRA in 2005 the social cost of carbon 'range from zero to over £1000/tC.'[75] In 2016 the Government confirmed that the CRC would end in 2019. Following CRC abolition organisations will not have to purchase allowances to cover the energy emissions currently covered by the CRC. This reform will not reduce firm costs as it is said to be 'fiscally neutral' because the CRC is to be replaced by the existing CCL whose rates will increase from April 2019.[76] So, there will continue to be a price attached to carbon emissions formally covered by the CRC.

In 2014 the *Energy Savings Opportunity Scheme (ESOS)* was introduced as a mandatory scheme for all large firms and public bodies. They must conduct energy audits every four years to identify energy saving measures and update them beginning in 2015 with the exception of bodies already subject to a green deal assessment. Acting on the audit findings is voluntary. The ESOS regulations 2014 bring into effect Article 8 of the EU Efficiency Directive.[77] Also, since 2013 mandatory greenhouse gas (GHG) reporting requires that all UK quoted companies report on their GHG emissions in their Directors Report.[78] The aim is to make company directors think more about carbon emissions and serve as a benchmark on which companies can be judged. Energy projects are now subject to the separate *European Environmental Impact*

Assessment Directive that requires them to produce an Environmental Statement (ES) that specifies their impact on the climate. Each of these regulations requires that firms identify energy saving opportunities and publicise their approach to pressure them to prioritise carbon reduction.

How can firms avoid these costs?

Firms can avoid CCL charges by signing up to a Climate Change Agreement (CCA), which were introduced in 2001 with the CCL. CCA are billed as 'voluntary agreements' but if a company does not sign up to a CCA they have to pay the CCL so it is not that voluntary in practice. Under the CCA, EII can gain a 90 per cent reduction in their fees for electricity and a 65 per cent reduction for their fees for gas if they agree to introduce the required energy efficiency measures.[79] Participants can buyout the difference if they miss their emissions reduction target at a price of £12 per tonne of CO_2.[80] CCAs are also exempt from the CRC requirements if 70 per cent or more of their energy is eligible for the CCA scheme.[81] Fifty-three economic sectors have CCAs.[82] The CCL discount for CCA participants will be increased from April 2019.[83] The Government is committed to maintaining the CCA scheme until 2023.[84] The decline of British EII during this period can seen in the decline in the number of firms participating in CCAs. For example, between 2001 and 2013 the number of paper mills declined from 100 to 50 and glass factories declined in number from 50 to 25.[85]

Why are these taxes popular with the Government and what are the added costs of the pro-renewables energy policies?

Consider the net effect of these three charges – a UK firm must pay a tax on receiving energy (CCL), pay a minimum carbon related charge on each unit of energy purchased (CPF) and pay for the right to emit carbon, or pay someone else to reduce their own emissions (the EU ETS). The taxes, among these charges, raise significant revenue, which is why they are retained. The Chatham House think tank in a report for DECC stated that: 'Governments that tax domestic energy become dependent on the revenue, which makes them reluctant to reduce it in the event of higher international prices.'[86] If as the Government suggest the taxes are a small part of firms' total costs then the revenue raised will, necessarily, also be an even smaller part of total Government tax revenues. Thereby the Government could more easily survive without this revenue or find it in ways that don't reduce UK competitiveness.

Former energy minister Amber Rudd promised that renewable generators would be held 'responsible for the pressures they add to the system when the wind does not blow or the sun does not shine.'[87] She commissioned a study by Frontier Economics to look at the total cost of different forms of power generation including renewables.[88] She was right to warn of the cost renewable electricity creates. However, it was wrong to suggest renewable generators could be made to pay those costs. The Government chose to subsidize an activity. This caused the electricity system to become more expensive and difficult to manage. It then promised to pass these

costs on to the firms who acted on those Government incentives i.e. renewable generators. These power generators have only two ultimate sources of income – consumers and taxpayers. Any attempt to make renewable generators pay for the costs they impose on the system is, ultimately, paid for by taxpayers and consumers.

How long do these commitments last?

The commitments that are being made will increase energy prices for decades to come. With the exception of the Green Deal scheme whose funding was eliminated in 2015[89] these are long-term financial commitments. The Renewables Obligation (RO) closes to new capacity from 2017[90] but payments to existing beneficiaries will continue for, up to, an additional twenty years.[91] In 2008 the Government had stated that the RO would be retained until at least 2037 to give 'certainty to investors'.[92] CfDs, which have replaced RO, make similarly long term commitments. Under FITs, new entrants are eligible for payments for between ten and twenty-five years depending on when they signed up.[93] Where there have been attempts to reduce payments under FITs they have been subject to a legal challenge by the solar power industry, with a full trial expected in 2017 where fifteen litigants are claiming damages of £189 million.[94] Each of these contractual commitments – RO, CfD and FITs – needs to be honoured but they will increase energy prices for years to come.

Why do renewables cost more to connect to the Grid?

Renewable energy, particularly in the case of offshore wind, can be located far from where it is consumed. Having a large number of small solar power installations connected to the grid increases system costs. The previous Labour Government recognised these weaknesses in the case for micro generation of power. These micro facilities were 'unlikely to lead to significant replacement of larger-scale infrastructure.'[95] Larger facilities were better because 'interconnection of large-scale, centralised electricity generating facilities via a high voltage transmission system enables the pooling of both generation and demand, which in turn offers a number of economic and other benefits, such as more efficient bulk transfer of power and enabling surplus generation capacity in one area to be used to cover shortfalls elsewhere.'[96] The Global Warming Policy Foundation (GWPF) estimates that the additional network costs of renewables will cost £5 billion in 2020 in addition to the £7.6 billion cost of renewable subsidies.[97] Nevertheless, it is Government policy to encourage the growth of these facilities through the FITs.

How has the integration of renewable electricity on the grid changed how the power supply is managed and increased system management costs?

Consumers both supply and generate power: Electricity used to be provided in a vertical manner. Power was generated in power plants and then transported via transmission

lines and distribution wires to the passive consumer. Now the interaction is two-way. Consumers can sell power and purchase it from the grid. The higher the penetration of renewables the greater the network costs. Also, Distribution Network Operators (DNOs) take the power off of the small-scale renewable generators at a local level. Because of the growth of renewables feeding power into the grid DNOs must manage the two-way exchange of power on a local level, which is usually the responsibility of the National Grid. Policy Exchange identify how 'the share of total generation capacity connected to local distribution networks (as opposed to the transmission network) increased from eight per cent in 2010 to 26 per cent in 2015.'[98]

Power supply is more difficult to predict because renewables are intermittent: The National Grid's Consumer Power scenario estimates that by 2035 there could be 30 GW of solar power connected to the distribution network.[99] DECC suggest that: 'this could suppress demand significantly during the middle of the day as well as steepen ramp rates, making it more challenging to balance the system.'[100] Solar power is more appropriate to a country where peak electricity demand coincides with times when solar power is generated e.g. countries that require air conditioning. Renewable power generators producing more than needed have to be paid to shut down for a brief period. Paying generators to not produce power when the system is overloaded has increased dramatically from less than £100 million in 2005 to £340 million in 2013-14.[101] In 2015 £90 million was paid to wind power generators alone not to generate power.[102] The GWPF highlights the increase in the Balancing Services Use of System (BSUoS) costs, which

are required to ensure power supply meets demand. These increased by a factor of three between 2001 and 2012. The cost per unit of electricity is now £3.50/MWh and total BSUoS costs are now £1 billion per annum.[103]

The system requires a new expensive back-up supply system: In 2009 the UK Labour Government recognized the need for additional investment to provide an electricity grid with 'the ability to manage larger fluctuations in supply and demand.'[104] They suggested that the growth in renewables: 'results in an increasing system requirement for flexible power stations to provide back-up (or for more demand side flexibility) to ensure that demand can be met during periods when wind output is low. Even when the UK's electricity supply is almost entirely decarbonised, it could still be necessary to use fossil fuel power stations (and supporting infrastructure) for short periods of time when renewable output is too low to meet demand e.g. when there is little wind.'[105] The National Infrastructure Commission (NIC) state that: 'As we switch to a more intermittent and less flexible low carbon generation mix, demand for these services [back-up power supplies] is expected to multiply by up to ten times.'[106] This requires that fossil-fuel powered back up needs to run part loaded and this the NIC believes is: 'expensive, inefficient and limit[s] the amount of low carbon power that the system can absorb.'[107]

Older fossil fuel stations are being closed early to bring the renewables online making it more difficult to manage the system: The UK faces an increasing risk to the security of supply due to the closure of old power plants and 'the more intermittent (wind) and inflexible (nuclear) generation [that] is being built to replace it.'[108] The specific example DECC uses to illustrate the risk of a potential

blackout that the Capacity Market seeks to address is 'during periods of low wind and high demand.'[109] The subsidy of renewable energy, through FITs, has made it more difficult to predict and control energy supply. In December 2015, DECC stated: 'most trajectories of energy demand and supply to 2050 anticipate significant new system challenges as we incorporate more low carbon generation, and meet increases in peak demand (typically 4-8pm on winter weekdays).'[110] Policy Exchange refer to how: 'Analysis by both Ofgem and National Grid has shown that the 'capacity margin' [the proportion by which available electricity generation exceeds electricity demand] has fallen to very low levels, which is already resulting in price spikes when supplies are tight.'[111] A senior partner at Ofgem, and former interim chief executive, Andrew Wright has stated that the increase in intermittent energy supplies mean that in future richer households could 'pay for a higher level of reliability' and that poor neighbours could be forced to 'sit in the dark' because 'not everyone will be able to use as much electricity as they want.'[112] This contrasts strongly with the Government's suggested focus on the interests of those people that are 'just managing'.

How has the growth of renewables reduced the incentives to invest in non-renewable electricity generation?

Renewable power plants are expensive to build but cheap to operate, the opposite is true for fossil fuel facilities. Renewables generate power at almost zero marginal cost when there is enough wind or sun etc. The growth in renewables creates 'an investment challenge,

in particular for plant such as gas which can alter its output to meet demand. This is because low carbon plant has lower operating costs, meaning fossil-fuel plant will operate less often than now and be less certain of its revenues. This could lead to under-investment and uncomfortably low levels of reliable capacity.'[113] In October 2015 DECC wrote: 'experience in the UK has shown that significant investment does not tend to come forward without long term contracts, and Power Purchase Agreements (PPA's)/tolling agreements where they exist are not currently sufficient for attracting finance. Long-term contracts help provide investment certainty for new generation capacity – investors generally require assurance that capital and operating costs will be covered by expected revenues, resulting in reliable repayment of debt and the delivery of reasonable returns to equity.'[114] However, this 'experience' is based on a policy environment where Government frequently changes policy and the return on investment is difficult to predict because it is dependent on Government regulation and subsidy.

What is the Capacity Market and how does it work?

Renewable power generation cannot be turned on and off, as is the case with fossil fuels such as gas. Renewables require the existence of a permanent form of backup power generation ready to be used when they are not generating enough power. Without a capacity market a growing renewables sector would lead to huge price swings in the price of electricity as supply rises and falls. This is because renewables generate power

at almost zero marginal cost when the sun is shining and the wind is blowing so power prices are very low when renewables are generating power. When they are not generating power it causes energy prices to increase rapidly. UK power supply and demand need to be balanced on a minute-by-minute basis by the electricity grid operator National Grid. It is important to have a reserve generation capacity to meet peaks in demand and drops in supply – this is, a large part of, the Capacity Market. Although, battery storage and electricity demand reduction can have a role.

The Coalition Government created a Capacity Market to ensure power supplies continue. Under the terms of the Capacity Market, suppliers are being paid to maintain the capacity to produce electricity on demand and not just for the delivery of the power itself. They are paid when they are not generating power too. The previous Labour Government thought that higher wholesale prices at times of peak demand would be: 'important in providing sufficient returns for investors in the flexible power stations.'[115] The National Grid both runs the Capacity Market and bids to receive payments under the system. Two auctions had been conducted as of July 2016 and they will deliver 49.26GW and 45.37 GW, at a price of £1.805 billion and £1.081 billion, in the years 2018/19 and 2019/2020 respectively, a third was conducted in December 2016.[116] The Government created an Electricity Settlements Company (ESC) in 2014 under EMR to administer the settlement process to make capacity payments to the designated supplies.

The UK will, potentially, allow foreign suppliers to participate in the Capacity Market through inter-connectors so they can contribute to the UK's reserve

electricity supply from 2019/20. This is problematic because EU rules 'make it impossible to guarantee flows of electricity to GB during stress events.'[117] Allowing entities that cannot be sure of providing the required power when needed to form part of backup generation seems misguided. Also, the connectors with France were damaged in Storm Angus in November 2016 with four of the eight cables being severed eliminating 1GW of capacity.[118] They will not be fixed until February 2017.[119] So, these facilities seem vulnerable to one form of weather related shock that might create a need to access power under the Capacity Market. However, they do allow the UK to import energy from countries where their peak demand does not coincide with UK peak demand as when a UK home nation is involved in a national sports event but France is not.

What are the costs of the Capacity Market?

The Office for Budget Responsibility estimates the annual costs of the Capacity Market will be £600 million in 2018/19 rising to £1.3 billion in 2020/21.[120] The Capacity Market is a product of the UK's move to having a greater proportion of renewables in the energy generation mix. Fossil fuels are excellent at balancing energy demand and supply without the need for a Capacity Market. We can burn more or less coal, or gas, as demand requires. Fossil fuels can be stockpiled to meet peaks in demand. For example, Margaret Thatcher stockpiled coal so in a future miners strike UK power supplies would not be disrupted. Both the EU and the IEA require that the UK maintain an oil stockpile. In contrast, the main forms of renewable energy, with the exceptions of hydro

and geothermal power, are intermittent. Solar panels do not generate enough electricity when it is cloudy. Wind turbines do not generate power when it is not windy and too much wind causes turbines to become unstable and stop working. This creates a new supply challenge to those managing the network. In December 2016 a capacity market auction awarded £130 million in subsidies to keep 5.7GW coal plants running to provide power in the winter of 2020/21.[121] This demonstrates some recognition of the reliability of coal as a form of energy generation given its role in the Capacity Market.

Is the UK power system secure?

The NIC points out: 'as technologies such as wind and solar generate a greater proportion of our electricity, weather patterns will play an increasing role in determining prices, increasing the level of volatility.'[122] The price of UK electricity has been subject to substantial price volatility. For example, in May 2016 UK electricity prices went negative.[123] In London Economics' report on 'Energy Retail Markets Price Comparability Study' the UK had the fourth highest volatility in industrial electricity prices out of twenty-one nations studied.[124] So far these issues have not caused a system failure and the power has been kept on. However, the British Infrastructure Group of MPs warn that there is just 0.1 per cent spare electricity in the current system and that the National Grid has had to pay more than 800 times more than the standard price of electricity to buy additional power to cope with shortages in 2015.[125] So, the strains on the system appear to be substantial.

The security of the electricity supply is measured

based on Loss of Load Expectation. This is the amount of time in a year when the electricity supply cannot meet demand, when the National Grid needs to use its back up balancing supplies. Presently, these incidents have been for a short duration, sometimes for as little as 30 minutes. The Government target is to make sure this measure does not go above three hours and the expected figure for 2015-16 is 1.1 hours.[126] With the gas system the measure of system security is how the system would cope if the largest piece of infrastructure were to be put out of action, under this scenario 112-113 per cent of demand could be met.[127] So, the system is not currently experiencing power shortages but price volatility is increasing, as is the threat of future power rationing and blackouts.

Why can't we store the power renewables generate and use it when we need it?

In 2009 the previous Labour government recognised that: 'currently the only viable utility-scale energy storage technology is pumped storage.'[128] The four pumped storage facilities then existent amounted to three per cent of total generation capacity.[129] The Government stated: 'there is limited further potential [for pumped storage] in the UK' and there is also 'little large-scale storage technology capable of commercial development above 5MW.'[130] Pumped storage 'was built several decades ago under a very different system, and there has been very little additional energy storage built since then.'[131] While the cost of battery technology has declined rapidly they are still expensive. Lithium ion batteries now cost $200 kWh compared to $3,000 in 1990.[132] The Government

spent £80 million on energy storage research and development between 2012 and 2015 but their regulatory policies have reduced the growth in this technology.[133]

The block on the deployment of battery technology is partly due to Government taxation. Battery stored energy is taxed when it is generated prior to storage and when it is released from storage to be used (double taxation). Policy Exchange has recommended that the Electricity Act 1989 and the required grid codes be updated to define activities such as storage and demand response and that both be exempted from renewables based charges.[134] The NIC has urged the Government to change the necessary regulations to remove barriers to the expansion of battery technology so the UK can become a 'world leader in battery technology.'[135] They predict that 15,000 MW could be deployed by 2030 if prices continue to drop.[136] They believe that consumers could save between £2.9 billion and £8.1 billion per annum by 2030.[137] DNOs, which are fourteen regionally based private companies that distribute power to end consumers, are not legally allowed to own energy storage facilities because it is classified as generation.[138] Therefore, battery storage remains problematic.

What is electricity demand reduction/ demand flexibility?

This is a new term for energy rationing. It means applying automated systems to reduce consumption by particular users at times of high demand. The NIC suggests that the Government should consider demand flexibility as a way of managing peak electricity demand. Demand side response is required because the supply of renewable

energy cannot increase when demand requires. It is used in both America and Australia. An Electricity Demand Reduction (EDR) programme has been introduced in the UK with projects above a minimum size (50kW) able to bid for a limited pot of funding in an auction.[139] The EDR pilot was conducted to establish if demand flexibility could achieve savings in peak time electricity use and if it could participate in the Capacity Market. National Grid has had difficulties recruiting firms to participate in its demand side balancing reserve to cut energy demand between 4pm and 8pm.[140] Few firms seem to want to volunteer to shut off production as and when the system requires, which is understandable.

Consumers will soon be able to respond to real time increases in energy prices. Smart meters will enable consumers to identify their electricity usage in real time and adjust to higher prices. This could be combined with allowing prices to be increased and reduced in real time. By 2017 energy suppliers will be able to offer time of use tariffs so households and businesses can adjust their usage to electricity prices. The cost of rolling out these devices is projected to be £11 billion, or £214.50 per household/business but the predicted energy saving is low.[141] Higher prices already apply for UK firms at times of peak demand. Already, firms such as Tata Steel have had to shut off production during the working day to avoid high energy bills. Tata Steel faced a £1 million bill after operating during a thirty-minute peak period in 2015.[142] Neither storage, demand management nor the introduction of smart meters will be enough to accommodate an extensive lull in renewable electricity generation e.g. two to three weeks of low and limited sunlight could cause severe problems for the electricity grid.

Can't we reduce the energy lost in generation/ transmission to the consumer? What is Combined Heat and Power (CHP) and how is the Government supporting it?

CHP generates electricity but captures the heat used in this process. Around 80 per cent of the UK industry energy demand is to produce heat.[143] Because both heat and power are created in a single process it reduces the amount of energy lost as heat in the generation process and because the heat is used locally it reduces the amount of energy lost in transmission. Support for CHP was available under the RO since 2006 (now through the CfD) and through the Renewable Heat Incentive that was introduced in 2011. Through these measures the Government aim to have 12 per cent of UK heat coming from 'renewable' sources by 2020.[144] The Government promotion of CHP is undertaken according to two EU Directives that promote energy efficiency and the adoption of CHP (Directive2004/08/EC and Directive 2012/27/EU).[145]

CHP has great potential however the Government approach to it shows how unstable policy signals affect the current energy market. In July 2016 DBEIS cut support for Biomass CHP units that use less than 20 per cent of their fuel to generate electricity by proposing an amendment to the Renewable Heat Incentive.[146] The Renewable Energy Association surveyed thirty-six companies building biomass CHP in the UK and found that thirty-four of the firms had put down non-refundable deposits or ordered equipment for their plants.[147] People were given 21 days notice of the change in policy by the Government. Given that CHP technology can be

applied to both renewable and fossil fuel power plants and makes these plants more efficient the Government should prioritise extending its use as a means of carbon reduction.

How has the Government sought to control the cost of their renewable promotion policies?

Clearly, these schemes impose substantial costs on taxpayers, businesses and consumers. In 2011, the Levy Control Framework (LCF) was introduced and HM Treasury set an annual limit on their cost. The LCF caps the total payments (above the electricity price) paid to low carbon generation for each year until 2020.[148] Since November 2012 the Framework has capped the costs of three schemes to support investment in low-carbon energy: FITs, the RO, and, now, CfDs. This cap does not apply to the revenue generating aspects of Government renewables policy such as the CPSM or the CCL. It is a cap on the subsidy of renewables through consumer bills and not a cap on tax revenues that can be collected by Government.

In 2013 the Government introduced *Electricity Market Reform (EMR)* in the Energy Act 2013 to build an electricity network capable of absorbing the huge growth in renewables. The RO was phased out subject to transitional investment contracts to allow investment in renewable generation prior to the CfD beginning. *CfD* were created as long-term private contracts between an electricity generator and the CfD counterparty to incentivise low carbon power generation by providing the generator with a pre-agreed price (the 'strike price') for the lifetime of the contract. Generators are paid the

difference when the reference price (a measure of the average market price of electricity in the UK market) is less than the strike price. Generators pay the difference when the reference price is higher than the strike price.

Under EMR the *CfD* works on an auction basis that helps reduce the level of subsidy required. In 2014/15 this resulted in the strike prices being lower than the reference prices by 12-14 per cent.[149] Also, CfDs issued after 2016 won't make payments if periods of negative pricing exceed six hours. Investment contracts were introduced as a stopgap measure to prevent a decline in renewables investment between the end of the RO and the beginning of the CfD. They show how costs can inflate if auctions are not used. The National Audit Office (NAO) estimate that the award of eight large renewable projects under this scheme in 2014 cost £300 million per annum more than if they had been subject to price competition as with the CfD.[150] The Capacity Market is also undertaken on an auction basis with price competition.

Didn't the Business Energy Efficiency Tax Review reduce the cost of this system?

In March 2016 HM Treasury outlined its response to the Business Energy Efficiency Tax Review (BEETR), initiated in 2015. It found that the CRC Energy Efficiency Scheme (CRC), Energy Savings Opportunity Scheme (ESOS) the Climate Change Levy (CCL), the Carbon Price Floor (CPF), the Renewables Obligation (RO) and the Energy Company Obligation (ECO) had, according to the businesses consulted, 'particularly onerous reporting requirements.'[151] They found that 'the scale

of change and lack of clear direction' from DECC and Ofgem led to 'significant opportunity costs and lost investment.'[152] The BEETR was limited to considering proposals that fit four criteria; they had to be consistent with fiscal consolidation plans, simplify and reduce compliance and administrative costs, protect energy intensive businesses at risk of carbon leakage, support productivity through improving incentives for energy efficiency and aid carbon reduction.[153] This means they were limited to making the implementation of existing policy less bureaucratic.

In its response to BEETR, the Treasury committed to deliver simplified energy and carbon data collection and reporting requirements and to consider the implementation of a de-minimis requirement for the new framework to reduce costs for small business.[154] It did abolish the CRC but, as previously mentioned, replaced it with an expanded CCL. These are very minor reforms given that BEETR identified that Ofgem Supplier Licences are four times their 2004 size.[155] There are 10,500 pages of industry guidance and in the year prior to 2016 there were between 800 and 1,000 consultations (including code modifications) industry could respond to.[156] The Government recognise these changes impose costs on energy suppliers that make electricity generation less attractive to investors and energy consumers. However, they made no commitment to reduce the size of Ofgem Supplier Licences by a specific amount.

The BEETR did not make any general commitment to build a policy environment that keeps prices low. The consultation to inform BEETR suggested: 'replacing the CRC and CCL with a new energy consumption tax based on the CCL.'[157] Instead the Government has abolished

the CRC and expanded the CCL. Of the four 'long-term issues' facing energy & climate change policies identified by the coalition government in 2010 none related to keeping energy prices low for all consumers.[158] In 2016 DECC stated as one of its departmental priorities keeping 'energy bills as low as possible for households and businesses.'[159] But it did not set any target to have the lowest prices in the OECD or the EU28.

Under Section 2 of the Climate Change Act 2008 the secretary of state can amend the percentage of emissions reductions to be made compared to the 1990 level by 2050.[160] But the secretary of state has not yet used this facility. Current Environment Secretary Andrea Leadsom has, previously, suggested that the UK should make no commitment to increase the UK proportion of renewables after 2020, while retaining the existing UK commitments but this is not Government policy.

What effect has the Levy Control Framework (LCF) had?

Departmental costs are now based on a complex web of predictions including changes in energy prices, weather conditions and technological development that are difficult to predict. Analysing the reliability of Government cost predictions is impossible because they have not reported on the full cost of their Levy schemes since 2014. The National Audit Office notes that the Government refuses to release the underlying assumptions behind their projections stating commercial sensitivity.[161] One clear effect is that in 2015 the Government required support for renewables to be reduced so the LCF was not breached.

The rapid cost increase in such a short period undermines the credibility of DBEIS's long-term cost predictions. In 2020, the cap on support for low carbon energy schemes will be £7.6 billion.[162] However, between February and June 2015 the projected framework costs for 2020 increased from £7.1 billion to £9.1 billion.[163] There are a variety of reasons for this. Top-up payments under the CfD scheme had increased due to low fossil fuel prices.[164] More schemes were brought forward under the RO and FITs and they generated more power than expected. For, example between 2012 and 2015 the Government expected 1.5 GW of solar power to be installed but 8 GW had been installed by 2015.[165] The LCF is flexibly applied and allows DECC to exceed the target by 20 per cent before it imposes a fine on DECC.

What is the EU ETS and what are the problems with it?

The EU ETS was created to apply a price to carbon emissions. The market failure identified is that while pollution imposes costs on wider society the market does not impose costs on the polluter to help meet these costs, to discourage them from polluting, or to make cleaner technologies relatively less costly. The EU ETS fixes the amount of carbon emissions and allows polluters to pay to pollute. The level of carbon emissions can then be managed down over time by reducing the pollution allowances and gradually making it more expensive to pollute. This sounds good but it has largely failed to achieve its objective for the following reasons.

First, the EU ETS applies to a restricted number of European nations and these nations compete in a

global market. Unilateral climate policy would, it was estimated, reduce EU export demand by 9.1 per cent and increase imports by 8.1 per cent.[166] Already, the EU has been modeled as 'the worst affected region from the earlier Kyoto Protocol, accounting for 41 per cent of total leakage caused by its mandatory commitments.'[167] The EC in 2009 identified one hundred and seventy-six sectors at risk of carbon leakage.[168] Without abatement measures it is estimated that EU firms would experience production declines of 20 per cent at a carbon price of €15/tCO_2.[169] Consequently, free allowances were given under the EU ETS to energy intensive users in the first two stages of implementation whose businesses were deemed at risk of carbon leakage. EU regulations define EII as firms with energy intensity of more than three per cent.[170] Balancing the systems 'need' for a high carbon price with the need to protect EU industry has proven difficult.

Second, the cap never matches the current economic requirements. The initial total emissions cap was set prior to an economic recession so more allowances were issued than needed. Subsequent allowances have been set in a period of economic decline based on subdued production. This restricts firms' ability to increase production when economic growth increases. Allowances require firms to start and maintain production or they lose their allowances. For example, plants lose their allowance if production falls below 50 per cent so some of them overproduce to keep their allowances. New plant can take time to reach full production levels but their allowances don't account for future increases in production.[171] In the ceramics sector DECC has found that: 'a particular barrier for larger

plants, which are obliged to participate in the EU ETS, is loss of ETS allowances if the project lasts more than 6 months. Restoration of full allowances is impossible under the current interpretation of the rules and reduced allowances will be granted only after 6 months or a year of new plant operation.'[172]

Should the UK leave the EU ETS?

By leaving the EU the UK will need to decide whether to remain within the EU ETS. Part of the UK's consideration of this will be whether the EU allows tariff free access to the EU Single Market to UK firms (not the same as membership of the Single Market). Certainly, the UK should retain the option to leave the EU ETS in any future trade deal and should regularly review the EU ETS to consider how cost effective it is. One possible alternative policy for an independent UK is to change from reducing the level of emissions to reducing the carbon intensity of production. To do this would require including the emissions used to manufacture UK imports within the national carbon budget. This would give a more precise indication of the UK's contribution to climate change.

The IPCC recognise that an increasing proportion of CO_2 emissions is contained in goods and services exported from upper-middle income countries to high-income countries. They state that China and the other emerging economies have doubled annual carbon dioxide emissions since 2000 to 14 gigatons per annum and estimate that two gigatons is due to them making goods for export.[173] Exports account for one third of Chinese emissions.[174] The problem is, as Vivid Economics identify, in the iron and steel sectors 'it is

impossible to tell by inspection what type of production process has been used to make a piece of steel, yet the carbon embodied in steel varies greatly by production method.'[175] A system of monitoring the carbon intensity of UK imports would require the application of rules of origin, adding to business expenses.

How do Contracts for Difference (CfDs) work?

The Government has created a new state controlled energy derivatives market. The transaction price for CfD is zero. Neither party is required to pay any consideration on entering the contract. The value is based on an estimate of future contractual liability. The predicted fair value of future CfD payments in 2015/16 was £30.6 billion.[176] In 2015-16 DECC apportioned £840 million to account for the movement in the fair value of CfD since 2014-15.[177] It could be more expensive than expected if, for example, energy wholesale prices are lower than expected. The increase in costs would appear small in percentage terms but this is partly because 'the majority of CfD support so far has been for relatively expensive offshore wind' so it is an increase in cost from a high base.[178] In 2014 the Government created a firm called the Low Carbon Contracts Company to collect the levy payments from energy suppliers, manage the CfD and pay/receive the difference payments.[179] It is funded by a levy paid by electricity suppliers. Electricity suppliers are required by the legislation to pay the supplier obliation levy to fund CfD payments – there is no option to opt out of this legislation.

In their submission to the EC DECC recognise that: 'these agreements potentially risk locking in consumers

at a higher price over a longer-term if future capacity prices fall (e.g. a cheaper technology or improved energy market rents).'[180]

How much do these policies increase industrial energy prices?

Despite the frequent celebration of the 'green jobs' and 'green growth' that the shift to a low carbon economy will create estimates of the effect of the promotion of renewables on GDP are that policies such as the Renewable Energy Strategy 2009 are 'roughly neutral to slightly negative.'[181] This is because all parties agree that in the short-term to medium-term renewables promotion increases energy prices.

- The Committee on Climate Change states that the cost of low-carbon policies is low and that they will raise energy prices for industrial consumers by 20-25 per cent between 2011 and 2020.[182]
- DECC estimates that in 2020 under their Low Fossil Fuel scenario a medium sized business will pay electricity prices 76 per cent higher than they would in the absence of climate change policies and prices will be one hundred and 114 per cent higher in 2030.[183]
- The GWPF states: 'even EIIs [energy intensive industries] entitled to compensation are presently paying energy prices as much as 18 per cent higher than they would be without energy and climate policies, and for an EII without compensation they are 26 per cent higher. However, by 2020 the figures will be 22 per cent higher for a compensated business, and 76 per cent higher for an uncompensated business.'[184]

How does the GWPF estimate the actual cost of these policies to consumers?

The GWPF believes carbon reduction policy is permanently locking in higher prices irrespective of current costs. DECC's cost estimates look to be an underestimate because the price of a barrel of oil in dollars has decreased substantially since DECC's estimates of the cost of its renewables policies were made. However, the relative cost of a barrel of oil has increased since this estimate because it is priced in dollars and the value of the sterling has decreased against the dollar. DECC's Energy Projections are based on assumed currency exchange rate projections. For illustration of how volatile currency movements can be consider that in September 2015 the assumed Pound Sterling to American Dollar exchange rate was £1=$1.648[185] but as of 21st November 2016 the actual rate was £1=$1.25. So, the price of a barrel of oil in dollars has decreased since the projections were made but so has the relative value of the pound. Both make long-term predictions on fuel costs difficult.

Another problem with estimating the costs of renewables is whether energy costs are compared to revenues or profits. The correct measure is to compare extra costs with a firm's profit margin. For example, imagine a business with revenues of £1 million per year that achieves profits of £50,000 per annum. If energy prices are 10 per cent of revenues (£100,000) and they increase by 25 per cent (£25,000) the business's profit will be reduced by fifty per cent. However, the increase in energy prices would amount to only 2.5 per cent of revenues. The GWPF cites Office of National Statistics (ONS) research which revealed that energy costs were

44 per cent of the gross operating surplus of firms in the iron, steel and ferro-alloys sector in 2008 but in 2014 they were 330 per cent of gross operating surplus.[186] GWPF analysis of ONS data for 2008-2014 suggests that direct energy costs amount to 13 per cent of gross operating surplus for all UK manufacturing firms.[187]

Will increasing energy efficiency among UK businesses reduce carbon emissions and lower energy prices?

While energy efficiency will increase the effectiveness with which energy is deployed it has a limited effect on total energy consumption as this continues to increase with economic growth. In 2013, the Green Growth Group in a report for DECC predicted: 'global primary energy demand is expected to rise by 47 per cent and global electricity demand by 89 per cent over the next 25 years.'[188] DECC predicts UK electricity demand will double by 2050.[189] However, energy efficiency is an area where carbon reduction and general business interests are in synergy. Energy is a cost to business and identifying how to produce the same output for less energy makes business sense and can mitigate the cost of other policies. The previous Labour Government recognized that without energy efficiency measures there would be 'potential competitiveness issues' when applying the EU ETS.[190] The 2009 Low Carbon Industrial Strategy estimated that UK businesses could save £3.3 billion on their energy bills per annum by 2020 through introducing greater energy efficiency measures.[191] The Coalition Government's Carbon Plan outlined in 2011 envisaged a reduction in energy use per

capita of between a fifth and a half by 2050.[192] The new Conservative Government in December 2015 referred to reducing electricity use as 'the most cost-effective way to cut emissions and help lower bills.'[193] But it's not clear Government involvement is needed to persuade firms to lower business costs.

Is UK industry reluctant to invest in reducing energy intensity?

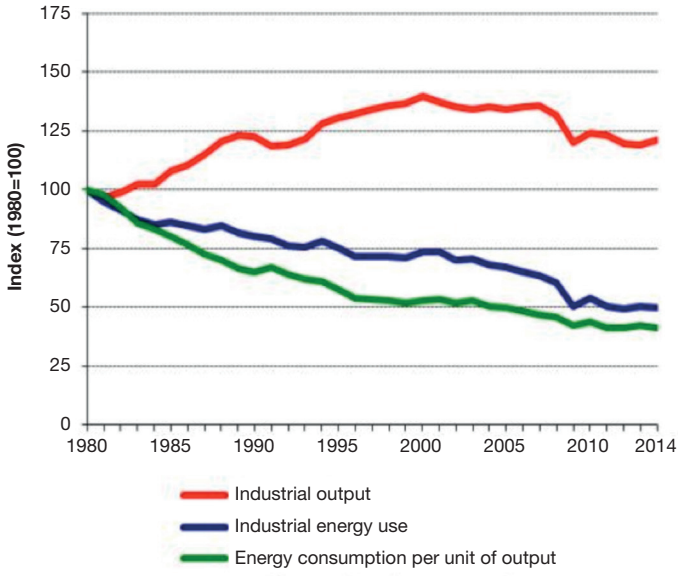
Governments of all political persuasions have identified a market failure in the area of energy efficiency. Businesses are said to invest too little because they are unwilling to bear upfront costs to make long-term savings. Businesses that operate a 'just-in-time' production model don't want to run the risk of disruptions to production. Sharing information on energy efficiency improvements is difficult because this is confidential commercial information that firms are reluctant to share with their competitors. Also, DECC estimate that: 'direct energy costs represent a small fraction of most industries' overall costs. For example, energy costs represent just three per cent of total production costs for German and UK manufacturers on average.'[194] For some less energy intensive firms the gains from implementing energy efficiency measures may not warrant the cost and effort required to put them in place.

DECC research into the barriers to SME investment in energy efficiency found that only 25 per cent of energy efficiency projects with an annual saving of £10,000 were implemented.[195] Thirty per cent of the possible improvements they identified required no capital expenditure.[196] DECC found that the average value of

the energy efficiency improvements they identified that the SME had not made amounted to between eighteen and 25 per cent of annual energy costs.[197] The payback period was key to whether an improvement was made with a two-year payback period being the maximum acceptable for most companies studied.[198] Since 2001 *Enhanced Capital Allowances (ECAs)* have allowed companies to claim 100 per cent of the cost of energy saving equipment against their taxable profit as a first year capital allowance[199] provided the technologies are contained on an Energy Technology List managed by the Carbon Trust for DBEIS.

However, it is not clear UK businesses are not already taking sufficient steps to improve their efficiency. Investment cycles in the steel sector last for between 25-40 years.[200] This means the 2050 target is at most two investment cycles away.[201] Energy efficiency improvements may require a piece of equipment to be replaced before the new, more efficient, piece of equipment is installed. The energy intensity of the UK economy has declined by 24 per cent since 2004.[202] Between 2006 and 2011 the median electricity intensity in the non-domestic sector fell by 10 per cent and gas intensity by 24 per cent.[203] DECC found that: 'manufacturing companies had a greater tendency to implement improvements (29 per cent versus 18 per cent).'[204] Also, industrial energy consumption per unit of production has halved since 1980 as Figure 1 shows.

Figure 1: Industrial energy consumption and industrial output from 1980 to 2014[205]



Wouldn't increasing energy prices just increase the need to invest in energy efficiency measures making UK firms more efficient and competitive?

While increasing energy prices should increase the incentive to invest in energy efficiency measures, they can also have the opposite effect. EII often operate in economic sectors that have a low profit margin. Reducing their profits means less money to re-invest back in their businesses. It can also make investment in less emission efficient plants overseas more attractive. This danger is named 'carbon leakage'. The suggestion is that existing plants will close due to competition from overseas plants with lower energy prices. This would depend

on whether the relocation costs exceed the climate reduction related costs. However, there is an additional danger, which is that rather than closing existing UK plant companies will just ensure that new investment is diverted away from the UK. This means less investment in UK manufacturing meaning that production facilities will become less competitive over time. Energy efficiency is a greater business priority then decarbonisation. A common business argument is that end consumers do not purchase materials based on the carbon intensity of their production. There is little consumer demand for carbon neutral products. Government could provide a market by purchasing carbon neutral products itself to further reduce public sector emissions which have dropped 40 per cent since 1990.[206] However, this would increase the costs to Government.

Does the Government believe that fossil fuel resources are scare and declining?

If UK access to fossil fuels were in danger and UK emissions were a significant part of worldwide emissions the renewables drive might make sense. But neither of these positions is true. In 2014 the UK emitted only 1.16 per cent of worldwide carbon emissions compared to almost 30 per cent from China and 15 per cent from the United States, the UK emits fewer emissions per capita than both countries and less than emerging markets such as Mexico and Indonesia.[207] In 2008 the then energy secretary, Ed Miliband, stated the energy market was designed for a world with 'abundant supply' and a new strategy was needed to deal with 'structurally higher energy prices' among other factors.[208] He stated: 'In

Britain, as our own reserves in the North Sea decline, we have a choice: replace them with ever-increasing imports, be subject to price fluctuations and disturbances in the world market and stick with high carbon; or make the necessary transition to low carbon, right for climate change, energy security and jobs.'[209] In 2011 DECC, under the control of the Conservative/Liberal Democrat Coalition Government, commissioned an independent report which predicted the world was 'headed towards a global oil supply crunch and price spike'[210] because oil supplies will increasingly be located offshore or in tar sands. It defined energy security as: '[a] defence against supply disruption and price instability'.[211] However, these fears have not yet been realised.

Will we run out of fossil fuel resources?

Since at least 1980 the growth of global reserves of oil and gas has exceeded oil consumption. The current state of global reserves better resembles the prediction of the Saudi oil minister who during the 1970's remarked: 'the Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil.'[212] It is important to distinguish between 'resources' and 'reserves'. Reserves are the fossil fuels that are currently recoverable given existing energy prices and technological capability. Resources are the larger amounts of oil or coal that exist. Resources can be reclassified as reserves when higher prices make previously uneconomic resources worth exploiting.

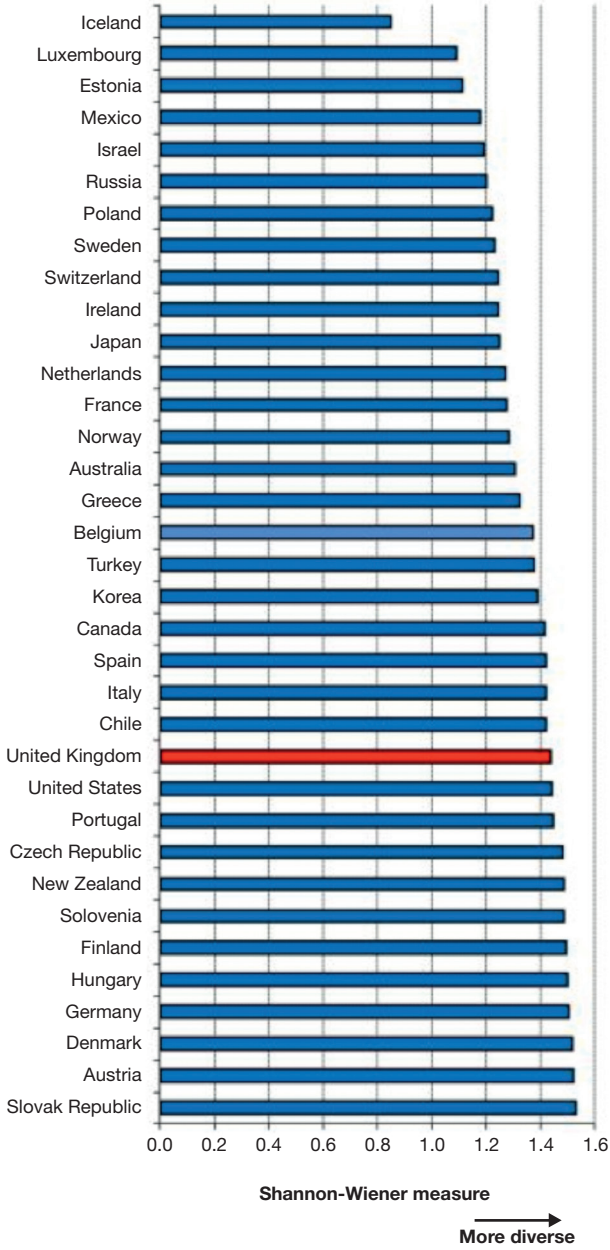
With regard to the UK, Carbon Brief states: 'the UK has had much less than 15 years of oil reserves remaining for the past 30 years.'[213] The UK has large amounts of

fossil fuel resources that are not being exploited. Also, the UK can access supplies from world markets where supplies are abundant. The US Geological Survey states that a fifth of undiscovered oil and gas reserves may be contained in the Arctic.[214] Resisting the efforts to place a moratorium on drilling for oil and gas in the Arctic would substantially increase our fossil fuel resources.[215] Unfortunately, the new Canadian prime minister has declared a moratorium on new oil and gas licenses in Canadian arctic territory, to be reviewed every five years.[216] Also, President Obama has imposed a permanent ban on Arctic drilling in American waters.[217] Since Ed Miliband's statements oil and gas prices have fallen dramatically. It is now starting to increase again from a low base. If it increases rapidly this will spur technological advancement making more oil resources recoverable.

Don't we have to import fossil fuels from unstable and unpleasant countries? Renewable energy must be more secure?

Security of supply is one of the arguments for renewables. In terms of the sources of our energy supply, however, the UK is among the more secure major economies in terms of the diversity of its primary energy. Fifty-seven per cent of gas imports in 2014 were from long time ally Norway.[218] Also, significant shale gas resources are available in the UK if the Government is able to facilitate their extraction. Coal is more precarious. Forty-two per cent of the UK's coal imports come from Russia.[219] However, the UK has extensive domestic coal resources and it is abundant in world markets. Ending coal-fired

Figure 2: Diversity of Primary Energy Supply in OECD countries and Russia (2014)[220]



power generation in the UK was a policy choice. In 2013, under EMR the UK Coalition Government introduced the *Emission Performance Standard (EPS)* limiting the CO_2 emissions produced by new fossil fuel power stations. This was designed to phase out coal-fired power not gas. The UK could reverse these policy choices and access these fossil fuel resources.

How did UK and EU policy help to kill off a declining UK coal industry through taxation and regulation?

The energy industries amounted to 2.8 per cent of GDP in 2014 down from 10.4 per cent in 1982.[221] Britain continues to have vast domestic unexploited coal reserves, much of which are located under the North Sea.[222] Recoverable coal reserves exist in over seventy countries and DECC estimated that world coal reserves were sufficient for 150 years at existing production rates (in 2008).[223] However, the UK no longer mines enough coal to meet domestic demand. Coal imports increased dramatically reaching 86.5 per cent of primary coal consumption in 2014.[224] Government policy towards coal has changed from trying to reduce the carbon emissions from coal-fired power plants (under the previous Labour Government) to closing them (under the Coalition Government and now the Conservative Government).

The previous Labour government did not rule out the continued use of coal. In 2006, they established the Coal Forum that brought together domestic coal producers and power generators to 'develop strategies to maximise economic production of UK coal.'[225] They stated that: 'new coal power stations would contribute

to the diversity and security of UK energy supplies.'[226] The previous Labour Government predicted coal would be used to generate 22 per cent of electricity in 2020.[227] DECC stated in their Energy Markets Outlook 2008 that: 'recent increases in the coal price have made the economics of re-opening closed or mothballed mines more attractive.'[228] As late as 2015 the Labour Party leader Jeremy Corbyn suggested re-opening a coalmine in South Wales using 'clean-burn technology'. However, this was subsequently clarified as support for a single mine and he reiterated his support for keeping 'fossil fuels in the ground'.[229]

What is Carbon Capture and Storage (CCS)?

Carbon Capture and Storage technology extracts the carbon emissions and stores them underground so they cannot affect the climate. In 2008, the Department for Business, Enterprise & Regulatory Reform said that coal with CCS would be part of the energy strategy and that: 'unnecessarily ruling out one of these options would, in our view, increase the risk that we would be unable to meet our climate change and energy security objectives.'[230] In 2009 the Labour Government pledged funding for Carbon Capture and Storage (CCS) technology to be installed in four coal-fired power stations by 2020, as a demonstration project, with all new such power stations fitted with the capacity by 2025.[231] They realized that, given existing environmental regulations, the cost of this new experimental technology would otherwise mean that no new coal plants would be built. CCS would reduce carbon emissions from coal plants by 90 per cent.[232]

Why is CCS important?

The IPCC says that without CCS the cost of reducing global warming could double.[233] Chair of the IPCC, Rajendra Pachauri said that: 'With CCS it is entirely possible for fossil fuels to continue to be used on a large scale.'[234] CCS poses significant challenges. It is a new technology. The carbon stored may have to remain so until the issue of the effects of CO_2 emissions on global temperatures is resolved. This could be centuries, which may be longer than the companies currently involved in these schemes. However, despite pledging £1 billion to CCS in the 2015 Conservative General Election Manifesto months later the Conservative Government abandoned the four-year competition to build a CCS demonstration plant six months prior to the date it should have been awarded.[235] The fact that a £1 billion manifesto commitment could be so quickly jettisoned shows how unstable policy in this sector currently is.

How did the Coalition, the EU and then the Conservative Government help to destroy both coal-fired power plants and the UK coal industry?

The Carbon Price Support Mechanism (CPSM), a tax, helps make coal generation unprofitable. Cornwall Energy has estimated that the CPSM has increased the cost of coal-fired electricity generation by 50 per cent (from £30.3/MWh to £45.8/MWh).[236] Remaining coal-fired power plants are being closed by the Industrial Emissions (Integrated Pollution Prevention and Control) Directive (IED). It increases the restrictions on sulphur

and nitrogen oxygen emissions. The Confederation of UK Coal Producers identifies how the EU Environmental Impact Assessment includes a 'screening procedure, a six months screening timetable, extending the content of individual schemes, 90 days for public comment and 6 months assessment period'.[237] The confederation stated that these were 'all sources of significant delay to our industry. Site life for a surface mine is between 2.5 and 10 years and this would mean that obtaining replacement capacity was further delayed and even more costly'.[238] The combination of these policies ensures no new coalmines nor coal-fired power plants are opened up. The CPS estimates emissions from UK power stations are up to five times more expensive than power plants on the continent due to the UK carbon tax.[239]

In 2009 the Government estimated that 22 GW of electricity would close over the next ten to fifteen years.[240] These closures are 'driven in large part by the Large Combustion Plant EU Directive (LCPD), which was introduced in 2008. This regulates emissions of sulphur and nitrogen oxides. Generating companies who chose to 'opt out' coal and oil power stations (amounting to about 12 GW) under the terms of the Directive are only able to operate for a maximum of 20,000 hours over the period 2008-2015 and will have to close by the end of 2015.'[241] In 2013 under EMR an Emission Performance Standard was created and set at a level that would 'not impact on the new gas generation capacity needed to replace older, retiring capacity' but would phase out coal based generation.[242] There was, in 2015, the largest fall in coal use, (outside of a miners' strike) in UK history.[243] The UK's last deep coal mine closed in December 2015.[244] Both the CPSM and emissions regulations combined with

recent falling gas prices have made UK coal production unprofitable.[245]

What risks does this pose for the UK power supply? The lesson of the winter of 2005/06

Coal's decline poses a risk to UK energy generation. In the winter of 2005/06 gas prices doubled compared to 2004/05. Electricity generators switched to generate power from coal instead of gas. This meant that: 'coal generation peaked at 50 per cent of total electricity generated and averaged 42 per cent for the duration of the winter, compared to 20 per cent in the winter of 2004/05 and 37 per cent in the winter of 2006/07.'[246] In June 2016 the DBEIS Electricity Market Reform Panel of Technical Experts stated that: 'if all coal plants were to permanently disconnect, then the capacity margin in 2018/19 could become very tight, as it would probably be too late to commission new replacement plant.'[247] DECC had an extra auction for delivery in 2017/18 to try to meet the problem. Recent Capacity Market auctions have awarded additional contracts to coal-fired generation recognising its low cost in generating power even if this is only as a form of back up generation in this case.

Government policy now subsidises the use of an inferior imported fuel over domestic coal

Bizarrely, the largest UK coal-fired power plant, Drax, has been converted to biomass, burning wood pellets instead of coal. Biomass is less energy dense than coal and more of it needs to be burnt to generate the same

amount of energy. It is carbon neutral because the crops used to produce it are replanted and it is classified as a 'renewable'. The UK produces around 0.3 million tonnes of wood pellets and briquettes but burnt 3.4 million in 2013/14.[248] Wood pellets are mainly imported from Canada and America. The UK has now become the world's biggest importer of wood pellets.[249] UK energy policy, strangely, encourages power generators to use this inferior fuel that is largely imported.

Could UK shale gas reduce UK energy prices substantially?

This depends on the scale of UK extraction. The British Geological Survey estimates that: 'the UK shale gas reserve potential could be as large as 150 bcm (5.3 TCF) – very large compared with 2-6 bcm estimate of undiscovered gas resources for onshore conventional petroleum.'[250] UK shale gas may not match the impact that US shale gas production has had on the US economy because production levels in UK wells are likely to be lower than in America due to lower pressure levels.[251] However, it could reduce prices and/or increase UK exports. In 2004, the UK became a net importer of gas.[252] The previous Labour Government estimated the decarbonisation of electricity supplies, heat efficiency and other climate change reduction measures would mean the UK imported 45 per cent of the gas it used in 2020 rather than 60 per cent without these measures.[253] Global supplies of conventional gas are relatively concentrated in areas of political instability such as the Middle East and Russia, if the UK were for some reason unable to access Norwegian gas. However, shale gas is

more prevalent in stable locations such as the United States and Europe. The net effect of enhanced domestic shale gas extraction will include export earnings, reduced gas imports and additional investment and domestic job creation from the extraction itself and the lower UK energy prices. As of 2014 the UK imported 45 per cent of primary natural gas consumption.[254]

Why is UK shale gas not expanding rapidly as the industry is in the US?

DECC promises that shale-gas applications will be 'fast-tracked through a new, dedicated planning process.'[255] They also pledge that: 'local people [will] have a strong say over the development of shale exploration in their area.'[256] Communities that host shale gas exploration will benefit because the Government will assign 10 per cent of shale tax revenues to them. However, this will invest only £1 billion over twenty-five years.[257] DECC, did change mineral rights in the Infrastructure Act 2015 to clarify landowners rights so drillers can access land below 300 metres without permission[258] and the Oil and Gas Authority was recently created. It is funded by an industry levy and its statutory objective is to 'maximise the economic recovery of UK offshore oil and gas revenues' from the UK Continental Shelf. However, UK shale gas production has been at very low levels, partly because of the unfortunate success of campaigns against local shale gas extraction sites.

The evidence is clear that the dangers of shale gas extraction are not substantially greater than conventional fossil fuel extraction – not risk free, but the risks can be managed. The Climate Change Committee determined

that the extraction of shale gas did not pose any additional risk to the water supplies compared to other forms of extraction of hydrocarbons.[259] In 2013 Professor David MacKay (then DECC's Chief Scientist) and Dr Timothy Stone assessed that the effect of UK shale gas production on UK greenhouse gas emissions would be minimal.[260] By displacing the importation of Liquefied Natural Gas it could even reduce them. Public Health England assessed the risks to the public from exposure to shale gas emissions as 'low if operations are properly run and regulated.'[261] Nevertheless, since the 2016 Labour Party Conference the party now has a position of opposing fracking within the UK when it previously wanted it banned it until environmental concerns were addressed.[262]

Why has the UK agreed to pay a substantial premium to ensure the construction of additional nuclear power plants?

Increasing the proportion of nuclear generation in the energy mix is the most reliable way of reducing carbon emissions while maintaining a reliable energy supply although the costs are substantial. Nuclear power is not intermittent but it is slow to start or shut down which makes it unable to respond to variations in demand. The UK relies on imports of uranium, mostly from Australia. In 2008 the Nuclear Decommissioning Authority estimated that UK uranium stocks were enough to fuel three 1000 MW reactors for sixty years.[263] The UK currently has fifteen nuclear reactors, they deliver 21 per cent of UK electricity but half of them are set to close by 2025.[264] In 2009 the Government said new nuclear

power plants needed to be constructed and to start generating by 2018. They predicted new nuclear power plant construction would begin in 2013 describing it as a 'realistic timeframe.'[265] However, the Government did not sign up to build the new Hinkley Point C nuclear power plant until September 2016.[266]

Under the Hinkley Point C deal the strike price agreed was £92.50 per megawatt hour of electricity for 35 years.[267] The difference between the wholesale price and this strike price is to be 'paid for through consumer bills'.[268] Ofgem in 'Wholesale Energy Markets in 2016' show that the current monthly average day ahead electricity price in 2016 is below £40 per megawatt hour and between 2010 and 2016 it has not been below £30 per megawatt hour, or over £70 per megawatt hour.[269] Britain has agreed to pay a substantial premium to ensure this project goes ahead. This may be because the Government commissioned modelling, designed to inform the 4th carbon budget, predicted that nuclear energy could serve 60 per cent of the UK's power demand by 2050.[270] Sadly, the Austrian Government has challenged the Government Hinkley Point C deal at the European Court of Justice on State Aid grounds claiming the Government should support renewables instead.[271] Given that Nuclear power is virtually carbon free this challenge is somewhat odd.

Why has the UK decided to prioritise national measures to meet the global threat of climate change?

The UK has made limited use of the ability to fund developing countries to transition to having a greater

proportion of renewables in their energy generation mix. DECC provides only £321 million out of its £5.5 billion budget to overseas aid to help developing countries with climate change.[272] Routing this money through the private Green Investment Bank, or a new development bank established for this purpose, and converting it from aid into a loan-based arrangement would provide a long-term boost to investment in renewable power generation in the developing world. The substantial costs of decarbonising the UK are due to the Government's decision to reduce emissions domestically and not through purchasing international offset credits. Although, the latter option remains open to the Government to meet its carbon reduction targets and the EU Renewable Energy Directive allows EU Member States to purchase renewable generated electricity from other countries and for it to count towards the purchasers' renewable energy targets. Meeting the challenge is not only expensive it also means more policy risk as Government incentive schemes are frequently changed without notice. Cambridge Economic Policy Associates indicate that the risks of investment in renewable generation can be lower in developing states than in Europe due to the way renewable investment is agreed. In the former private power purchase agreements are agreed that are enforceable in the courts. In Europe subsidies are contained in laws and these can be changed as the Government did in 2015 when it cut subsidies for solar power by 65 per cent.[273]

Connecting the UK to other European countries electricity grids

Currently, the UK has only 4GW of electricity interconnection, five per cent of generation capacity.[274] The value of this is that peaks in UK demand can be balanced by importing electricity. Peaks in UK supply can be dealt with by exporting the surplus electricity. The Government has supported five new interconnector projects in total with France, Norway, Denmark and Ireland.[275] However, EU rules require that where a levy is imposed on electricity supply to fund a support scheme available to particular generators, imports of electricity must be exempt from contributing to the report scheme.[276] This gives a potential competitive advantage to non-domestic energy generators. Under the FITs, the mandated renewable import exemption has led to increases in imports of renewable electricity and 'an increase in costs for smaller electricity suppliers of around 10 per cent, higher prices to UK consumers, and windfall profits for foreign renewable generators.'[277]

Don't EII have an exemption from the costs of these renewable energy subsidies?

The Government has the power to apply a reduction in the costs of renewable energy promotion policies for some industries. EC's Energy and Environment State Aid Guidelines restrict the level of compensation businesses can be given for the cost of renewables policy. Compensation for the costs of carbon taxes are governed by EU state aid rules which require that exemptions are applied to a minority of firms that are

energy intensive, they restrict the option of granting 100 per cent compensation and compensation is based on an energy efficiency benchmark so only the most carbon efficient firms would gain the maximum exemption.[278] A few exemptions have been agreed such as the 100 per cent exemption from the CCL for energy-intensive metallurgical and mineralogical industrial processes.[279]

As of 2015 HM Treasury decided to give EII an exemption from the indirect costs of the RO, CfD and FITs that should be effective as of April 2017. EIIs have gained an exemption from the indirect costs of the CfDs based on the EIIs obtaining a certificate issued to them by the Department of Business, Energy & Industrial Strategy.[280] Following the UK's decision to leave the EU this could change. The exemption that firms have from the CfD costs could be extended to all firms and not just the EII. However, this would have the net effect of increasing prices for domestic consumers because it would shrink the tax base, as it has in Germany. BEETR stated: 'the UK currently has an energy tax system where tax costs and implicit carbon prices vary significantly across different groups of businesses and within organisations. A number of stakeholders have argued that this has weakened the effectiveness of tax as a price signal to save energy and cut emissions.'[281] The exemption reduces some of the cost of renewables to business but energy prices will remain high compared to the UK's major competitors.

2

What energy policies do the UK's major competitors have?

Now we will compare and analyse the policies of three major developed western countries. Two of these countries are members of the European Union (France and Germany) who are now embracing a change to renewables. However, both have managed to provide competitive energy prices for their firms through providing preferential pricing to their larger firms. America has been chosen because it is set to change its policy on this subject to abandon its focus on renewable energy and emissions reduction. American energy policies affect the UK as a major market for UK goods and a competitor in world markets.

1. FRANCE

Are French electricity prices low?

French electricity prices are far below the EU28 median prices and among the lowest of any major Western European economy. They are lower than large European competitors such as Germany, Italy, Spain and the United Kingdom but higher than Poland.[1] PricewaterhouseCoopers (PWC) describes how both France and Germany have 'a sizeable competitive advantage on the other countries in terms of electricity

commodity cost.'[2] The French Economic Analysis Board in a note on 'Energy and competitiveness' found that French manufacturers had a 23 per cent competitive advantage compared to German manufacturers.[3] When German exemptions and reimbursement of the electricity network usage charge are applied France still had a competitive advantage with prices for French heavy industrial energy users 12 per cent lower than in Germany.[4]

What role does the state play in the French electricity market?

The overwhelming majority of French electricity is generated by EDF which is part owned by the French Government. Since 1999 large industrial firms were allowed to choose their electricity suppliers and SMEs were allowed to do this too in 2004.[5] However, the part state owned electricity supplier EDF reaches special agreements with EII so they can purchase power at a discounted rate. These agreements 'set electricity purchase prices that fall below the market price, and therefore also below the Eurostat average electricity purchase price of 4.42 ct/kWh for electricity purchases for companies that consume up to 150 GWh/year.'[6] In 2014 EII secured an agreement from EDF and Exeltium after 'friendly' intervention by the French Government[7] that allows power prices to fluctuate within a band until 2019. The Exeltium price paid by twenty-seven largest power consumers will vary according to French nuclear power plant output.[8] Prices for the large energy users are important because: '90 per cent of aggregate exports are the work of just 5 per cent of exporting companies'[9]

so low prices for these EII significantly boosts French exports.

The French energy market is dominated by a small number of private firms with a heavy state role. EDF owns the transmission network (RTE) and the distribution network operator (ERDF). The latter manages 95 per cent of the French distribution network.[10] EDF is now separated from its transmission and distribution network as EU Directives require. The French Government brokered the sale of the reactor division of Areva to EDF, who now operate all fifty-eight French nuclear reactors.[11] Since 2010 EDF is required to make a quarter of the nuclear electricity it generates available to competitor suppliers on the wholesale market at a fixed price.[12] The former state owned operator Gaz de France (GdF) dominates the gas market. French gas prices are below those for the EU28 but higher than the UK, which produces gas domestically.[13]

What exemptions do French firms have from the network taxes levied?

The French Council of Economic Analysis (FCEA) recognise that: 'From an economic perspective, it is only rational for heavy electricity users who are also major exporters to pay less towards the fixed costs since the average cost (of the network and the public service charge) is lower for these heavy users. This is why the public electricity service charge (CSPE) is capped at €550,000 per industrial site and 0.5 per cent of the companies value add for industrial companies using more than 7GWh.'[14] In France, EII and those that generate their own electricity can be exempt from the

electricity tax. EII can receive exemption from these taxes for the energy they use in specified industrial processes e.g. metal processing. Electricity used for the production of electricity is exempt. Products where more than half the production cost is due to electricity costs are exempt. Companies subject to the EU ETS are exempt. So a wide variety of activities and user types are exempt from the costs of grid maintenance.

Are French electricity prices stable?

Electricity prices are stable with the market price between €45 and €47/MWh.[15] London Economics in their 'Energy retail markets comparability study' found that France had average volatility in electricity prices being tenth highest out of the twenty-one nations they studied.[16] So prices are low and relatively stable. The FCEA believe France's 'special position' is due to 'the scale of its nuclear power network' and 'the strict pricing regulation on the part of the government.'[17] In 2013, nuclear power generated 75.4 per cent of French electricity and hydropower generated 13 per cent.[18] The 'unique nature of the French situation results in a very low electricity price … for the majority of businesses.'[19]

The French competitive advantage in electricity prices is slowly being undone

In 2013, the French Directorate General for Competition Policy, Consumer Affairs and Fraud Control (DGCCRF) described electricity prices for industrial consumers as 'a competitive advantage that is increasingly coming under fire.'[20] French industrial electricity prices, while

still low, increased by 30.39 per cent between 2008 and 2013.[21] The FCEA predict that a 10 per cent increase in electricity prices would reduce French exports by 1.9 per cent.[22] The FCEA also estimates that if natural gas prices rose by 10 per cent French exports would decline 1.1 per cent.[23] The FCEA believes 'the distortions generated by a degree of commercial mercantilism are visible on an international scale. It would therefore be fair to say that 'environmental dumping' is often a reality; the governments soften their environmental policies to improve competitiveness in certain sectors.'[24] So, as the competitively low electricity prices are gradually being undone this is being recognised as a threat to competiveness.

French electricity prices are set to increase because of the new promotion of renewable electricity

Unfortunately, France has decided to engage in an act of economic self-harm. The merits of nuclear power with its high state subsidies can be debated. However, France has a functioning energy market that provides low cost and stable power supplies. This has now changed as the French Parliament has agreed to reduce nuclear energy output from almost 75 per cent of the total to 50 per cent by 2025.[25] Renewables will be promoted in place of nuclear power. This is despite the fact that France has the lowest absolute level of carbon dioxide emissions in the G7.[26] So, these targets were not to reduce emissions but because of an ideological commitment to renewables.

The renewables targets were set because of agreements reached between the Green Party and President Hollande,

and EU policy in this area.[27] Under the requirements of the 20/20/20 EU targets, France is required to generate 23 per cent of final energy consumption from renewables by 2030.[28] To meet the target France will need to close twenty-two nuclear reactors at a cost of €40 billion.[29] The majority of French nuclear plants will be decommissioned between 2020 and 2035 unless their lives are extended.[30] The renewable energy support charge to be billed to customers that France has introduced is set to increase from €1.4 billion in 2011 to €8 billion in 2020.[31] In January 2015 France introduced a peak power capacity mechanism recognising, as the UK did, that increased renewables present a greater challenge in keeping power supply and demand matched.

The FCEA states the change to renewables will increase electricity prices: 'The total cost per MWh [Megawatt hour] for the various equipment that is likely to be commissioned by 2030 would appear to be noticeably higher than that of the 'legacy nuclear network' and 'the average production cost variance over the same period is estimated at around 30 per cent, or even more, between the scenarios involving the decommissioning of existing 40GWs of the legacy nuclear network and those in which it would primarily be postponed until after 2030.'[32] France has also rejected a move to gas generation. France actually banned the geological surveys needed to establish the extent of domestic shale gas resources.[33] The effect on French gas prices is difficult to determine. The FCEA believes that higher production costs in Europe mean that domestic shale gas would be comparable in price to imports of American liquefied gas.[34] So, France has a very strong competitive position that recent policy measures are steadily undermining.

2. GERMANY

Are German electricity prices low?

This depends how big the consumer is – large firms enjoy lower average prices given their higher level of consumption. German electricity prices for large consumers have decreased since 2008 and for small firms from 2011.[35] A study by Green Budget Germany found that German industry power prices 'not including taxes and levies' are 'now cheaper than the other big EU countries aside from France. Notably, only Germany's power has gotten cheaper since 2007.'[36] Around two thirds of power supply contracts concluded by German industry are concluded at least a year in advance.[37] Between 2010 and 2014 German manufacturing output increased by 10 per cent and employment in the sector rose seven per cent.[38] German exports constituted 51 per cent of GDP in 2013.[39] Germany has made 'competitiveness' an explicit goal of Germany's energy transition (Energiewende) and has shielded its large firms from the costs of its conversion to renewables.[40] The German State Secretary for Energy in the Economics Ministry Rainer Baake has said that: 'If energy intensive industry leaves, nobody will follow suit.'[41]

Small German firms pay higher electricity fees than larger German firms

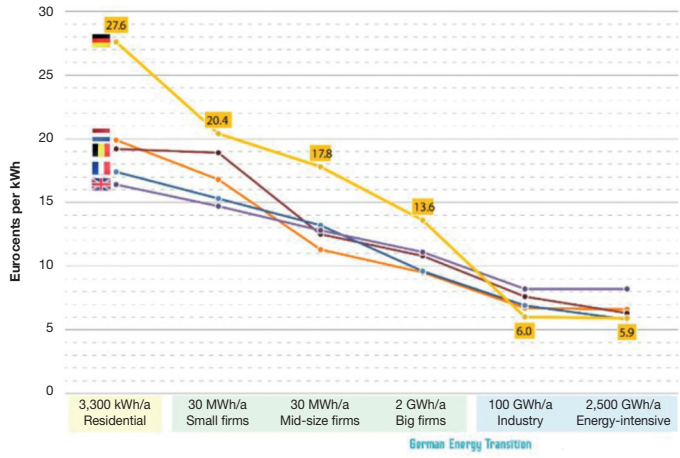
PWC, in a study for the Dutch Economics Ministry, found that German electricity prices are higher for consumers who use less power. This makes electricity prices for the very largest industrial firms lower than in the UK as shown in the graph below.[42] Smaller, medium and even relatively big businesses pay higher prices than their

counterparts in the UK and France. Only a very small minority of industrial firms, just four per cent of the total, received a rebate on the EEG renewables surcharge in 2013 but these firms accounted for 20 per cent of total German power consumption. Eliminating the rebates would mean a 65 per cent increase in electricity prices for the largest firms that gain the maximum exemption and prices would increase for all EII users.[43]

Figure 3: Small German power consumers massively cross-subsidize industry

Electricity prices by consumer groups and annual consumption in 2013

Source: PwC, Prijsvergelijk elektriciteit, for Dutch Economics Ministry, 2014



Taxes and levies reduce as firms consume more power

For German households and small businesses German electricity prices include grid access fees (a fifth), surcharges to promote renewable energy (a third), two kinds of taxes (a quarter), and the power price and supplier margin.[44] Market forces determine the price of the

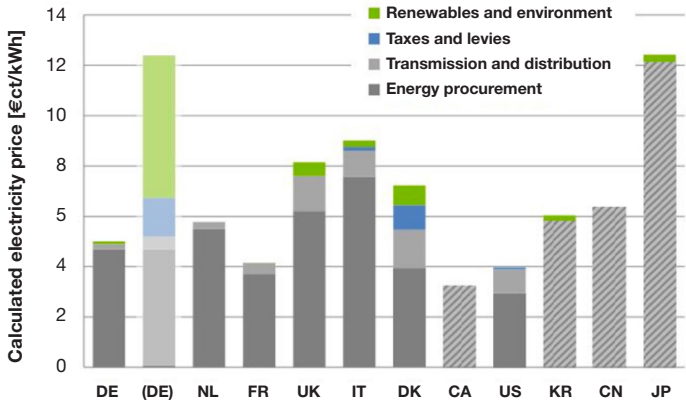
later two charges. In contrast, large industrial consumers are 'largely exempt' from renewables surcharges.[45] Companies with electricity demand greater than 100 MWh pay a reduced rate of renewable energy surcharge. Companies renewable surcharges are reduced based on the electricity intensity of the company and their gross value added.[46] As the DGCCRF recognise: 'Germany has introduced measures in support of industrial firms that are high consumers of electricity. These companies do not pay for the transmission of electricity, pay a lower tax rate for financing green energy and are compensated better if they agree to immediate power cuts to ease demand on the grid.'[47]

All customers pay the Electricity Network Ordinance Surcharge. It finances the reduction in network charges for EII. Its tariff level is reduced for power consumption above 1 GWh/year. A separate electricity tax is levied on consumption but it is reduced by up to 90 per cent based on the company's energy efficiency.[48] The offshore liability surcharge, levied to finance costs associated with offshore wind farms, is reduced for electricity users above 1 GWh to a fifth of the level of purchasers who buy less than 1 GWh.[49] For firms whose energy costs are in excess of four per cent of their turnover the rate is halved again.[50] Firms whose energy intensity is 16 per cent of gross value added are given reductions and deemed privileged because they are thought to be most at risk from high electricity prices.[51] So, Germany provides its largest energy users and EII with an exemption from renewables taxes and reductions in grid access fees, the latter based on their consumption.

Between them, six energy-intensive industries (aluminium, chemicals, copper, paper, steel and textiles)

account for 70 per cent of the German manufacturing sectors electricity consumption.[52] The power consumption of some defined energy intensive manufacturing processes is also exempted from taxes and levies. Analysis by the German Ministry of Economic Affairs and Energy (ECOFYS), conducted in 2015, on the electricity costs of EII shows that without tax relief energy prices would be much higher for larger firms as shown in the graph below.[53] The first bar in Figure 4 shows German electricity prices after rebates have been applied and the second bar shows the cost before they are applied for 'big, privileged companies'.

Figure 4: Electricity prices for firms ECOFYS called 'big, privileged companies'



DE – Germany, NL – Netherlands, FR – France, UK – United Kingdom, IT – Italy, DK – Denmark, CA – Canada, US – United States, KR – South Korea, CN – China and JP – Japan.

Without these exemptions what effect would renewable subsidies have on German competitiveness?

The Special Equalization Scheme (SES) in the Renewable Energy Sources Act (EEG) provides for a reduction of the renewables surcharge (EEG surcharge) for EII. Companies that introduce energy management systems get reduced taxes and levies under the SES. SES means that the EEG renewable energy surcharge is limited to a maximum of 0.5 per cent of the gross value added of a company.[54] SES alone caused electricity prices for German companies to vary substantially (by 6.2 ct/kWh in 2014).[55] Without SES the average price of production of German products would increase by around 3.5 per cent.[56] Production in the EII would decrease by between eleven and eighteen percent if the rebates were removed and the costs fully passed on to consumers.[57] Forty-five thousand jobs would be lost.[58] A 2014 study by IHS, a research group, sponsored by the Chemicals Industry Association, stated that if German large industry were to have their exemption from the renewables charge removed German GDP would be almost five per cent lower and real disposable income per capita would decrease by over €500 per annum.[59]

So, who pays for the renewables transition and is this legal under EU law?

Because the rates of state regulated electricity tariff components are graded this means heavy users pay less per unit of energy.[60] This reduces the tax base and thereby increases the costs on German households. Germany has

one of the highest residential electricity prices in Europe. Around half of the residential electricity bill in Germany is due to taxes and surcharges.[61] Since 1998 the surcharge for renewable energy increased from one per cent to 22 per cent of the power price.[62] However, German residential electricity constituted only 2.3 per cent of household disposable income in 2015.[63] German households appear to tolerate bearing the cost of the transition to renewable power generation so large-scale German businesses that export do not have to. In December 2013, the European Commission (EC) investigated the renewables surcharge and the rebates for EII included in the German Renewable Energy Act 2012 to see if they were compliant with EU State Aid rules. In November 2014 the EC approved the tariff reductions given to EII with the proviso that the more excessive reductions be paid back and lower reductions be applied.[64]

Has Germany abandoned fossil fuels?

Germany is the eighth largest coal producer in the world.[65] Coal is the largest single factor used to generate German electricity. In 2015 it was used to generate 44 per cent of German electricity, with an additional 11 per cent coming from other fossil fuels.[66] Lignite is mainly used for electric power generation and it constitutes 38.5 per cent of indigenous primary energy production.[67] Until 2018 Germany will subsidise the production of hard coal.[68] Lignite causes CO_2 emissions a third more than hard coal and three times as much as natural gas.[69] In 2015 the German Government wanted to introduce a 'climate fee' on coal burning power plants that would have required coal plants to purchase additional allowances from the

EU ETS. Protests caused a policy reversal. The reversal will cost between $2.2 billion and $3.3 billion, with the burden split fifty/fifty between the Federal Government and consumers.[70] Utilities now will be paid to maintain their plants and the capacity they bring but will be asked to reduce plant output. The German Government has established a 'National Capacity Reserve' similar to the UK capacity market to manage the challenges renewable energy creates.

What agreement did Germany sign with Russia for the provision of gas?

Germany has concluded agreements with Russia to import natural gas. In November 2015, at the International Economic Forum in Saint Petersburg Gazprom announced it would build two gas pipelines across the Baltic Sea to Germany. This is despite the fact that the EU's 'Third Energy Package' means additional Russian pipelines on EU territory should be curtailed, partly because of Russia's involvement in the Ukraine and the EU desire to punish them for this. However, this new project will export an amount of gas to Germany equivalent to half UK annual gas consumption per annum.[71] From this we can judge that Germany is willing to defy EU policy in its attempts to address the increases in electricity bills that SMEs and ordinary consumers are facing.

Why is Germany set to lose any competitive advantage its firms have in electricity prices?

Germany is taking steps that will further increase electricity prices on which the UK could capitalise. The

average electricity price level for all industry, including SMEs, was 40 per cent higher than the international benchmark in 2013.[72] The HIS, estimated net export losses attributable to the electricity price differential were €15 billion in 2013.[73] German nuclear policy has been compromised by German political parties' need to form coalitions which empower small parties. When the SDP/Green coalition agreed to phase out nuclear power plants, Angela Merkel, then opposition leader, condemned it as equivalent to the destruction of state economic assets.[74] The SDP/Green coalition set limits on the amount of electricity each nuclear power plant could produce and set a lifecycle for each nuclear power plant of thirty-two years[75], which would mean the last nuclear plant would close in 2021.[76]

In 2010, the German Federal Government adopted its energy concept (Energiekonzept) extending the life of their nuclear plants by 12 years, on average with the last of the current nuclear plants to shut by 2040.[77] However, a year later the nuclear incident in Fukushima Japan caused a rethink. Germany has now re-committed to phasing out nuclear power by 2022. Closing German nuclear power plants has led to Germany importing electricity from nuclear power plants in the Czech Republic.[78] The European Association of Transmission System Operators notes that Germany imports more electricity from the Czech Republic, Denmark, and Sweden than she exports.[79] The growth in German renewables is reliant on Germany's neighbours providing backup supplies when German renewables fail to generate enough power.

What effect has the growth of renewables had on German energy prices?

It has made the market more difficult to manage and prices more volatile. FITS have guaranteed solar and wind power producers a fixed above-market price for the electricity they generate and preferential access to the electricity grid. But Germany lacks sufficient transmission lines to transport surplus electricity generated in the north to the south. Both Poland and the Czech Republic have had to invest to prevent system overloads when German wind power production is high.[80] The shift to renewables in Germany has also 'created a power market so volatile that humans are having trouble keeping up with it.'[81] German power market intraday price movements are, according to Karl Frauendorfer, a Professor of operations research at University of St. Gallen in Switzerland, 'about 200 times that of financial markets'.[82] The practical effect of this policy is as Bloomberg describe that 'the intermittent renewable output has made traders increasingly focus on hourly or 15-minute electricity contracts to quickly react to changes in weather that alter the power supply'.[83] In March 2015 prices per megawatt hour varied between 'minus 164.48 euros per megawatt-hour to as much as 464.37 euros'.[84] German deputy economy and energy minister, Rainer Baake, made a virtue of this instability, saying price spikes will encourage energy traders to hedge and buy long-term contracts.[85]

3. UNITED STATES

What does the election of Donald Trump mean for UK energy policy?

The election of Donald Trump as American president constitutes a decisive break with the energy policy of current President Barack Obama. The United States is the second largest emitter of carbon dioxide in the world after China and above the entire European Union.[86] The president-elect's policies will, substantially, increase carbon dioxide emissions. The UK is seeking a free trade deal with the United States. This would be of huge benefit to both countries and is one of the biggest trade gains that can be made once the UK leaves the EU. President-elect Donald Trump is proposing a series of energy policies that, if implemented, would give US firms an additional competitive advantage over UK firms. He seeks to make maximum use of American fossil fuel resources. Taxes and regulations designed to reduce fossil fuel based power generation are to be eliminated. Jobs and economic growth are to take precedence over cutting carbon emissions.

What policies did President Obama have towards energy and carbon emissions?

American energy policy was broadly consistent with the European approach with its prioritisation of reducing carbon emissions. In September 2016, President Obama reached an agreement with Chinese President Xi Jinping that both countries would ratify the Paris Agreement on Climate Change.[87] The USA agreed to reduce emissions by between twenty-six and 28 per cent by 2025 compared

with 2005 levels.[88] Bjorn Lomborg, President of the Copenhagen Consensus Center has estimated that the US commitment under the Paris Agreement to cut carbon emissions will reduce US GDP by $150 billion annually.[89] President Obama signed up to the Paris Agreement without seeking Senate ratification, declaring that it was merely an 'executive agreement'.[90] He also took this approach with the Clean Power Plan, described below, that was adopted by 'Executive Order'. The way these were adopted makes it easy for President-elect Trump to end them, if he chooses to do so. He just needs to sign an 'executive order' on his first day in office to revoke them.

In August 2015 President Obama adopted the Clean Power Plan to reduce emissions in the power generation sector.[91] It required the states to submit emissions reductions plans by September 2016.[92] If they had not achieved an extension, and did not submit a plan, then the Environmental Protection Agency (EPA) would impose one on them. NERA Economic Consulting predicted the initial EPA proposal to reduce power generator emissions by 30 per cent would increase electricity prices by 13 per cent above inflation.[93] The final Clean Power Act set a 32 per cent rate (based on 2005 levels) so the costs will be higher.[94] An EPA Regulatory Impact Assessment of their proposal to reduce emissions by 30 per cent estimated it would lead to the retirement of between 108 and 134 GW by 2020.[95] It will mostly affect coal-fired power generators. Without CCS, coal plants are more polluting. During Obama's period in office electricity prices have increased 15 per cent.[96] President-elect Trump has pledged to end the Clean Power Plan and the Climate Action Plan.[97]

What happened to the coal industry during President Obama's period in office?

The American coal industry declined as the UK and wider EU coal industries have declined. Between 2007 and 2014 coal's proportion of the US electric supply declined from 48 per cent to 39 per cent.[98] The American Action Forum states that regulations have cost fossil fuel plants and coal miners $10 billion since 2011 with an additional $10 billion in regulatory costs planned.[99] Between 2008 and 2013 coal mining jobs have declined by 4.5 per cent and US power plant jobs declined by 28.8 per cent.[100] As of August 2015, four major coal producers went bankrupt.[101] In January 2016 President Obama put a moratorium on granting new federal coal leases while the Federal Coal Programme was placed under review. During the campaign Democratic Presidential Candidate Hillary Clinton declared: 'We've got to move away from coal and all of the other fossil fuels.'[102] She stated: 'We're going to put a lot of coal companies and coal miners out of business.'[103] These arguments were not as popular in coal producing states.

What is President-elect Trump's view on fossil fuels' place in the energy mix?

The president-elect's website describes his energy policy as 'Energy independence'. It pledges to fully exploit America's domestic energy resources including fossil fuels and renewables and refers to the former as 'a treasure trove of untapped energy'.[104] America's oil, gas and coal reserves are said to 'represent trillions of dollars in economic output and countless American

jobs, particularly for the poorest Americans'.[105] The United States has the largest estimated recoverable coal reserves in the world – 26 per cent of the world total (2011 figures).[106] Based on US production in 2014 of 1 billion short tonnes, the USA would have enough coal to last it another 256 years.[107] The EPA will now, according to President-elect Trump's plan, concentrate on ensuring clean air and clean drinking water and protecting natural habitats.[108] This suggests policy will focus on improving the local environment and not reducing global carbon emissions, although added coal use will affect local air quality if abatement measures such as CCS are not applied.

President-elect Trump plans to end what he refers to as 'the war on coal.'[109] President-elect Trump criticised the Obama administration for its alleged policy to 'undermine and block America's fossil fuel producers'. The moratorium on new coalmines in federal lands will end and a 'top-down review of all anti-coal regulations issued by the Obama Administration' is to be conducted.[110] He pledges to open federal land and waters to onshore and offshore leasing for fossil fuel production. The US Federal Government owns four per cent of the land east of the Mississippi.[111] However, it owns 60 per cent of Alaska and over half of the land in eleven sparsely populated western states.[112] Production of coal in the American West represents 56.6 per cent of total US coal production in 2015.[113] Already 41 per cent of American coal production comes from government owned land.[114] So, allowing additional coal mining on federal land could lead to a substantial increase in US coal production.

How will this affect United States energy policies?

The US oil and shale gas revolution has already made US gas prices far lower than her European competitors. The shale gas boom reduced natural gas prices in America between 2008 and 2013 until they became just a third of European natural gas prices.[115] In just five and a half years shale oil will reverse the forty-year decline in US oil production and America will produce the same level of oil she did in 1970.[116] United States gas recoverable reserves have tripled since 2000 and they are now enough to meet current demand for one hundred years.[117] President-elect Trump's 'America First Energy Plan' commits to ensuring that America becomes 'totally independent of any need to import energy from the OPEC cartel or any nations hostile to our interests.'[118] They predict that expanded shale gas production could add two million jobs in seven years.[119] Gas and oil prices are likely to drop because of these policies. This makes UK high energy prices a big liability but it also offers an opportunity to import US shale gas and benefit from the lower prices.

Will the new president-elect retain any of the existing carbon emissions reduction policy approach?

It is not yet clear. President-elect Donald Trump did pledge to pull the United States out of the Paris Agreement on Climate Change and to defund the United Nations Climate Change fund.[120] However, he recently signaled that he, now, has 'an open mind' on the Paris Agreement

and was 'looking at it closely'.[121] Key elements of the Paris Agreement were to limit global temperature increases to below 2°C, the introduction of national plans to cut domestic industries emissions, the transfer of money from wealthy nations to poorer nations to help their adjustment and a plan to monitor progress in meeting these objectives. Without United States agreement China may also pull out of the agreement. This could lead to it unravelling. Until the president-elect assumes office it is difficult to know exactly which of his policy pledges he will implement and which he won't (as is usually the case in this interim period between presidents).

What will the new president-elect put in place of the Obama measures on climate change?

Representative Kevin Cramer, a North Dakota Congressman and energy advisor to President-elect Trump, suggests that tax revenues from a carbon tax could be earmarked 'to help fund clean fossil fuel research and development, not to fund the government, not to punish fossil fuel generation, not to manipulate fuel choice.'[122] This idea could be adapted in the UK. Given that fossil fuel sources will continue to form a substantial proportion of UK energy for years to come this may be the cheapest way of reducing emissions.

3

How have UK energy policies affected the energy intensive industries?

Why are energy intensive industries (EII) important?

EII are the canary in the coalmine. In this case they highlight the danger high energy prices pose to the wider economy. EII are affected first and most acutely. Consumers in the three case study sectors identified here make decisions based on price rather than the carbon intensity of production processes. Ageing UK plants in each of the EII have to compete to sell their goods with firms in countries where energy and labour costs are lower. They also have to compete for investment within the multinational firms that own them against sites in foreign countries owned by these firms.

What carbon reduction goals does the Government have for UK industry?

Government policy prioritizes reducing carbon emissions. The Committee on Climate Change propose a reduction in industry emissions of 25 per cent by 2030 (on 2010 emissions level).[1] In 2011 the Government proposed that UK industrial emissions decline by 70 per

cent by 2050.[2] DECC and BIS has produced Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050 for eight sectors designated as EII. Many of the proposals included in these plans impose additional costs on the industries featured.

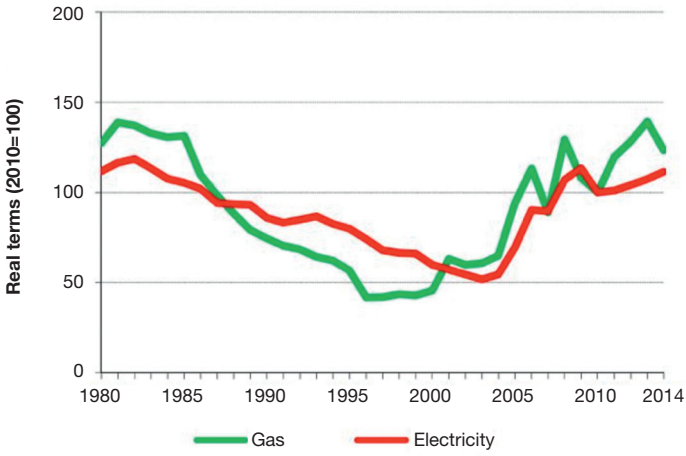
Are UK energy prices competitive?

In contrast to the United States, France and Germany, UK industrial energy prices are high. The electricity price doubled between 2004 and 2014.[3] In 2014 UK electricity prices for median industrial users were 25 per cent above the EU28 median.[4] Between 2013 and 2014 the UK was one of only two countries in the EU28 where industrial electricity prices increased. This was true for both medium users (where the other country was Germany) and extra-large users (where the other country was the Netherlands). For medium users UK electric prices rose by five per cent compared to the EU median change, which fell seven per cent.[5] For extra-large industrial users average electricity prices increased five per cent compared to a 10 per cent reduction in the EU median.[6] Electricity prices for large industrial users in 2014 were the second highest in the EU and 55 per cent above the EU28 median.[7] The graph below shows how energy prices have increased since the early 2000's following a twenty-year decline. DECC admits its policies increased EII energy bills for those eligible for all Government support by 11 per cent in 2014.[8]

We have identified how both France and Germany have reduced energy prices for their larger industrial firms. DECC recognises that: 'For large energy-intensive industries, the UK has among the highest electricity

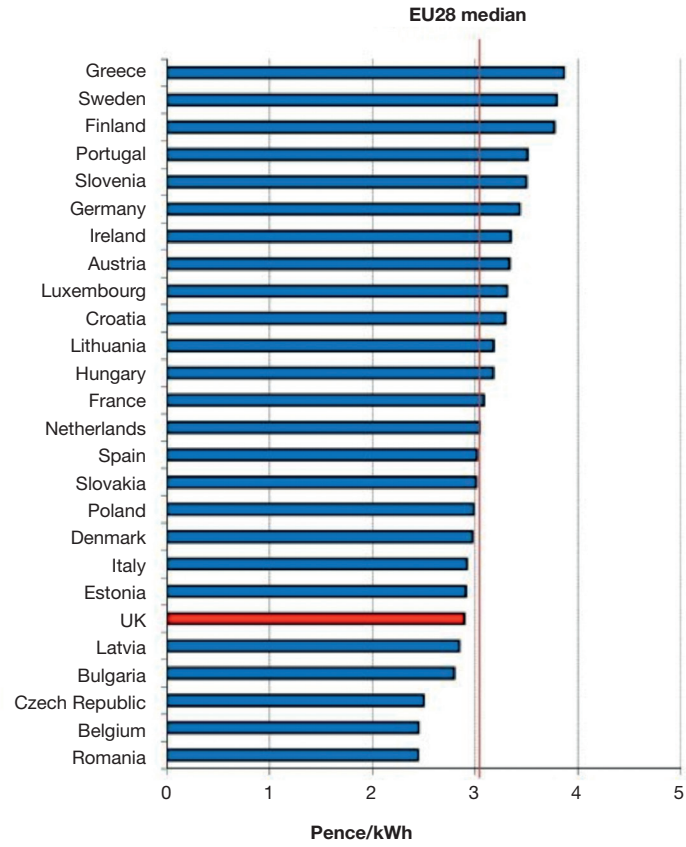
prices in Europe and in the mid-range compared to G7 countries; a growing proportion of that cost is linked to climate change policy (ICF International, 2012).'[9] The Confederation of British Industry (CBI) estimates that: 'energy costs for the largest users are around 80 per cent higher than the EU average, with wholesale prices driven up by a range of policies focused on supporting new low-carbon power generation.'[10] Industrial gas and electricity prices began rising in 2000 (gas) and 2003 (electricity) respectively as displayed in the graph below. The UK produces some gas, which is why in 2014 UK gas prices for the median industrial user were six per cent below the EU 28 median.[11] However, the UK competes in a global market in which non-EU countries such as Russia, the United States and the Middle Eastern countries all have lower gas prices.

Figure 5: Fuel prices for the industrial sector, 1980 to 2014 including the Climate Change Levy[12]



Source: DECC

Figure 6: Industrial gas prices for medium consumers, including taxes where not refunded, within the EU28 in 2014 converted to UK price per kWh[13]



Graham Evans MP suggests EII pay 'four times the cost of carbon paid by their continental competitors such as France or Germany' to help achieve these targeted reductions in carbon emissions.[14] By 2020 DECC suggested that support measures for UK EII could reduce the cost of government policy measures in their energy bills by 80 per cent compared to a scenario of no support.[15] However, reducing a high cost by a significant

amount does not mean eliminating the extra costs UK firms' face that their competitors do not. We shall now consider the effect these electricity costs have had on three EII in particular – Aluminium, Steel and Chemicals.

1. Aluminium production in the UK and the Lynemouth aluminium plant

Why have you chosen aluminium?

Aluminium is a very energy-intensive metal to produce. It amounts to 'the largest consumer of energy for any material on a per-weight basis and the largest electricity energy consumer of any manufactured product.'[16] The London Metal Exchange sets the price of aluminium.[17] This gives a competitive advantage to producers located in countries with low energy prices. The International Energy Agency (IEA) notes that growing demand for aluminium in Europe has not resulted in investment in local smelting capacity.[18] A key reason for this is that producers are unable to pass the full costs of higher energy prices on to consumers. EU producers have little influence over the global price because they supply 'only eight per cent of global output, and absorb more than 80 per cent of the cost increase.'[19] Vivid Economics, in a study for DECC on carbon leakage, found that aluminium is a: 'commodity [that] is traded in a global market, with very low transport costs relative to product price and sufficient global capacity to take any market share given up by EU producers'.[20]

Is the UK aluminium sector economically viable?

Sadly, there is very little aluminium production remaining in the UK. The British Aggregates Association, in response to the Government Balance of Competences Review into the powers of the EU prior to the UK's referendum on EU membership, stated: 'Climate change policy has seriously disadvantaged our mineral related high energy user industry – far, far more heavily than other industrialised countries in Europe and North America. In particular our primary aluminium production has been virtually wiped-out by the closure of the two largest of the UKs three smelters in the last two years.'[21] From this analysis we can derive two lessons, first that climate change policy has affected EII in the UK adversely, and second that it is due to domestic climate change legislation as well as the implementation of EU climate change policy by the Government.

What happened with the Lynemouth Aluminium plant?

Rio Tinto Alcan owned the Lynemouth Aluminium plant and estimated that it made a £120m contribution to the UK economy.[22] It used to be the largest private employer in Northumberland until it closed in 2012.[23] In April 2015, the Lynemouth site was purchased by Harworth Estates the former property arm of UK Coal and is now being redeveloped.[24] The Lynemouth plant in Northumberland had its own coal-fired power plant that was located close to coal plants in Ellington and Lynemouth and to a port, which was needed to import bauxite. The Ellington coalmine closed in 2005, the Lynemouth coalmine had closed before this. After 2005 the coke used in the production process had to be

imported from America. Lynemouth was, as a previous Civitas publication has described, 'one of the most efficient smelters in the entire world'; it had reduced its emissions by 65 per cent based on 1990 levels – far in excess of the UK's national goal of a 34 per cent reduction by 2020.[25] The Lynemouth plant had two of the most efficient ring burners in the world.

What role did EU legislation have in the closure of the plant?

The European Court of Justice ruled that the plant was subject to the LCPD and was in violation of it.[26] The Lynemouth plant was closed in March 2012 citing the impact of European environmental legislation. The plant stated that because of the EU's decision to reclassify the onsite coal powered generator as a power station it would receive no free allocation of emissions permits under Phase III of the EU ETS.[27] The Civitas paper 'The Closure of the Lynemouth aluminium smelter: an analysis' cites an official explanation by the plant's owner Rio Tinto Alcan that 'energy costs are increasing significantly', causing the firm to conduct a 'strategic review' into the plant's future.[28] Rio Tinto Alcan, in its statement announcing the closure of Lynemouth, stated: 'The smelter is no longer a sustainable business because its energy costs are increasing significantly, due largely to emerging legislation.'[29] John McCabe, Rio Tinto Alcan Corporate Affairs Director, said that Lynemouth's energy bill would increase from £7 million to £100 million per annum between 2013 and 2015.[30]

What impact did the closure of the Lynemouth plant have on the wider economy?

The economic impact of the closure of the site and the power plant on the wider business community was estimated to be £9 million in Northumberland and an additional £15.9 million in the North East of England although the actual impact will have been slightly lower than estimated.[31] The coal-fired power plant ceased generating in 2014 but it is currently being converted to burn biomass.[32] The UK Metals Report Q4 2011 recognised that the closure of UK aluminium plants was counterproductive:

> Smelter closures are unfortunate, given the British aluminium industry's reputation for being highly efficient. The closure of capacity would invariably increase the UK's reliance on imported aluminium as well as boosting demand for recycled aluminium. Ironically, this will benefit less regulated smelters in Asia which have fewer restrictions on carbon emissions. The transfer of metals production from the UK to lightly regulated emerging markets undermines the British government's objective of reducing global carbon emissions.[33]

What does the closure of the Lynemouth plant say about the Government's refusal to either back CCS or to remove the environmental regulations that require its use?

The Lynemouth plant closure shows how UK manufacturing has been damaged by the failure of the Government to back CCS or to reduce anti-fossil fuel regulations. Rio Tinto Alcan had proposed, in response to the Department of Energy & Climate Change consultation on 'A Framework for the Development of Clean Coal', to convert one of the three electrical generating units at the Lynemouth plant into an

Integrated Gasification Combined Cycle plant with full carbon capture and storage.[34] It stated that this project would mean: 'securing the long-term future of the Lynemouth aluminium smelter, where 650 people are currently employed.'[35] The project would have stored the carbon in a saline aquifer in the North Sea capable of storing 5 billion tonnes of carbon.[36]

To understand the scale of the CCS project consider that, combined with a CCS project in Teesside, it would have accounted for 15Mt of the 50Mt carbon dioxide emissions reduction the Climate Change Committee set for the whole UK by 2020.[37] Also, the power generated from the new IGCC plant would have been 2.5 times that generated by the previous coal-fired plant.[38] Rio Tinto Alcan stated: 'Our coal-fired generation is associated with an internationally competitive manufacturing business, with China as the world's largest manufacture of aluminium, most of its electricity being coal-fired with higher CO_2 emissions per MWh.'[39] They argued that the CCS demonstration projects be located near existing industrial clusters and stated this was necessary because: 'international companies are already factoring carbon risk into their international investment priorities.'[40]

How do energy costs affect profit margins and why are the latter important?

John McCabe, Rio Tinto Alcan Corporate Affairs Director when announcing the Lynemouth closure stated that Rio Tinto Alcan was: 'streamlining its global aluminium business in order to focus on its top assets globally, unfortunately Lynemouth isn't considered to be one of them as it does not return 40 per cent rate of return for

the business.' Mr McCabe said Lynemouth was 'a high-cost operation' and this was 'largely due to the cost of producing energy in the UK.'[41] The then local MP Sir Alan Beith stated: 'Rio seems determined to concentrate its aluminium interests in areas where energy is cheaper or the regulatory regime is less tight.'[42] Since closing its plant in Lynemouth – Rio Tinto has invested heavily in a French aluminium smelter – a country with high labour costs but low energy prices.

Why did Rio Tinto Alcan decide to invest in aluminium production in France and Iceland instead of the UK?

In 2013 Rio Tinto invested €80 million in its Dunkirk aluminium plant, the largest such plant in Europe.[43] Electricity costs amount to 23 per cent of its production costs.[44] They were set to rise 80 per cent in 2016 as the twenty-five year agreement Rio Tinto had with EDF to supply electricity to the plant expired.[45] Rio Tinto suggested linking power prices to uranium prices and agreeing to shut down production at key points to allow EDF to manage periods of peak electricity demand. Half of Rio Tinto's post 2017 electricity needs are now accounted for by bulk long term power purchase deals with a consortium including the firm Exeltium.[46]

Compare this with the experience of an aluminium plant in Anglesey in the UK that closed in 2009. It had an agreement with the nearby Wylfa nuclear power station that the aluminium plant would be supplied with power at a discount price. When the Government's Nuclear Decommissioning Authority acquired the nuclear power station it stopped the discount power deal because the deal would violate EU state aid rules.[47] The Dunkirk

aluminium plant might have shut had similar rules been applied to it.

Similarly, in 2010 while considering the future of Lynemouth, Rio Tinto Alcan Iceland agreed a power supply deal with Landsvirkjun lasting until 2036.[48] Rio invested $500 million in the plant to increase production and to develop higher quality products.[49] Landsvirkjun built a hydro power plant to provide the necessary power. Due to unforeseen problems the plant purchased less power than expected and the contract was reviewed in 2014 but this agreement could secure the long-term future of the plant, which produces 205,000 tonnes of aluminium per annum.[50] This single plant, accounts for a quarter of Iceland's annual exports and could flourish if a trade union dispute does not cause energy unrelated difficulties.[51]

Aluminium production is an important part of the Icelandic economy – the three Icelandic aluminium smelters together account for 38 per cent of the island's exports.[52] Ketill Sigurjonsson, chief executive officer of consultant Askja Energy Partners notes that: 'There are about three hundred aluminum smelters in the world and there are probably fewer than five smelters anywhere that are paying less for power than Alcoa and Century [two additional firms that run aluminium smelters in Iceland] pay in Iceland.'[53] Alcoa Iceland Chief Executive Magnus Thor Asmundsson has said: 'Competitive energy price is the premise for producing aluminum and investments in the aluminum sector are mostly directed to places which offer competitive energy prices.'[54]

Will aluminium production in the UK survive?

The last UK aluminium plant is in Lochaber. Rio Tinto placed the plant under review.[55] It produces 47,000 tonnes of aluminium per annum.[56] When the Lynemouth Plant closed in 2012 a Lochaber plant manager stated: 'there were significant synergies and economies of scale that the Lynemouth operations provided in raw-material supply and functional expertise and support. Lochaber is now essentially a stand-alone business in the UK and has had to adapt quickly to this new mode of operation.'[57] This statement exposes how the closure of one firm affects the competitiveness of other firms within the sector in the UK. Lochaber has survived but it was the smallest of nine aluminium plants Rio Tinto own worldwide so its future was, until recently, in doubt.[58] Luckily, SIMEC and Liberty House recently bought Lochaber aluminium plant and the hydro plant in November 2016 for £330 million.[59] The new owners have pledged to keep it as an aluminium producer. Had it closed this would have ended UK aluminium production.

2. Steel – the decline of Tata Steel's UK operations

Why is the steel sector important?

Global steel demand is set to increase from 1.3 billion tonnes to 3 billion tonnes by 2050.[60] UK steel exports (£6 billion) exceeded imports (£5.9 billion) in 2014 and the steel sector has been in trade balance since at least 1997.[61] The sector is vital for the defence industry as it is an essential component of battleships and aircraft. The sector burns fossil fuels to produce heat. This

amounts to two-thirds of sector energy consumption.[62] The UK iron and steel sector is concentrated in a few big companies that operate in a global market that is highly price sensitive. A DECC and BIS joint report found that: 'steel customers primarily make purchasing decisions based on cost for service delivery, rather than on carbon emissions.'[63] Public policies that increase production costs will reduce UK firms cost competitiveness.

Why does increasing energy costs pose such a problem for the sector when they are a small percentage of total costs and of sector revenues?

The Government recognise steel is price sensitive but they suggest their energy policies impose minor costs. Recently, Amber Rudd, when energy secretary, wrote to Angus McNeil, chairman of the House of Commons Energy and Climate Committee, to explain that electricity costs are only three per cent of the total costs for the steel sector and policies only add 0.5 per cent to costs for the sector.[64] But these costs are not minor. Tata Steel's director of operations in South Wales stated in February 2016 that it expected to spend £100 million on energy out of an annual turnover of £1 billion.[65] In September 2015 UK steel producers attending the UK Steel Forum stated that UK steel's energy costs were up to double those of French and German plants.[66] The EU Industrial Emissions Directive is set to add £500 million to these costs by 2020.[67] Steel is recognised as an EII precisely because energy costs are a larger share of sector costs than most other industries.

The sector contributed £10 billion in revenues to the UK economy in 2013 and profits were £672.8 million.[68]

Notice the low profit margin implied in these two figures – the profit was equivalent to around seven per cent of revenues. Then consider that the majority of firms in the sector interviewed by DECC and BIS have stated that: 'their main source of capital for investing in energy efficiency and decarbonisation projects is from their own revenues.'[69] Higher energy prices reduce the capacity of UK steel plants to invest in energy efficiency improvements even while they increase the need to reduce energy intensity. Nevertheless, DECC acknowledges that many of the options proposed in the Government's industrial decarbonisation and energy efficiency roadmap for this sector 'are likely to incur additional production costs for the steel manufacturers.'[70] Research by Tyneside firm Utilitywise suggests that wholesale electricity costs for industrial users will remain flat at around £40 MW/h until 2021 but the price after climate change policy measures are included will be double at £82 per MW/h even after Government compensation is included.[71] Without Government compensation the total cost would rise to £110 per MW/h over the same period. So, high UK electricity prices are set to get even worse for steel producers.

It is true to suggest that energy costs are one cost among many. There are many other business costs where the UK has adopted uncompetitive policies. For example, business rates for EII are between five and ten times the rates in the UK's EU competitors.[72] Also, the steel industry has clear problems regarding its pension arrangements. Tata Chief Executive Bimlendra Jha stated that if the steel pension problems could not be resolved a buyer would not be found. The £15 billion British Steel Pension Scheme is in deficit and only one in thirteen of its 130,000 members

still pay into the scheme.[73] Tata Steel is closing its pension scheme to new contributions and this should prevent additional liabilities accumulating. However, the pension difficulties do not make energy costs any less significant. There is no reason why action cannot be taken to address all the issues affecting the competitiveness of the UK steel sector. The fact the industry already has structural problems that damage its competitiveness is not a reason to add additional cost to it. The Government partially recognised this by exempting the steel sector from the indirect costs of RO and FITs but more needs to be done.[74]

The global steel market suffers from overcapacity issues and the world needs to reduce steel production to match existing demand. The global steel industry is working at only 66.2 per cent of capacity.[75] Each country that has steel producing firms can decide to improve the competitiveness of its domestic steel industry or allow its domestic firms to close and so reduce the capacity issues in the steel sector. The steel price has been increasingly volatile as excess capacity is reduced. Steel prices reached a historic high of $1265 per MT in June 2008 and a record low of $90 per MT in March 2016.[76] China has been accused of dumping low cost steel on European markets. Chinese steel sells for €583 a tonne but EU steel sells for an average price of €897 per tonne.[77] On 22nd November 2016 steel prices were $312.50 per MT.[78] For this reason the EU imposed anti-dumping tariffs on Chinese and Taiwanese steel for a six-month period in 2015 to prevent EU producers having to absorb the full shock of the reduction in global steel capacity.[79] If UK steel firms can survive this adjustment they should prosper but small cost variations with other producers, like those imposed by higher energy prices, will be costly.

How does limiting UK carbon emissions affect the UK steel sector?

Attaching a cost to emissions necessarily constrains the growth of the UK steel sector. A growing steel sector will mean an increase in UK sector emissions and given that the sector is one of the top emitting UK industries this will affect the achievement of the national carbon emission reduction target. For example, between 2011 and 2014 CO_2 emissions in the iron and steel sector increased 73 per cent because an iron and steel plant re-opened.[80] This was partly due to the former Tata Steel BF (SSI UK) at Teesside reopening. UK steel production in 2012 was at the lowest level since 1934 but in 2013 production increased by 32 per cent.[81] This is not because UK steel plants are not energy efficient. Energy consumption per tonne of UK steel produced went down by 40 per cent between 1973 and 2013[82] but the sector is an EII and it still amounts to nine per cent of industrial energy use.[83]

How does limiting UK carbon emissions affect the global climate?

UK climate change measures offshore UK production to other countries, particularly China, with less efficient means of production. The carbon intensity of UK steel is lower than that of Chinese steel – 2.3 tonnes CO_2 per tonne of UK steel compared to 3.1-3.8 tonnes of CO_2 per tonne of Indian or Chinese steel produced.[84] The Carbon Trust estimates that: 'almost half of carbon emissions associated with the use of steel in Europe are embodied in imports of either steel or finished products.'[85] Tata Steel Europe suggest: 'If policy measures [to address climate change] only target local manufacture, then they

only tackle half of the problem and risk making 3rd country imports even more attractive and so potentially increasing global emissions.'[86] Tata Steel suggests that climate change should seek to 'incentivize low-carbon technology' and 'product based policy must consider full product life cycle impacts' and policy should be based on carbon consumption rather than carbon emissions and should be part of a global deal.[87] A unilateral policy of high energy prices reduces UK emissions but not global emissions as production moves abroad.

But surely UK steel production can never compete with that in developing countries?

The suggestion is sometimes made that steel production is no longer economically viable in the UK. For example, Rakesh Arora an analyst at Macquarie told the Financial Times producing steel in the UK 'makes no sense' because steel's labour costs in the UK are about $200 per tonne of production, compared with as little as $10 for Chinese producers.[88] However, the UK imports most of its steel from its European partners, including 809,000 tonnes from Germany, 709,000 tonnes from Spain, 512,000 tonnes from Belgium and 459,000 tonnes from France, and not from developing countries.[89] Each of these countries has comparable labour costs. Also, UK steel production is decreasing faster in the UK than in the wider EU. Between February 2015 and February 2016 steel production in the EU28 declined by 13.4 per cent while it reduced 37.9 per cent in the UK.[90] UK production declined ten times more than German production during the same period (37.9 per cent reduction v 4.3 per cent reduction).[91] The Institute for Public Policy

Research (IPPR) estimated the Government would lose £2.2 million per day in additional benefit payments and lost tax revenue if UK steel plants closed.[92] EU State Aid rules prevent the Government bailing out the UK steel industry but other EU countries manage to maintain a steel sector while the UK accepts its decline.

Why is there a difference between the decline in UK steel production and that in the wider EU?

Part of this is due to the fact as Tata Chief Executive Bimlendra Jha told the House of Commons Business Select Committee UK energy costs for his UK steel plants were £40 million per annum more than they are in Germany.[93] Steel is an industry that supports the production of many other successful UK industries. The UK car industry sources 13 per cent of the steel in its cars from Tata Steel's UK plants[94] and 45 per cent of the steel used in Nissan's Sunderland plant came from Tata Steel's UK operations.[95] But as the Society of Motor Manufacturers and Traders recognise the advantage in logistics of domestically produced steel are good but they do not outweigh the importance of buying steel at competitive prices.[96]

Will the UK steel sector survive?

The steel sector shows that small cost increases matter when profits are low compared to revenues. In March 2016, Tata Steel announced it would sell its UK steel plants and some disposals have been made. Tata Steel sold its long products business, located largely on a Scunthorpe site to investment firm Greybull for £1[97] and the new buyers renamed the business British Steel

and plan to make profits of £120 million on £1.2 billion of revenues.[98] Tata Steel sold its Yorkshire based steel plants to Liberty Group for £100 million and this could enable parts of the industry to survive because the new firm may lack the legacy issues that have plagued the previous owners. In June 2016, Tata Steels Port Talbot plant in South Wales posted a small £5 million profit[99] and Tata Steel has agreed with the trade unions to keep the Port Talbot plant open for five years, to avoid compulsory redundancies and invest £1 billion in the business if a deal could be agreed on closing the final salary pension scheme and replacing it with a defined contribution plan.[100] Each of these developments offers hope for UK steel producers. However, UK steel firms continue to operate in a competitive market and energy costs must reflect this. Small changes in energy prices could wipe these firms out and yet the cost of electricity is set to be substantially higher in future years due to the cost renewable energy poses for the electricity network.

3. Chemicals – The demise of Winnington Chemical Plant

What role do energy prices have in the challenges faced by the UK chemicals sector?

The chemicals sector faces substantial competitiveness issues linked to high energy prices in the UK and the EU. In 2014, Jim Ratcliffe, the majority owner of chemicals giant Ineos, wrote to Jose Manuel Barroso, the EC President stating that in the UK the firm had seen 'twenty-two plant closures since 2009 and no new builds.'[101] He stated that we 'need to think about the consequences of it all disappearing. If they think about it

too late, it will be too late. It's all fine and dandy having the highest green taxes in the world but if that closes down your manufacturing industry, it's not so good.'[102] The letter claimed that gas prices are triple those in the USA and electricity is 50 per cent higher.[103] This is prior to any increase in shale gas and coal production under President-elect Trump's plans.

DECC interviewed UK chemical firms' representatives and found they 'did not consider high energy costs to be an enabler or to stimulate investment in energy reduction and efficiency; rather, they see them as a business cost that reduces global competitiveness and lowers the attractiveness of investment in the UK.'[104] The Carbon Trust says that energy intensity varies widely between the subsectors in the chemicals industry. Energy costs are 50 per cent of manufacturing costs in the chlor-alkali subsector but five per cent in some pharmaceuticals businesses.[105]

Why is the Chemicals sector important?

The UK is the fourth largest producer of chemicals in the EU28.[106] It consumed 16.5 per cent of energy used by UK industry in 2012.[107] The sector directly employs 106,000 people and has an annual turnover of £32 billion.[108] UK chemical exports account for 18 per cent of UK goods exports and 28 per cent of industrial R&D.[109] In addition, the Royal Society of Chemistry claims £222 billion of GDP and 5.1 million jobs are partially reliant on the UK chemical industry and research.[110] For every one job in the chemicals sector five more work in the supply chain, according to the TUC.[111] The UK Chemistry Growth Strategy Group aims to achieve a 50 per cent growth

in Gross Value Added by 2030.[112] The industry firms interviewed by DECC identified the EU ETS, CRC, CCAs and the CPF as being 'contributors to competition issues.'[113] This is because making chemicals is an energy intensive process. The Chemicals Industry Association state that when bulk producing basic chemicals energy costs can account for sixty per cent of total costs.[114] They favour pressing ahead with UK shale gas extraction to reduce UK energy costs.[115]

How do high energy costs undermine the long-term economic health of the UK chemicals sector?

In 2011 the Chemical Industries Association stated that when cost-pass through rates were factored into the cost of Government energy policies, they would increase electricity prices by nearer 100 per cent, rather than the Government's estimate of 52 per cent by 2020.[116] The Government decarbonisation and energy efficiency roadmap for the chemical sector found that the chemical firms they interviewed said: 'High energy costs are seen as a barrier rather than an enabler as they tend to encourage production to move to lower cost locations, rather than incentivising investment in energy efficiency. This risks plants being starved of development spending and ultimately becoming unattractive due to the age of the original assets and their low book value.'[117] Chemical plants operate for between twenty and fifty years. This means that 'The number of major investment cycles between now and 2050 is very limited, providing limited opportunities for major process changes to be implemented'[118] which gives firms in the sector little opportunity to introduce carbon reduction measures.

However, the UK chemicals sector has reduced its carbon emissions by 70 per cent since 1990 and is one of the more efficient in the world.[119]

Who will benefit if the UK chemicals sector declines as the UK aluminium and steel producers already have?

The European Climate Foundation found that Asian countries increased their chemicals output from a low level in the 1990s to a level greater than Europe in 2011.[120] European companies face increased competition from firms in America and the Middle East who have lower energy costs. UK firms have to compete with sites overseas for investment and 'decision-making processes tend to go against UK sites and operations as the business case is stronger elsewhere. The primary reasons, according to these interviewees, are the lower cost of energy and labour in other markets, and stronger government incentives (e.g. in Germany), which result in a more financially sound business case compared to the UK.'[121] Companies headquartered abroad own 70 per cent of UK chemicals firms.[122] These firms will not invest in the UK unless they are confident that UK energy costs will be competitive in the long-term. For example, US chemical output is predicted to double by 2020 due to the lower price of shale gas and chemical feedstocks.[123]

Have chemicals firms acted on their energy price concerns to close UK plants?

In 2014 Tata Chemicals Europe (TCE) closed its soda ash and calcium chloride making Winnington plant in Northwich, Cheshire.[124] The site had produced soda ash for 140 years.[125] It was producing 500,000 tonnes of soda

ash per annum at the time of its closure.[126] Soda ash is used in glass production among other uses. In a press release announcing the closure, TCE stated: 'this action is in response to the serious threat posed by high and rising energy prices.'[127] In particular, 'high and rising gas prices' were the problem[128] and energy prices had more than doubled in the previous few years.[129] TCE had a long-term agreement with E.ON that had sheltered it from high energy prices. It jointly owned a power plant with E.ON that supplied the TCE Winnington and Lostock chemical plants.

In 2015 the deal with E.ON was set to end. Energy costs were expected to rise substantially. Consequently, in 2013 TCE had to reconfigure a CHP plant that had supplied power and steam to their plants to reduce the firm's energy bill. TCE took sole control of the formerly joint owned plant. The changes made reduced steam output and increased the electricity output. Dr Martin Ashcroft, Managing Director of TCE, stated 'The energy challenge which TCE has faced is an example of how the state of European energy markets seriously threatens the ability of energy-intensive manufacturing companies to compete on the world stage.'[130] 220 jobs were lost when the plant closed.[131] Following the closure of the Winnington plant TCE imported soda ash from the United States where it is mined.

What can we learn from the experience of EII firms?

The companies involved in the EII tend to concentrate on energy efficiency rather than decarbonisation. If these sectors grow they will increase carbon emissions in the UK. Decline in these sectors is the simplest way

to reduce emissions. This can be seen in the cement industry where emissions declined 55 per cent between 1990 and 2011[132] but half of this reduction was due to a decline in production.[133] The Government could create incentives for firms to cluster and to share knowledge on energy reduction. This might reduce the carbon intensity of production. It would concentrate production in the UK, a country with the capital to invest in technological improvements that make it easier to produce the required materials with lower emissions. It would reduce the need for imports of these materials, the transportation of which adds to global carbon emissions. What the Government should consider is that each EII is part of a supply chain and high energy costs that drive one firm out of business reduce the economies of scale and skills available to other firms.

Given that low carbon products are judged by some policymakers to be a key future growth market why don't firms in these sectors embrace decarbonisation?

In many of the EII including the ceramics, food and drink sectors there is a 'limited market demand for low carbon products.'[134] But Government initiatives are focused on decarbonisation. Glass sector firms interviewed by DECC stated that: 'Energy efficiency is perceived as important, but decarbonisation is generally not a priority in the current investment climate as it is currently perceived as additional business cost.'[135] Glass 'consumers are not perceived to be currently willing to pay higher prices for low-carbon products.'[136] Where sectors have moved aggressively to decarbonise, as in the pulp and paper sector (which has reduced its

emissions by 50 per cent since 1990)[137] this occurred before Government took action. DECC found that: 'before carbon-related legislation was introduced, the UK pulp and paper sector was already evolving towards a lower carbon energy strategy.'[138] Company investment cycles and the Government's carbon emissions target are very loosely aligned. For example, in the pulp and paper sector investment cycles are between thirty and sixty years[139] or one cycle pre 2050. Thus the power of Government to force energy efficiency improvements as opposed to plant closures is limited.

Why can't the Government just force firms to become more energy efficient?

Compliance can force firms to introduce energy efficiency measures because firms will comply with regulation. However, they also create costs and reduce the profit margin of UK based firms. Many of these firms are part of worldwide groups that will invest capital where it will generate the highest rate of return. They will decide where to locate new business activity in areas with a high return on investment and energy prices will be part of this calculation. For example, in the food and drink sector firms told DECC that internal financing within wider groups was difficult to obtain for UK sites because of 'the lower cost of energy and labour, and government incentives (e.g. in France and Germany), which result in shorter payback times compared to the UK'.[140] Cement producers interviewed by DECC said: 'that increased competition from other countries with lower environmental regulations and energy costs is making it more challenging for UK cement companies to

obtain internal funding due to a reduction in profits.'[141] The ceramics sector firms interviewed by DECC said: 'current electro-intensive refractory and technical ceramic production is uncompetitive due to high electricity costs and is at risk of being lost to the UK.'[142] Energy efficiency projects also have to compete with other uses of capital within the business, many of which will have a higher rate of return.

How does regulatory uncertainty about future energy policy affect investment in these sectors?

Regulatory uncertainty imposes costs. It makes it difficult for companies to take large investment decisions. Examples discussed during DECC's interviews with EII in the pulp paper sector include 'the changed support for Combined Heat and Power (CHP), and the cancellation of the Carbon Trust sector efficiency programme after the potential projects had been collaboratively identified and had been ready to be implemented.'[143] The paper and pulp firms DECC interviewed: 'stated specifically that the industry seeks overall reassurance on how the Government can ensure that paper manufacturers (and other energy-intensive industries) are not driven out of the UK by policy decisions or pricing around energy and carbon.'[144] The cement firms DECC interviewed wanted: 'reform of UK-specific climate change and energy regulations, taxes and incentives to allow UK-based cement producers to be more cost competitive with both EU and global competitors.'[145] In the cement sector CCS was found to be an: 'integral part of established sector roadmaps'[146] but the Government closed the CCS scheme in the 2015 Spending Review.[147] In the paper and pulp

sector the firms interviewed stated that possible barriers to installing new equipment included 'rising UK energy prices perceived as non-competitive, uncertainty about return on capital, and global competition for funding from group headquarters.'[148]

Energy policy costs are increasing the cost of energy to UK firms. UK energy prices are higher than those faced by UK firms competitors. UK firms are closing down now and urgently require that the Government change course of energy policy.

4

What energy policy should the UK adopt?

Why does the UK need to fundamentally change its energy policy?

Many of the Government reforms to the energy market in the last fifteen years have been detrimental to UK businesses and wider consumers. They have added unnecessary costs and increased energy prices. Piecemeal reform is not enough. Something more radical is required. The UK's withdrawal from the EU provides an opportunity for UK energy policy to be reset to put the needs of UK consumers first and to repeal EU wide policies that make UK firms less competitive in the global market in which the UK must compete. We have seen how the different approaches of the French and German Governments have shielded key firms from the effects of these policies. However, the French system is difficult to replicate in the UK and the German system imposes too high a burden on smaller businesses and consumers. The United States has experienced a shale gas revolution while the UK has not and looks set to increase its competitive advantage in energy pricing. Clearly, a new UK energy policy needs to be implemented that ensures UK energy prices become, and remain, competitive. It should be governed by five core priorities.

What are the five priorities that should govern UK energy policy?

(i) The first priority of the Department for Business, Energy & Industrial Strategy's energy policy should be to provide a secure, stable and reliable energy supply.

Recent UK energy policy has prioritised the reduction of UK carbon emissions and boosting the proportion of renewables in UK electricity generation. This has led to a less reliable energy supply. For this reason, Government promotion of renewable energy, through both regulation and subsidy, should now cease. The Government should allow energy to be sourced from wherever it is cheapest and should allow a genuine private market to determine what is best.

(ii) The second priority of the Department for Business, Energy & Industrial Strategy's energy policy should be to keep energy prices low.

Recent energy policy has been relentlessly negative about energy use in general and, particularly, the energy derived from burning fossil fuels. Actually, cheap and reliable energy helps drive economic growth. Low energy prices greatly benefit small firms and ordinary consumers on low incomes. The Government recognise this when they refuse to increase fuel duty. Dictating the energy generation mix, by forcing the purchase of the more expensive renewable generated energy is, effectively, an additional tax on energy usage. UK energy policy should establish UK energy prices as a source of UK competitive advantage.

(iii) The third priority for the Department for Business, Energy & Industrial Strategy's energy policy should be to build a competitive energy generation market and to provide a stable predictable energy policy in the UK once the package of reforms outlined here is implemented.

The need to reform the current poor policy framework should include a rejection of the constant tinkering that damages the UK as a place to invest. In place of the inadequate Business Energy Efficiency Tax Review recently conducted by the Government a new 'UK Energy Competitiveness Review' should be undertaken. The purpose of this review would not be limited to making the existing system slightly less bureaucratic. It would be to set a new direction for UK energy policy as a world-leading destination for energy investment. The Review should seek to build an energy market capable of delivering low prices through free competition. It should make the UK regulatory regime the most attractive in the world.

(iv) The fourth priority for UK energy policy should be to maximise the extraction of UK fossil fuel resources and secure the maximum possible economic return to the UK from their extraction.

UK fossil fuel resources are a substantial source of UK wealth. Their full extraction will create large numbers of jobs. The Government should estimate the amount of fully recoverable UK fossil fuel resources, update this estimate annually, and commit to extracting them. These resources represent significant wealth that could be deployed to help drive wider productivity enhancements in the UK economy. The extraction

of fossil fuels to help provide low cost energy helps spread wealth and opportunity across the UK. Existing regulations that prevent the use of domestic coal, gas and oil resources for power generation should be abolished. The UK competes in a global market. President Trump has signalled his intention to make the maximum possible use of American fossil fuel resources and to drive down energy costs, which are already lower than the UK and EU levels. This represents a challenge to the competitiveness of UK firms and an opportunity to import cheap fuel from a key ally.

(v) The fifth priority for UK energy policy should be to promote energy efficiency. Part of the tax revenues generated from fossil fuel extraction should be earmarked to set up a new UK energy efficiency fund.

The Government has fixated on decarbonisation and the reduction of UK emissions. Concentrating on energy efficiency would achieve some of the goals of decarbonisation but it would achieve more industry support. What matters is the carbon intensity of production. The UK can be a world leader in developing technological innovations to use power more efficiently. Doing this means increasing the profit margin on these projects and making their adoption as simple as possible. The Government should also create an energy efficiency fund and be prepared to allocate to it a substantial sum, perhaps £1 billion to invest in research to increase the energy efficiency of power generation, manufacturing processes and battery storage.

What are the fifteen policy recommendations that the UK should adopt to transform UK energy policy to make energy prices lower and to improve the competitiveness of UK firms?

1. End the commitment to generate a proportion of UK energy from renewables.

The attempt to dictate the technology used in electricity generation and to fix prices to make uneconomic forms of power generation viable has meant that there is no free market in electricity generation. Former energy minister Amber Rudd declared in November 2015 that: 'We now have an electricity system where no form of power generation, not even gas-fired power stations, can be built without government intervention.'[1] No supplier should be required to purchase an arbitrary amount of power from any particular form of electricity generation. If renewable technologies can compete on the basis of price with fossil fuels they should be able to access the grid and to sell their power on equal terms. However, no subsidy should apply. All investments should leave the market risk with the investor. The Government should not subsidise any specific form of energy generation.

Until the issue of balancing renewable power generation and energy demand is solved Government should not promote the growth of renewable energy. The new Government should declare a moratorium on the promotion of renewables in the UK energy mix until the issues surrounding intermittency and power storage are solved. This will require that the UK opt-out of all EU Directives and UK regulations that specify the percentage of renewables in the energy mix and

withdraw from the binding international agreements that specify the percentage of renewables in the future energy mix. Andrea Leadsom is the Secretary of State for the Environment and a leading member of the Fresh Start group of Conservative MPs. In a recent report, they suggested the UK could refuse to abide by any EU renewables target beyond 2020 and unilaterally refuse compliance with the EU ETS.[2]

2. The Climate Change Act should be substantially amended to remove the legal requirement to reduce carbon emissions. It should also be changed to include UK emissions imports in the UK national emission target.

The 'legally binding' requirement to reduce carbon emissions by a specified percentage should be replaced with a policy target that is not-legally binding. The Government should continue to set Carbon Budgets but their performance against these targets is a matter for public debate and not one for legal enforcement. The requirement to have regard for UK domestic action in reducing carbon emissions should end and the Government, and UK firms, should be willing to purchase international credits to meet the UK's aim to reduce carbon emissions if necessary. The climate gives no special benefit to UK specific carbon reductions. Carbon emissions should be reduced where it is cheapest to do so. The UK can invest in renewable electricity projects in developing countries where they are more cost effective. Public policy should aim to reduce emissions at the lowest possible cost. Instead: 'carbon budgets account for emissions produced on UK soil, they exclude emissions embodied in materials and products produced elsewhere

but imported in the UK.'[3] It is better that EII exist where they are most energy efficient. The UK should maintain as much EII within the UK as possible.

3. The Government should commit to having the lowest industrial electricity prices in the EU28 (lower than all the EU27 after the UK withdraws from the EU) within five years.

The Government should set a firm target to reduce energy bills to ensure that its commitment in this regard can be established. I would suggest that this be that the UK aims to have lower industrial energy prices than the remaining EU27 states within five years. To help them achieve this a new Energy Competitiveness Committee should be established adopting a similar model to the Committee on Climate Change. It should report annually and it should identify all Government imposed regulatory and taxation costs that affect UK energy prices. It should update the Government on the energy policies of all the UK's major competitors and any changes in them that might make the UK energy prices less competitive. It should propose policy options to lower UK energy prices. A relentless focus on cost reduction and deregulation needs to be central to UK energy policy making. The new committee should conduct an 'UK Energy Competitiveness Review' as described below.

4. The UK should immediately convene a new 'UK Energy Competitiveness Review' that will examine how to ensure the UK has the most competitive energy prices it can.

Under the Review all existing regulations relating to the generation, transmission and supply of energy and the

extraction of fossil fuel resources should be identified. A commitment should be made to reduce their number, and their cost by a fixed percentage by a specified date e.g. fifty percent within five years. The Government should pledge not to introduce any new energy taxes for a ten-year period. A moratorium on new energy regulations that do not relate to issues of safety, energy efficiency, or to provide a competitive energy market should be introduced until the review has concluded. The Review should be required to determine if this moratorium can be extended for the ten-year period in which there will be no new energy taxes. No new energy or fossil fuel regulation should be imposed without a 'sunset clause' that requires it to be reviewed by the Energy Competitiveness Committee on an annual basis to determine if it is still necessary and gives a firm date for its repeal if not re-approved. The new Energy Competitiveness Committee would ensure this focus on deregulation would be permanent.

5. End the Contracts for Difference auctions (CfD) with immediate effect.

Contracts for Difference are a mistake. All existing payments required under the CfD already agreed should be honoured but no new auctions should be undertaken. Following the end of these contracts the tariff level achieved should revert to existing market prices. The Government should ensure a competitive market in the generation and supply of energy. The CfD scheme attempts to fix energy prices for decades into the future and by doing this the Government risks locking in permanently higher prices. If market prices increase

above the strike price the contracts mean the generator will pay back the difference but if market prices fall below the strike price consumers must pay the difference to the generator. The UK is a growing market and there is no inherent need for the Government to guarantee the investment return of firms that invest in our electricity market.

6. End the Feed-in-Tariff financial support for renewable power generation with immediate effect and the new Power Purchase Agreements for independent renewable generators contained within the 2013 Electricity Market Reform.

Renewable technologies should have the full costs of their connection to the grid charged back to them and reflected in the cost of the electricity they generate. The net subsidy of micro renewable generation should reduce to zero by 2019. Also, the right for new micro renewable generators to be hooked up to the electricity grid should be abolished. If the costs exceed the costs of attaching conventional generation or if the additional renewable capacity is estimated to make the network more difficult to manage then connection to the grid should be denied. All existing payments under FITs should be honoured until the existing pledged date. Following these dates the tariff should revert to existing market prices. Commitments to fix prices for decades into the future should end and no premium on the market price for energy should be paid to producers of renewable electricity generation.

7. Abolish the UK Carbon Price Floor and Carbon Price Support Mechanism and the Climate Change Levy with immediate effect.

The UK Carbon Price Floor and the Carbon Price Support Mechanism (CPSM) should be abolished. The CPF is now a general tax on energy-use that raises revenue for the Treasury. It does not promote renewables as they are now also subject to it. It is a unilateral UK policy that imposes costs on UK firms that their competitors do not face. There should be no floor for carbon prices. If a market in carbon emissions is to exist the prices should reflect the value emitters place on their ability to emit within the overall agreed limits imposed by Government or the relevant intergovernmental body (as with the EU ETS). There should be no attempt to artificially inflate these prices in the UK market to the detriment of UK firms. The Climate Change Levy should be abolished because there should be no tax on the delivery of electricity to businesses separate to any network charges incurred by other power network users.

8. Reduce the Levy Control Framework cap on expenditure to zero for all new renewable energy support agreed from this point onwards with immediate effect.

The Levy Control Framework should be reformed. The caps on the amount of price support for new renewable energy should be set to zero for all future contracts. The existing CfD and RO have set legal obligations that entitle firms to payments for decades and these will be honoured. However, no new commitments should be made. The aim of the Government should be to impose no additional policy cost on UK power generation and

supply and to gradually allow those that already exist to be phased out. The net savings to the UK consumer from ending the policy support for renewable energy will be substantial as the cost of policy support is projected to reach almost £8 billion in 2020.

9. Make the UK's continued membership of the EU ETS conditional on tariff free access to the EU market.

EU policymakers have the capacity to grant the UK access to the EU Single Market on a privileged basis. If they choose not to do so this will impose additional costs on UK firms. UK energy intensive firms that export to the EU will be substantially damaged. To address this the UK could make UK membership in the EU ETS conditional on the UK continuing to enjoy tariff free and privileged access to the EU market. If the UK cannot secure a favourable agreement with our European trading partners then it must move quickly to reduce the costs incurred by UK exporters. Removing the UK from the EU ETS would create significant savings for UK firms who would not need to buy any emissions permits or comply with them.

The Energy Competitiveness Committee should include an assessment of the trade costs of the UK's membership of the EU ETS. If these costs are ever judged to be too high or counterproductive the UK should retain the right to withdraw from the EU ETS and not cede this right in any trade deal with the EU. This will provide future Governments with the flexibility necessary to make an informed decision on future UK participation in the EU ETS.

10. Extend the life of existing power plants as necessary to meet any fallback in initial investment in power generation capacity.

Removing the existing support schemes for renewable power generation creates the potential for a reduction in investment in energy generation as firms adjust to the new policy reality. Suspending UK adherence to EU Directives such as the Industrial Emissions Directive and UK regulations such as the Emissions Performance Standard that require early shutdown of functioning UK fossil fuel power plants will help to extend their lives where necessary. It will also reduce the amount of electricity network investment necessary because these inflated investment totals have included the costs of early closure of fossil-fuel powered plants.

11. Introduce a new 'fair competition commitment' prohibiting Government subsidy for the deployment of any specific form of electricity generation to the grid.

Different technologies carry with them different risks, this is reflected in their cost, Government intervention to subsidise renewable technologies has distorted market signals, as it has done with nuclear energy. Private investors should assume the market risk for their investments in power generation. But firms will require reassurance that the Government will not intervene to subsidise their competitors. For these reasons, and many others, the Government should implement a new 'fair competition commitment' prohibiting it from intervening in the electricity generation market to subsidise any particular form of electricity generation (this should include a provision to allow the Government to still

invest in energy storage technology and trial it). This will allow the, newly restored, free market to determine which forms of generation are most effective. It will allow private investors to make more informed projections of the cost of different options and the potential return on investment.

12. Introduce a new 'Consumer Price Protection Clause' to require any future regulatory costs imposed on the energy sector for the next ten years to be met directly from Government revenues with a prohibition on passing them through to consumers through their bills.

The reason the Government has been willing to impose substantial regulatory costs on the sector is because these costs are passed on to consumers. Energy companies are then blamed for rising bills. Ensuring that the authority responsible for creating these costs is then responsible for financing them being met will ensure that reasonable and proportionate regulation is agreed in future. Exceptions could be made for regulations that improve safety or consolidate existing regulations.

13. Create a new energy efficiency prize fund and end the requirement for firms to conduct energy audits and conclude Climate Change Agreements.

Existing UK policy requires that firms conduct energy audits to identify potential energy savings. Firms that agree to enforce energy efficiency changes are given an exemption from the costs of the Climate Change Levy. The model requires a significant bureaucratic structure to maintain. Instead the Government should create individual prize funds for technological improvements

that will most advance carbon emissions reduction. Creating a prize fund for energy efficiency improvements provides direct financial benefit to those who solve our key problems. The prizewinners could be publicised and firms could use the prizes as a mark of the quality of their research. A condition of receiving the prize would be that the invention would be licensed and made available for purchase by other UK firms.

The reason that renewables are so unreliable is that energy cannot be stored cheaply when it is generated to match it with demand. Unfortunately, battery technology is very expensive and inefficient. It is impractical to store the required level of energy to fully backup UK renewables. The Government should invest in boosting the efficiency of battery storage and lowering its cost. To do this it should establish a new task force on intermittent energy. It should also allocate some of the 'energy efficiency prize fund' to the creation of a substantial time limited cash prize for the creation of an ultra efficient form of battery technology to remedy this problem as part of the £1 billion fund suggested for energy efficiency improvements in our fifth energy policy priority.

14. The Government should commit to making the public sector carbon neutral by 2040 and to create a new legal duty on all local authorities to conduct a Local Economic Growth Opportunity Impact Assessment before they can refuse a request to drill or mine a natural resource.

Each of the Government's energy efficiency roadmaps recognises that there is a limited market for materials made using low carbon technology and processes.

Government as a large purchaser of goods and services could verify the carbon intensity of the main construction materials used in public construction projects such as steel. The carbon intensity of production could be considered along with securing value for money in the procurement process. The Government could use its purchasing power to create a market for low carbon products if it so wishes. It could do this by committing to make the public sector carbon neutral by 2040 to serve as an example to others and show genuine leadership.

The Government should create a new legal duty for local authorities to conduct a 'Local Economic Growth Opportunity Impact Assessment' before they can refuse a request to drill or mine a natural resource. This assessment must estimate the number of jobs and tax revenue the activity would generate that will be foregone by the refusal to permit development. This foregone revenue should be included on all council budget documents.

15. Introduce a renewable price support consumer transparency clause so individual consumers can see how much they individually are paying to subsidise renewable energy generation.

The costs of renewable energy policy support are paid for through consumer bills but they remain hidden to the consumer. The Government should legislate that the price of renewable policy support should appear on individual consumer bills so individual consumers know how much they are contributing to finance the promotion of renewable energy.

Conclusion

The UK needs to rip up its existing energy policy and replace it with a new policy that delivers low and stable energy prices for all users. Prices should be kept as low as possible. Low energy prices should be second only to ensuring the necessary investment in the infrastructure necessary to ensure secure and stable energy supplies. Efforts to reduce carbon emissions should focus on carbon intensity and not total carbon emissions and they should not be a priority of energy policy. The Government should aim to safeguard its energy intensive industries and to establish energy prices as a source of competitive advantage for UK firms. Existing energy policy should end its commitment to increasing the proportion of renewables in the UK energy generation mix. The Government should invest in developing more efficient battery storage technology to allow the peaks and troughs of electricity demand to be managed cost effectively.

Energy costs are a business cost. It is true that there are many business costs such as labour, Government regulation and taxation, premises and transportation that are significant. However, a policy of increasing energy costs damages the competitiveness of all affected firms. Some firms whose energy costs are a small percentage of these costs may be able to absorb them. However, for businesses that are capital intensive, with a low profit margin, small changes in energy costs can deter future

investment. In some cases high energy prices can lead plants to close, which generates headlines. However, it is the plants that are not constructed and jobs not created that are just as real but more difficult to draw to policymakers' attention. These proposals should boost economic growth, create well-paying jobs and help to build a country that works for those companies that are 'just about managing'.

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Notes

Introduction

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4. What energy policy should the UK adopt?

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A series of policy initiatives since 2000 have rendered energy supply in the UK unstable and expensive. This has been driven by a desire to reduce carbon emissions in response to concerns about global warming.

The effect, however, has been to drive energy intensive industries overseas, to countries with less carbon efficient means of production, resulting in a net increase in per capita global emissions. For the UK, it has meant de-industrialisation and the loss of jobs – while those firms that remain are placed at a competitive disadvantage by the high cost of energy.

It does not need to be this way. As Glyn Gaskarth argues here, the UK needs a secure, stable energy supply, with prices as low as possible to give British industry a competitive advantage against its rivals in other advanced nations.

Far from driving away energy-intensive economic activity, it should be designed to ensure as much of it as possible can take place on UK shores. Government investment should be focused on improving energy efficiency, making fossil-fuel use cleaner and supporting decarbonisation in developing countries.

Only by dismantling the architecture of current energy policy, can a new framework be established that is fit for purpose – addressing carbon emissions on a global basis and ensuring that the UK's 'just about managing' companies are not placed at a competitive disadvantage in the world.

ISBN 978-1-906837-84-6

978-1-906837-84-6

£8.00