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European Union Committee

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No Country is an Energy Island: Securing Investment for the EU's Future

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CONTENTS

	Paragraph	Page
Summary		5
Chapter 1: Introduction	1	7
Box 1: TFEU—Article 194		8
Chapter 2: Investments and costs	15	11
The scale of investment required	15	11
Investing in energy at a time of economic crisis	16	11
Low carbon energy investment	21	13
Financing	29	15
Box 2: EU Project Bonds Initiative		16
Costs and pricing	41	18
Chapter 3: The energy mix	51	22
EU competence	51	22
Carbon capture and storage	55	23
Box 3: Carbon capture and storage		23
Gas	64	25
Box 4: Comparative greenhouse gas emissions of fossil fuels		26
Unconventional gas-shale gas	69	27
Box 5: Unconventional gas		27
Coal and lignite	76	29
Box 6: Lignite		29
Renewable energy	83	31
Box 7: Renewable energy		31
Nuclear	92	33
Chapter 4: Delivering policy clarity—2030 framework	99	36
EU Emissions Trading System	104	37
Figure 1: Evolution of carbon prices		37
Renewable energy target	117	40
Energy efficiency	122	41
Energy-intensive industries	128	42
The politics of a 2030 framework	134	44
Chapter 5: Research and innovation	139	46
The role of research and innovation	139	46
The EU's approach	145	47
Chapter 6: Interconnection and energy security	161	52
Visions of the future grid	169	53
Energy Infrastructure Regulation	174	55
Public acceptance	176	55
Regulatory obstacles	179	57
Gas supply	183	58
Capacity mechanisms	189	59
Chapter 7: Conclusions and recommendations	197	61

Appendix 1: List of members and declarations of interest 68
Appendix 2: List of witnesses 70
Appendix 3: Call for evidence 73
Appendix 4: Glossary 75
Appendix 5: Share prices of major EU energy companies 79
Appendix 6: EU energy legislation and proposals 80
Appendix 7: Levelised cost estimates for projects starting in 2018 (10% discount rate) 83
Appendix 8: Household and industry electricity prices (second half 2011 (1) (€/KWh) 84
Appendix 9: List of abbreviations 86

Evidence is published online at http://www.parliament.uk/hleud and available for inspection at the Parliamentary Archives (020 7219 5314)

References in footnotes to the Report are as follows:
Q refers to a question in oral evidence.
Witness names without a question reference refer to written evidence.

SUMMARY

Energy is a basic requirement for survival and is central to our economy. We are therefore alarmed at the degree of uncertainty, complacency and inertia about how an affordable supply of secure and low carbon energy will be provided in the European Union (EU). This, in essence, is the 'trilemma' facing the EU.

Several factors underlie our concern: the imminent closure of large numbers of coal plants across the EU due to environmental rules; an investment crisis; the importance of affordable energy at a time of economic hardship; the need for sustained and deepening cuts in greenhouse gas emissions; the continued reliance on imports for the supply of over 50% of the EU's energy; price volatility; weak interconnection between many EU Member States; and the failure of governments to boost public acceptance of new energy infrastructure.

It is far from clear, however, where the required investment—of around €1 trillion over the period 2010–2020—will come from. The share values of EU utilities companies have slumped. Public money for energy infrastructure investment and for low carbon energy innovation is insufficient. Institutional investors hold €13.8 trillion of assets but, in order to invest in energy projects, even at a time of historically low interest rates, they need confidence in policy. That is why agreement on a 2030 policy framework, by 2015, must be a priority for the EU. Without that clarity and investment, the EU will be uncompetitive and over-dependent on elsewhere to meet its energy needs, and it will fail to seize an opportunity to make a material and enduring contribution to European economic recovery.

The required EU energy transformation could stabilise consumer and retail bills. But such stabilisation will require investment, a clear policy framework and support for innovation into both lower carbon technologies, including carbon capture and storage (CCS), and ways in which energy can be saved.

No country is an energy island. There are therefore clear benefits to be derived from working within the EU on the energy challenge. There is, however, a dilemma. It is for each Member State to decide what mix of energy is the most appropriate for them. But the choices of one country affect others, including the collective need for energy security, an efficient market and environmental improvement, and so the European Commission should have a role in monitoring choices and their impacts.

There are specific aspects of energy policy where a more coordinated EU strategy would be helpful. These include:

- Agreement on an energy policy framework through to 2030;
- A revised EU Emissions Trading System (ETS) with a floor price, accompanied by a tighter cap on the number of allowances, a 2030 renewable energy target and, possibly, an energy efficiency or consumption target;
- Coordinated research and development (R&D);
- Increased physical interconnection between Member States, which will require authorities to be clear with the public that certain choices, including 'not in my back yard', come at a cost; and
- Reduction of regulatory obstacles towards the completion of the EU internal energy market.

No Country is an Energy Island: Securing Investment for the EU's Future

CHAPTER 1: INTRODUCTION

1. The central focus of this inquiry has been securing the necessary investment for the EU energy infrastructure over the next few years. This is crucial for the EU to overcome what many describe as the energy 'trilemma': how to meet the EU's carbon reduction trajectory whilst maintaining security of energy supply and affordability to domestic and industrial consumers.

2. This report has taken into account a range of issues, which include: the necessary investment and costs; different energy sources; a potential 2030 policy framework; research and innovation; and issues of interconnection and energy security. We have not considered the detail of specific renewable sources—such as wind and solar—but consider renewables in a more general sense. The aim of this inquiry is to offer our views on the future direction of EU energy policy at a time when the European Commission, Member States and other interested groups are engaged in discussions about the role of energy beyond 2020. We issued our call for evidence in September 2012 and took oral evidence from a range of EU and UK witnesses between October 2012 and February 2013. Our findings are of relevance to policies within the broader EU, with some reference to how this might impact the UK. It must, however, be stressed that we did not concentrate on UK policy. This inquiry has predominantly considered how to resolve the trilemma in a cost efficient way.

3. Decarbonisation should be delivered largely through the electricity, heat (buildings) and transport sectors which, in 2011, accounted for 27%, 35% and 20% respectively of the UK's greenhouse gas emissions.[1] We have focused on the electricity sector based on the analysis of the UK's Committee on Climate Change, which has found that the costs of decarbonising the power sector are generally lower than for other sectors and has made the point that both heat and transport are likely to become increasingly electrified.[2] For this reason, we have excluded oil from our study. We note that the Commission recently published an Alternative Fuels Strategy relating to decarbonisation of the transport sector.[3]

4. Historically, the EU has never had an explicit energy policy in the way that it has, for example, in the areas of agriculture and competition. Energy has, nevertheless, been on the European agenda since the formation of the European Coal and Steel Community (ECSC) and European Atomic Energy Community (Euratom) in 1952 and 1957 respectively. Other EU policies,

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1 *Meeting the Carbon Budgets–2012 Progress Report to Parliament*, Committee on Climate Change, June 2012

2 *The Fourth Carbon Budget*, Committee on Climate Change, December 2010

3 COM(2013) 17

such as internal market, environment and competition, all bear upon energy and so the EU developed a *de facto* energy policy.

5. It was not until the Treaty of Lisbon in 2009 that the EU allowed explicitly for an energy policy. Article 194, TFEU[4] (see Box 1), establishes energy as a competence which is shared between the EU and Member States. Whereas Member States have the right to determine which energy sources to employ, the EU has the authority to establish measures necessary to achieve the objectives as outlined in the Article.

BOX 1

TFEU—Article 194

The Treaty of Lisbon established Article 194 of the TFEU, which outlines the competence for energy policy:

> "(1) In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to:
>
> (a) ensure the functioning of the energy market;
>
> (b) ensure security of energy supply in the Union;
>
> (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
>
> (d) promote the interconnection[5] of energy networks."

The EU may adopt measures to achieve those objectives, but:

"Such measures shall not affect a Member State's right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply."[6]

6. The existing EU policy framework for energy is comprised of numerous Directives and Regulations. The most significant of these are: the EU Emissions Trading System (ETS) (2003); the Security of Supply Directive (2005); the climate and energy package (2008); the third internal energy market package (2009); and the Energy Efficiency Directive (2012) (see Appendix 6). Recently, a number of proposals relating to the EU energy sector have been put forward, including: a trans-European Energy Infrastructure Regulation; the Connecting Europe Facility (CEF); and the ETS backloading[7] proposal (see Appendix 6 and Chapter 4). EU environmental legislation also affects energy policy, such as the Large

4 Treaty on the Functioning of the European Union

5 For the purposes of this report, interconnection is the physical connection of two or more energy systems that allows for the sale or exchange of electricity between different Member States

6 Treaty on the Functioning of the European Union

7 Backloading refers to a proposed amendment to the ETS. The amendment would postpone the auctioning of 900 million allowances from 2013–2015 to later in Phase III of the ETS, which ends in 2020. The backloading does not affect the overall volume of allowances to be auctioned in Phase III, only the distribution of auction volumes over the eight-year period (the 'auction time profile')

Combustion Plant Directive (LCPD) and the Industrial Emissions Directive (IED) (see Appendix 6).

7. Today, the EU finds itself in a dramatically altered economic situation compared to 2008 when the energy and climate change package was adopted (see Appendix 6), and there has also been an unanticipated revolution in the energy market. Most predictions at that time have been proven inaccurate. The deteriorating economic circumstances have made the energy trilemma much more difficult to resolve. It is on that basis that the Commission suggests the EU's future energy policy should be formulated.[8]

8. There has also been a significant shift in the global situation. As was identified in the International Energy Agency's (IEA) World Energy Outlook 2012, the global energy map is changing.[9] The past decade has seen a rise in global fossil fuel prices, linked partly to economic growth in Asia, which has seen it take an increasingly large share of global fossil fuel consumption. More recently, the US has experienced a shale gas 'revolution', with the prospect of becoming energy self-sufficient and a drop in gas prices that will potentially add 0.5% to US Gross Domestic Product (GDP) by 2017.[10] The cost of some renewable energy (notably solar) has also declined sharply. Overall, there has been a growth in coal generation, and a rise in global carbon emissions, of which the EU is currently responsible for approximately 10%.[11]

9. The debate about resolving the energy trilemma is also pertinent given developments in UK energy policy. The UK Government stated that the UK electricity sector will require around £110 billion of investment over the next decade to improve its infrastructure. In response, they have published an Energy Bill aimed at attracting investment in low carbon electricity. The main elements of the Bill are contracts for difference—which will stimulate investment in low carbon technologies by lowering risks to investors—and the capacity market—which will secure energy supply by giving capacity providers financial incentives to provide reliable capacity (see Chapter 6). These elements will be supported by a carbon floor price—from 1 April 2013 a minimum price has been applied to the cost of emitting carbon dioxide—and an Emissions Performance Standard (EPS), aimed at preventing the construction of new polluting coal plants. In Autumn 2012, the UK Government also published their Gas Generation Strategy, which considered the barriers faced by potential investors in gas.[12]

10. The increased prominence of the energy debate at the EU level is reflected in recent Communications from the Commission. It is in large part because of these Communications that we deemed it necessary to conduct this inquiry. In October 2011, the Commission published an Energy Roadmap to 2050.[13] It explored the challenges posed by decarbonisation in the context of ensuring security of energy supply and competitiveness. The Renewable Energy Roadmap assessed both the share and progress of renewables in the

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8 COM(2011) 885

9 *World Energy Outlook*, International Energy Agency, November 2012

10 *Gas Works*, The Economist, 14 July 2012

11 Q 128

12 *Gas Generation Strategy*, Department of Energy and Climate Change, December 2012

13 COM(2011) 885

energy mix, and initiated the debate about setting a target for the level of total EU energy consumption to be derived from renewable energy sources by 2030, as well as measures to promote renewable sources in the electricity, biofuels and heating and cooling sectors.[14] The Commission's Roadmap for moving to a competitive low-carbon economy in 2050 gives long-term consideration to cost-efficient ways to make the European economy more climate-friendly and less energy-consuming.[15] This Communication sets an EU target of reducing greenhouse gas emissions by 80% by 2050 over 1990 levels, with renewable energy sources and efficiency seen as playing a pivotal role. The Internal Energy Market Review paper, meanwhile, assessed the current state of play of the internal energy market, which is supposedly to be completed by 2014 (see Appendix 6).[16] Looking to the future of the ETS, the Commission published an options paper on its future reform in 2012.[17] The Commission further issued a Green Paper on 27 March 2013, which identified a number of mid-term options up to 2030 on both energy and climate issues (see Chapter 4).[18]

11. The upcoming international climate change negotiations, including the UNFCCC[19] Conferences in Warsaw and Paris in 2013 and 2015 respectively, added impetus to this inquiry.

12. The members of the Agriculture, Fisheries, Environment and Energy Sub-Committee who carried out the inquiry are listed in Appendix 1, which shows their declared interests. We are grateful for the written and oral evidence that was submitted to the inquiry; the witnesses who provided it are shown in Appendix 2. We are also grateful to Professor Michael Grubb, Senior Research Associate, 4CMR Land Economy, Cambridge University, who acted as specialist adviser to the inquiry.

13. The call for evidence is shown in Appendix 3. The evidence received is published online.

14. **We make this report to the House for debate.**

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14 COM(2006) 848

15 COM(2011) 112

16 COM(2012) 663

17 COM(2012) 652

18 COM(2013) 169

19 United Nations Framework Convention on Climate Change

CHAPTER 2: INVESTMENTS AND COSTS

The scale of investment required

15. The European Commission indicated in 2010 that, by 2020, investment of around €1 trillion[20] would be required across the EU's energy system (generation, transmission, distribution and demand) to replace obsolete capacity, modernise and adapt infrastructure and to cater for increasing and changing demand for low carbon energy.[21] Our witnesses supported this estimate, and it was even described by Mr Martin Wolf as "rather low" in the context of the EU's overall economy, a view echoed by EDF. Mr Wolf estimated the suggested investment to be less than 1% of the EU's Gross Domestic Product (GDP) over that period.[22]

Investing in energy at a time of economic crisis

16. Dr Robert Gross and Bloomberg New Energy Finance (BNEF) were in agreement that the current economic climate ought to be a favourable time to raise money cheaply for secure investments.[23] Mr Wolf concurred. Both he and Mr Dimitri Zenghelis explained that there are excess savings "of an extraordinary scale" in the economy at the moment. According to Mr Zenghelis, those resources, if invested, could attract a substantial multiplier effect. Professor David Newbery agreed, observing that holding other investment constant and increasing energy investment specifically by shifting to less carbon-intensive solutions should stimulate an under-employed economy.[24]

17. While the economic crisis has in one way created an ideal climate for investment, the Commission highlighted the related sovereign debt problem in EU countries as an obstacle. Financial institutions had indicated to the Commission that, until the debt problem was resolved, they would not invest in at least 12 of the 27 Member States.[25] BNEF warned that regulatory changes to the financial sector introduced to tackle the crisis, such as the Basel III rules on the amount of liquidity that must be held,[26] may restrict the amount of available finance. In its recent Green Paper on long-term financing of the European economy, the Commission agreed with this point, highlighting prudential rules for banks and for the insurance sector as particular obstacles.[27] As part of the solution to overcoming the economic crisis, the EU has introduced the European Semester, a system which allows the Commission to make annual recommendations to Member States on their economic and fiscal policies. Recommendations are formulated on the basis of the Commission's annual growth survey, setting out in general terms

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20 1 trillion=1,000,000,000,000

21 COM(2010) 639

22 Q 57, Q 178, Q 194, Q 211, DECC

23 Q 94, Q 176

24 QQ 206–207, Professor David Newbery

25 Q 265

26 *Basel III: International framework for liquidity risk measurement, standards and monitoring*, Basel Committee on Banking Supervision, December 2010

27 COM(2013) 150

the priorities on which Member States should focus in their economic and fiscal policy. These recommendations have included energy-related suggestions, particularly on energy efficiency.[28]

18. **We recommend that the Commission includes energy policy within its annual growth strategy and that Member States be encouraged, through the European Semester, to consider how their fiscal policies can contribute to unlocking investment in the energy sector.**

19. The Confederation of British Industry (CBI) took the view that meeting the three key energy priorities of security, decarbonisation and keeping costs competitive was in itself good for growth: "by investing in energy you do not just get the general benefits of investing in the economy; you also get a more growth-positive environment in Europe".[29] ScottishPower agreed that "efficient investment" in energy should have a beneficial impact on the economy and create new jobs, making the distinction that investment in expensive forms of renewable energy, for example, was less efficient than investment in cheaper methods.[30]

20. As a sector in which to invest, the Committee heard from the Commission and others that it can offer steady returns with low risk and offers a very stable credible yield. Life times of assets can range from 30 to 60 years.[31] Mr Zenghelis acknowledged that energy investment was not a panacea but thought that it was certainly part of the solution. He observed that investment in infrastructure tended to have a stronger domestic effect than other investment as "a lot of it goes into domestic employment and a lot of it goes into domestic supply chains".[32] Mr Wolf considered that "it would be incredibly sensible to focus on investment in general, and energy investment in particular, as one way of generating growth-oriented policies in the [eurozone] countries that are now in difficulty".[33] He argued that, "without a supply of reasonably cheap energy, future growth will be seriously constrained", an argument supported by ABB Limited.[34] This point was further illustrated by an Ernst & Young report for Energy UK, in which it was noted that "a pound spent on investment in this sector has a larger indirect effect on the rest of the economy than most others".[35] The only note of scepticism was struck by Mr Peter Atherton, who questioned the contribution that energy investment could make to boosting growth and argued for better macro-economic analysis to support the debate about that contribution.[36]

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28 Q 179, Q 236

29 Q 305

30 Q 189, Q 192

31 Q 64, Q 182, EESC, SEC(2011) 1565

32 Q 209, Q 216

33 Q 217

34 Q 208, ABB Limited

35 *Powering the UK: Investing for the future of the Energy Sector and the UK*, Ernst & Young, 2012, a report for Energy UK

36 Q 176

Low carbon energy investment

21. The Committee heard a substantial amount of evidence to suggest that greater investment in low carbon energy in particular could add economic value. Various reports, referenced by our witnesses, have pointed to the added value of wind over gas. Research by Cambridge Econometrics on behalf of World Wildlife Fund (WWF) estimated that large-scale investment in offshore wind energy as opposed to a power system more heavily dependent on gas would increase UK GDP by 0.8% by 2030 (an additional £20 billion).[37] The added value to be derived from a technology such as wind energy compared to gas depends on the level of imported gas, with the advantage of wind increasing as the proportion of gas that is imported increases. This was the clear conclusion of an Ernst & Young report for RenewableUK, which concluded that, in all European countries analysed (UK, Spain, Portugal, France and Germany), investment in wind creates more GDP than gas. There was a marked difference, though, between countries such as France, which imports 98% of its gas, and the UK, which imports 37% of its gas.[38]

22. According to the Cambridge Econometrics study, the added value of wind to the economy, compared to gas, also depended on the location of the wind power equipment supply chain.[39] The Scientific Alliance observed that wind turbines were increasingly being sourced from China. Consequently, argued Mr Atherton, "the vast bulk" of the money spent on the initially high capital costs (see Appendix 7) to construct wind farms "will go overseas anyway". Mr Antony Froggatt acknowledged this issue but emphasised that installation and maintenance would remain local.[40]

23. The Energy Technologies Institute (ETI) and EDF believed that low carbon generation has the capacity to deliver a significant boost to economic growth.[41] The CBI agreed that an investment benefit could be derived from investing in low carbon energy domestically rather than fossil fuels, the prices of which are volatile and are currently rising.[42] EDF brought to our attention a report by the Institute for Public Policy Research (IPPR) on behalf of EDF, which found that new nuclear capacity could boost UK GDP by between 0.04% and 0.34% per annum for 15 years, depending on the cost and timescale.[43]

24. Sustained competitiveness of the EU economy requires adequate investment and innovation to facilitate a competitive, well-priced set of supply-side inputs, such as energy, to a growing economy. **We therefore agree with the evidence presented that the time is right for infrastructure investment, including in energy, because it can have a multiplier**

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37 *A Study into the Economics of Gas and Offshore Wind*, Cambridge Econometrics, November 2012, a report for Greenpeace and WWF-UK

38 *Analysis of the value creation potential of wind energy policies: A comparative study of the macroeconomic benefits of wind and CCGT power generation*, Ernst & Young, July 2012

39 *op. cit.*

40 Q 44, Q 176, Scientific Alliance

41 Q 189, ETI

42 Q 305, Q 321

43 *Benefits from Infrastructure Investment: A Case Study in Nuclear Energy*, IPPR Trading Ltd, June 2012, a report for EDF

effect, it can provide secure energy at a stable cost and it can boost technological advance. Low carbon generation and system infrastructure in particular can provide domestic energy production for decades at low and stable operating costs but at a high capital cost. We conclude that such investment is particularly appropriate at a time of historically low interest rates and recession. The potential to utilise underemployed financial resources, at low financing costs, while providing a secure indigenous supply for future growth means that investment, particularly in low carbon energy, could make a material and enduring contribution to European economic recovery.

25. In terms of jobs, the IPPR report on nuclear energy estimated that the delivery of additional nuclear energy capacity could result in an extra 32,500 jobs in the UK. We heard that the numbers employed in the renewable energy sector across the EU are predicted to rise to two million by 2020 and to three million by 2030. In the UK alone, the renewable energy sector could support 400,000 jobs by 2020 according to the Renewable Energy Association.[44]

26. There is, however, a lack of data on the extent to which low carbon energy investment can create net new jobs. On the one hand, the Ernst & Young report cited above found that wind energy creates 21 job years per million Euros invested compared to 13 for gas. On the other hand, Scientific Alliance and Professor Newbery considered that many low carbon jobs come at the expense of existing ones and may be relatively short-term in nature, such as the erection of turbines or installation of insulation. BNEF agreed that jobs in renewable energy tend to be available during construction but not during the life of the plant.[45] A wind turbine manufacturer, Vestas, addressed this issue and drew our attention to a report[46] on the employment effects of the operation and maintenance of offshore wind farms. This found that, if the expected 20.5 gigawatts (GW) of offshore wind power were to be installed in the UK by 2020, 4,000 long-term jobs would be created, along with a further 3,000 indirect jobs. Most of these jobs would be in economically fragile coastal areas, where the additional employment would be welcome.[47]

27. It was put to us by Mr Stephen Tindale that "the most sensible job rich approach is energy efficiency" rather than renewable energy. BNEF and the Commission agreed that energy efficiency could be an important source of new jobs, although they offered no analysis as to the extent to which they might be net new jobs.[48] The Chartered Institution of Building Services Engineers (CIBSE) and Institution of Engineering and Technology (IET) did not discuss jobs specifically, but considered that further stimulation of energy efficiency has the potential to maintain a significant contribution to economic growth.[49] Dr Karsten Neuhoff added that grid infrastructure

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44 *Renewable Energy–Made in Britain*, Renewable Energy Association, 2012

45 Professor David Newbery, Scientific Alliance

46 *Analysis of the Employment Effects of the operation and maintenance of Offshore Wind Parks in the UK*, Oxford Economics, June 2010, a report for Vestas Offshore

47 Vestas

48 Q 7, Q 64, BNEF

49 CIBSE, IET

development, leading to greater connectivity, could have a positive impact on jobs.[50]

28. **Investment in low carbon energy will undoubtedly create jobs, but we caution that the case is not yet clear as to the extent to which net new jobs will be generated in the EU. We recognise the significant job creation potential of energy efficiency and energy connectivity developments.**

Financing

29. As highlighted in paragraph 15 above, at least €1 trillion needs to be invested in the EU's energy system over the period to 2020. It was clear from our witnesses that the bulk of that would need to be sourced from the financial markets, with an important leveraging role for the public sector.

30. We heard that the investment challenge is an issue relating not to finance, but to risk. The Commission has indicated that institutional investors[51] hold an estimated total of €13.8 trillion of assets.[52] Financing is therefore theoretically available, but there is caution about investing.[53] The CBI noted that money was available on the global financial markets, but the challenge was to attract it to the UK and EU.[54] Mr Atherton warned that the share prices of European utilities had tumbled since 2008 (see Appendix 5) and planned capital expenditure by utilities companies was low, which was confirmed by the energy industry. ScottishPower told us, for example, that its parent company, Iberdrola, had committed to investing £3.5 billion in the UK, an amount which represented 42% of its global investment over the period 2012–14. While helpful, this did not amount to the "many billions of pounds", which ScottishPower acknowledged were required from the investment community.[55]

31. According to Mr Atherton, bonds were particularly important due to reduced capital expenditure by industry.[56] BNEF and Mr Wolf noted that pension and bond funds were keen to identify investments yielding more than the maximum 2% currently available for 10 year UK Government bonds, although pension funds lacked appropriate knowledge. It was considered that policy makers could make it easier for the industry to construct bonds and pool investments.[57] In its Green Paper on long-term investment, the Commission also observed that there was a lack of skills to support investment decisions and suggested that it may be necessary to consider initiatives designed to pool financial resources and to structure financing packages according to different phases of risks.[58] New long term investment funds could be of some assistance in this regard.

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50 Q 8

51 Life insurance companies, pension funds, mutual funds and endowments

52 COM(2013) 150

53 Q 179, Q 292, ETI

54 Q 305

55 Q 172, ScottishPower supplementary evidence

56 Q 179

57 Q 182, Q 211

58 COM(2013) 150

32. The importance of using public funds to engage in risk sharing in order to leverage private investment was highlighted. Mr Froggatt asserted that "how the EU and Member States can use their funds in a coherent way to leverage greater investment" would be crucial.[59] According to witnesses, this could be through European Investment Bank (EIB) lending and the new Connecting Europe Facility (CEF). Both the European Network of Transmission System Operators for Electricity (ENTSO-E) and Mr Wolf observed that the EIB can offer comfort to investors and encourage engagement in higher risk projects.[60]

33. The EIB signed loans in 2011 for energy and energy-related lending of €12.8 billion. Since then, it has been decided to increase the Bank's capital by €10 billion, allowing it to spend an additional €20 billion in each of the next three years. Its priorities derive from the policy priorities of the Member States. One of the six priorities is a competitive and secure energy supply. In addition, 25% of its lending should be towards climate action, which includes renewable energy. Any coal plants financed must be capable of being retro-fitted with carbon capture and storage (CCS) (see Chapter 3 and Appendix 4). A policy consultation on the EIB's criteria for supporting fossil fuel-fired generation is currently underway, a development which was welcomed by WWF.[61]

34. Some of our witnesses considered that the EIB could make an important contribution through the new Project Bonds Initiative (see Box 2).[62] While acknowledging that this was still at an early stage, the EIB confirmed interest by a number of institutional investors, notably pension funds and insurance companies. The EIB was confident that the degree of credit enhancement available would be sufficient to take a project with a borderline investment grade[63] (such as BBB) to a higher grade, "so achieve a two to three-notch" uplift in the credit quality of those bonds. Evidence suggests that a single A rating is the "sweet spot" in terms of the balance between risk and reward for the institutions. Initial projects under the pilot phase would be limited by the relatively small amount of available Commission funding and by the requirement that projects be completed by the end of the pilot phase.[64]

BOX 2

EU Project Bonds Initiative[65]

A pilot phase (2012–13) of the Project Bonds Initiative was agreed by the European Parliament and Council in July 2012.[66] Project Bonds are private debt issued by the sponsor(s) of a project—either a private company or a 'special purpose vehicle', created by one or more companies to finance a specific project. The EU project bonds initiative will provide credit enhancement for projects in order to make it easier for their sponsor(s) to attract private financing.

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59 Q 57

60 Q 20, Q 49, Q 66, Q 170, Q 219, Q 237, Q 293

61 Q 161, Q 316

62 Q 20, Q 166, Q 237

63 Credit ratings are opinions about credit risk published by a rating agency. Investment grades range from BBB- to AAA, with the latter being the highest rating and most likely to attract investment

64 QQ 165–166

65 Q 166, Council of the European Union Memo 12331/12

66 Regulation 670/2012

The debt issued by the sponsor(s) will consist of both 'senior' and 'subordinated' tranches of debt. Initial losses will be incurred on subordinated debt and it has been decided that the EIB will take up the subordinated debt, up to the value of 20% of the senior debt. The credit standing of the senior debt is in this way enhanced because it carries less risk. The EIB's contribution will be supported by a contribution from the EU budget. In the energy sector, that will amount to a total of €10 million, from which the EIB can then raise a further €120–140 million.

If successful, the pilot phase will be followed by an operational phase during 2014–2020 under the EU's CEF at a larger scale.

35. The CEF is the EU's new instrument over the period 2014–20 to finance new energy, transport and telecommunications infrastructure identified as Projects of Common Interest (PCI). At the European Council meeting of 7–8 February 2013, it was agreed that the budget for PCI in the energy sector over the period 2014–20 will be €5.1 billion. The Secretary of State for Energy and Climate Change, the Rt Hon Mr Edward Davey MP, expressed satisfaction with this decision, though it should be noted that spending for 2014–20 might still be agreed between the Council and the European Parliament.[67] This funding will partly support the operational phase of project bonds (see Box 2), but will also support grants and other financial instruments. Several of our witnesses identified the CEF as very important, but Dr Neuhoff warned that its relatively modest size suggested that it should focus on innovative projects.[68]

36. A number of obstacles to the provision of finance were raised. The most significant of those was considered to be uncertainty over the future direction of EU energy and climate policy. According to witnesses, investment would not be forthcoming without some clarity as to what policies the EU would put in place beyond 2020.[69] Mr Zenghelis emphasised that the policy framework must also be credible to the private sector in order to ensure confidence in the framework.[70]

37. Inconsistency by governments in regard to the fiscal environment was an additional aspect of uncertainty raised by Mr Wolf.[71] The UK Government taxed oil companies making what the public considered to be excess profits when bills were also rising.[72] U-turns in Spain and Bulgaria in relation to financial support to the solar industry were other examples of governments causing financial uncertainty.[73] As a result, Mr Atherton argued that investors were now suspicious that future governments may choose to continue this destabilising practice.[74]

67 Q 359

68 Q 20, Q 49, Q 237, Q 330, EESC, Dr Karsten Neuhoff supplementary evidence

69 Q 2, Q 189, Q 190, Q 192, Q 211, Q 315, CER, DECC, ETI, WWF

70 Q 209

71 Q 211

72 For example, March 2011 increase in the UK's supplementary charge on oil and gas profits

73 Q 176, Q 189, Q 197, Q 262

74 Q 183

38. **We conclude that there is a crisis of investment, which needs to be overcome if the estimated €1 trillion of investment required in the EU's energy system to 2020 is to be released. The balance sheets of utility companies have slumped. Public funding can make a small but catalytic contribution. The bulk of the financing will therefore rely on institutional investment.**

39. **We recommend that the Commission and Member States work urgently with investors, including pension funds, to ensure their awareness of the opportunities, to identify obstacles and to propose solutions, such as the development of instruments to allow the pooling of resources in order to mitigate risk and encourage investment. Initiatives such as the EIB's Project Bond Initiative should be appropriately financed and promoted within the investment community. The EIB has a particular role in that promotion, but responsibility falls also to the Commission and Member States.**

40. **It is evident to us that a clear and credible EU energy and climate change policy through to 2030 is a pre-requisite for attracting investment and must therefore be adopted as a matter of urgency. Failure to invest, or investment at high financing costs due to perceived policy risk, could push up the overall cost of energy to consumers.**

Costs and pricing

41. The Commission was clear that there was growing political interest in energy prices as a factor in competitiveness, a position reflected in the Conclusions of the March 2013 European Council.[75] It has also risen to political prominence recently in light of the fall of the Bulgarian government, a consequence of high energy costs.[76]

42. Comparing the energy costs of different technologies is complex. Nevertheless, a 'levelised cost' can be established, representing the average cost over the lifetime of a plant, per megawatt hour (MWh) of electricity generated. This takes into account the fact that certain technologies, such as renewable energies and nuclear, are capital intensive while others, such as coal and gas, are fuel-intensive. These calculations are based on a high degree of uncertainty but they are nevertheless helpful to illustrate potential trends between technologies. Recent levelised costs published by the UK Government are set out in Appendix 7.

43. Key uncertainties in the levelised costs include the cost of fuel and capital. The IEA found in its World Energy Outlook 2012 that fossil fuel price rises would be likely over the period to 2035 in a Business as Usual scenario, and that they would be likely to stabilise if a low carbon path is taken. Similarly, the cost of capital will depend on the cost of lending to support the investment, a particularly important concern for renewable and nuclear energy. We were told that the extremely low running costs of nuclear and renewable energy mean that, in short-run competitive markets, they can induce periods of very low wholesale energy prices when the output from low

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[75] Q 216, European Council Conclusions 14–15 March 2013

[76] *Bulgarian government resigns amid protests over high electricity costs*, The Guardian, 20 February 2013;

carbon sources is sufficient to meet all electricity demand. This is known as the merit order effect.[77] Whilst an attractive proposition for consumers, this in turn risks undermining the investment case.[78]

44. It was clear from our evidence that costs evolve with innovation and industrial development, as illustrated dramatically by the swift expansion of shale gas exploitation in the US (see paragraphs 8 and 73). US gas prices dropped from a June 2008 high of $12.69 per million BTUs[79] to a low of $1.95 in April 2012, and had risen to $3.33 by February 2013.[80] We heard from BNEF that industrial development has led to a 50% reduction in solar photovoltaic costs over the last three years. The offshore wind industry is confident that it can reach a levelised cost of £100 per MWh (see paragraph 42 above) for projects contracting in 2020, from a price of around £130–140 per MWh at current prices. That objective assumes further technological development and the creation of a stable market and regulatory environment.[81]

45. Some witnesses considered that, while the internal market was containing prices, bills were likely to rise, at least in the short-term. The extent of that rise would be dependent on a range of factors, including energy mix, but particularly on the ability to attract low cost investment into the energy system and on levels of energy efficiency. Sir Donald Miller warned of consumer bill rises of up to 58% by 2020 if no changes were made to energy policy.[82] Statistics on energy prices across the EU are only available until the second half of 2011 (see Appendix 8). They demonstrate that prices paid by industrial customers were significantly lower than those paid by domestic customers, a point highlighted to us by Mr Froggatt in relation to Germany.[83] The levels of taxes applied had a significant impact on the differences between Member States.

46. All of the Commission's Energy Roadmap 2050 scenarios involve a substantial move towards renewable energy. It is therefore interesting to assess the German experience, as Germany is already moving in that direction. Germany subsidises producers of renewable energy such as solar and wind power in part by imposing a supplement on household electricity bills. As the industry has grown, demand for the subsidy has increased, driving the surcharge up. In January 2013, the surcharge, which amounts to about 14% of electricity prices, almost doubled to €5.28 per kilowatt hour (KWh). The German government has proposed to put a cap on this surcharge until the end of 2014 and then restrict any rise in the surcharge after that to no more than 2.5% a year. It also plans to tighten exemptions, which would force more companies to pay the surcharge, thus helping to balance out the burden between industry and consumers.[84] Dr Neuhoff explained that, in 2013, German consumers "will pay on average about 2.5%

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77 Q 94, RenewableUK, Fiona Hall MEP

78 Q96

79 British Thermal Units (worldwide measurement of gas)

80 *Henry Hub Gold Coast Natural Gas Spot Price*, US Energy Information Administration

81 EIT, IET, Vestas

82 Q 60, Q 94, Q 194, Q 321, CIBSE, IET, Sir Donald Miller, Oil & Gas UK

83 Q 36

84 *Germany to curb green energy supports*, Energy Market Price.com, 15 February 2013

of their expenditure bill for their power", compared to an average expenditure of 2.3% for power in the mid-1980s.[85]

47. In examining the extent to which industrial and consumer bills may need to rise, we noted that fossil fuel and network costs still account for the great majority of the electricity price in almost all Member States (see Appendix 8). This demonstrates that the price of the commodity affects the majority of the bill, with the remainder consisting of costs to cover distribution, transmission, storage and margin. If, therefore, surcharges were to be applied to bills to cover the costs of a transition to greater renewable energy or development of CCS, its impact would be small compared to the impact of changes in commodity prices. A number of witnesses emphasised that a move towards low carbon generation and away from volatile fossil fuels could certainly stabilise bills rather than force increases,[86] particularly if the costs of extraction of fossil fuels rose dramatically in future years.[87] WWF cited a study by Oxford Economics for the Department of Energy and Climate Change (DECC), which found that the impact on UK economic output from fossil fuel price shocks could be reduced by around 60% in 2050 through the introduction of climate policies, such as a greater focus on energy efficiency and the large-scale deployment of renewable energy.[88]

48. The risk of fuel poverty[89] as a result of rising energy bills was explored with some witnesses. The Commission was clear that the issue "fully justifies" Member State intervention. Indeed, EU internal energy market legislation allows Member States to define vulnerable groups of consumers and to regulate prices for those consumers. Several witnesses pointed to energy efficiency as an important part of the solution to fuel poverty.[90] In its Energy Roadmap 2050, the Commission noted that specific measures needed to be defined at national and local levels to avoid energy poverty. One such example was that of Flanders, where consumers unable to pay their energy bills are supplied by the energy distributors on the basis of an agreed payment plan.[91]

49. **Energy pricing is, rightly, attracting attention as a factor of competitiveness and affordable energy should certainly be a goal of policy makers. The impact of the required energy transformation on retail bills, for industry and consumers, is uncertain. Ultimately, retail bills depend on a combination of taxation, energy efficiency and, most significantly, potentially volatile energy costs driven by business cycles and uncertainty. Policy makers cannot totally control volatility but their actions can mitigate its impact. We consider that bills are more likely to increase long-term if delays in developing a clear policy framework fail to ensure adequate and timely investment,**

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85 Q 5

86 Q 94, EDF, SSE, WWF

87 Q 57, Q 89, Q 267, DECC, EDF, Fiona Hall MEP, SSE, WWF

88 *Fossil fuel price shocks and a low carbon economy*, Oxford Economics, December 2011, a report for DECC

89 A household is currently said by DECC to be in fuel poverty if it needs to spend more than 10% of its income on fuel to maintain a satisfactory heating regime

90 Q 7, Q 23, Q 260, Q 379, E.ON supplementary evidence

91 *An introduction to fuel poverty in Belgium*, EU Fuel Poverty Network, 2 November 2012

including and particularly relating to low carbon sources which do not depend on global fossil fuel markets.

50. **Failure to stabilise bills could provoke a serious political backlash. This underlines the need for governments and energy suppliers to convey a transparent and credible narrative to their consumers about the objectives of energy policy. As recommended by the Commission, specific measures must be defined at national and local levels to tackle fuel poverty.**

CHAPTER 3: THE ENERGY MIX

EU competence

51. Throughout our inquiry, witnesses recognised the provision in the Lisbon Treaty (see Box 1) that the energy mix—that is, the choice of energy sources—remains a national competence and for Member States to decide.[92] It was noted, however, that there is EU legislation relating to renewable energy, market liberalisation and emissions reductions which do, as highlighted by Mr Froggatt, "affect the choice of Member States".[93] For example, the Renewable Energy Directive[94] sets a minimum level of energy to be derived from renewable sources.

52. The European Commission emphasised that the purpose of European policy is not to divide competence, but to "add value to what is a national energy policy" and see what "can be done in common". This common interest in relation to energy, the Commission explained, is the mutual challenge of "providing safe and secure energy at affordable prices".[95] It is no longer possible, the Commission observed, to talk about a national electricity generation policy, without taking into account what is happening elsewhere and in neighbouring countries.[96] This extended to considerations of whether support by Member States to certain sectors constituted unacceptable state aid.[97]

53. It was generally accepted that the decisions taken by one Member State—such as pursuing renewable energy—can have significant implications for neighbouring countries. Some witnesses focused on Germany and its decision to phase out nuclear energy in favour of renewable energy and more coal-fired power, and the impact this can have on its neighbours in terms of unplanned surges of electricity through neighbouring countries at times of high wind energy production.[98] As a potential step forward, the Office of Gas and Electricity Markets (Ofgem) supported the proposition that some form of mechanism be introduced that would require governments to hold discussions with neighbouring countries before going ahead with national policies.[99] Ms Niki Tzavela MEP advocated a stronger "pan-European governance"[100] on energy so that, at the very least, Member States are held accountable for the policy decisions they make.[101]

54. There is an inherent tension between EU-level environmental and competition goals, its renewable energy and internal energy market policies, on the one hand, and maintenance by Member States of responsibility for the

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92 Q 60, Q 81, Q 235, Q 239, Q 309, Q 353, Q 366, FSR

93 Q 45

94 Directive 2009/28

95 Q 60

96 Q 61

97 Q 263

98 *ibid.*, Dr Karsten Neuhoff supplementary evidence

99 Q 339

100 Q 239

101 Q 190

energy mix on the other hand. If Member States do not all adopt secure and responsible generation policies, there is a danger that the EU may fail to meet the objectives not only of its energy policy, but also of its environmental policy. **We recommend that consideration should be given to annual obligatory reporting by Member States to the Commission on their national energy policies, with assessments conducted by the Commission on the implications of emerging policies for neighbouring countries and the EU as a whole. This must extend to assessment of the compatibility of national policies with EU rules on state aid, on which we recommend the Commission provides further clarity.**

Carbon capture and storage

55. Carbon capture and storage (CCS) (see Box 3) is seen by many as an important technology in the decarbonisation process. As noted in the UK Government's Gas Generation Strategy, CCS has the potential to decarbonise power and industrial sectors in "economies worldwide".[102] According to the IEA, fossil fuels (including oil) met 81% of total global energy demand in 2009. The IEA emphasised that the only way to burn fossil fuels without adding more CO_2 to the atmosphere is through the use of CCS.[103]

BOX 3

Carbon capture and storage

CCS involves capturing carbon dioxide from fossil fuel power stations (or large industrial sources), transporting it mainly via pipelines and then storing it safely onshore or offshore in deep underground structures such as depleted oil and gas reservoirs or deep saline aquifers. It is estimated that the total reduction in emissions per unit of electricity from the use of CCS is around 70%.[104]

56. Although generally agreed that CCS applied to fossil fuel combustion is likely to be of critical worldwide importance, there has been a regrettable lack of progress, as was emphasised by the Commission in its recent Communication on the future of CCS in the EU.[105] The IPPR said that, whilst CCS is technically workable and environmentally acceptable, it has proved challenging to make it commercially viable.[106] WWF stressed that CCS is still only at the pre-demonstration stage, with repeated delays resulting in uncertainty.[107] The Secretary of State noted the importance of calculating how everyone involved in the supply chain could get a return on

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102 *Gas Generation Strategy*, Department of Energy and Climate Change, December 2012

103 *CCS is a necessity for a world hooked on fossil fuels*, IEA.com, 1 January 2013

104 DECC supplementary evidence, *Environmental impact assessment of CCS chains–Lessons learned and limitations from Life Cycle Analysis literature*, International Journal of Greenhouse Gas Control, Vol. 13, March 2013

105 Q 12, Q 104, Q 250, Q 369, COM(2013) 180

106 IPPR

107 WWF

their investment.[108] The UK Government announced in their March 2013 Budget that two CCS projects[109] had been selected to go forward to a detailed design phase (known as Front End Engineering Design[110]) of the CCS competition, which the Secretary of State claimed was a significant step closer to a viable CCS industry. The intention of the UK competition is to make available £1 billion of funding to the preferred bidder.[111]

57. Divergence of views among Member States is another reason for lack of investment. German projects to apply CCS have been restricted due to public concerns about onshore CO_2 storage. The Commission's own NER-300[112] facility to support CCS demonstration projects has declined massively in value as the EU Emissions Trading System (ETS) price has collapsed, and this has been compounded by the unwillingness of Member States to support the bids. As a result, no CCS projects were supported within the original competition and a portion of the finance was held back to reopen the competition in mid 2013. A number of witnesses considered that insufficient progress on CCS was being made, and much of this criticism was directed at Member States.[113] The Commission noted its additional concern about the exclusive focus on coal, with no gas in the possible demonstration projects considered thus far for NER-300 support.

58. As for how CCS might be encouraged, suggestions included: an EU-level Emissions Performance Standard (EPS), which would prevent the operations of coal-fired power stations unless they were equipped with sufficient CCS to meet the required standard; the mandatory application of CCS at some point in the future; and improved collaboration between Member States, perhaps through a credit system allowing Member States or industry to invest where there was the least public resistance. Mr Chris Davies MEP, who articulated the latter suggestion, observed that an EPS at the levels currently being proposed in the UK would simply be a mechanism to favour gas over coal and would not necessarily encourage the use of CCS.[114] The Commission agreed in its recent Communication on CCS in the EU.[115] Mr Tindale, though, argued that an EU-wide EPS set at a sufficiently low level would rule out "cheap, highly polluting forms of energy", as it would cap their emissions intensity (greenhouse gas per unit of output).[116] From the UK perspective, National Grid highlighted how CCS has a crucial role to play in meeting carbon targets affordably.[117] The European Climate Foundation (ECF)

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108 Q 371

109 Peterhead Project in Aberdeenshire, Scotland, and the White Rose Project in Yorkshire, England

110 Front End Engineering and Design (FEED) studies are best practice for complex projects in the engineering and construction industry. FEED studies typically follow on from initial high-level plans, and allow project developers to refine designs and, for example, source quotes from suppliers

111 *Preferred bidders announced in UK's £1bn CCS Competition*, GOV.uk, 20 March 2013

112 The NER-300 was launched by the Commission in 2008. It is intended to provide financial support for the development of innovative low-carbon technologies, at commercial scale, across the EU. Funding derives from selling 300 million allowances (or rights to emit one tonne of CO_2) in the New Entrants' Reserve of the ETS

113 Q 38, Q 63, Q 104, Q 161, Q 225, Q 250

114 Q 251

115 COM(2013) 180

116 CER

117 National Grid

suggested that the focus should be on the application of CCS to gas and industry, particularly given the likely reduction in coal capacity. It was noted that such a concentration might be easier if there was a focus on industrial clusters so that the by-products of CCS can be used.[118]

59. The Secretary of State noted that the development of CCS in the EU could allow it—and the UK in particular, given its huge offshore storage potential—to take a lead in developing the technology.[119] This position was supported by National Grid who noted that the combination of EU programmes, along with UK support through the DECC commercialisation programme has "ensured that the UK and Europe are at the forefront of this technological development" and are thus well-placed to take advantage of the resulting opportunities.[120]

60. **In terms of worldwide electricity generation, CCS could make a larger contribution than anything else to reducing greenhouse gas emissions. The EU has a common interest in the development of CCS because of its common decarbonisation target and availability of significant carbon storage capacity.**

61. **We consider that, in relation to both coal and gas, CCS is technically feasible, but faces both financial and political obstacles. We urge the UK Government to deliver and build on its commitments to support pilot projects and stress the importance of an EU CCS portfolio including at least one CCS project applied to gas.**

62. **Where possible, CCS should be developed in industrial clusters so that it can be applied to industry as well as the power sector, thereby allowing its by-products to be used for industrial purposes.**

63. **It is particularly disturbing that as the need for CCS has increased, the effort to deliver it appears to have diminished. The slow progress of CCS thus far and its importance to EU energy policy suggest that a stronger incentive needs to be developed at EU and Member State level. This requires a stable source of national and EU funding and a credible carbon price or regulatory approach. Such an approach should include a provisional target date for requiring CCS to be applied to any new fossil fuel power stations, based on the results of pilot projects.**

Gas

64. There was a strong view among witnesses that gas is important as a transitional fuel[121] for two reasons: to complement the intermittency[122] of renewable sources; and to provide capacity of lower carbon content than coal while renewables are being developed. The IEA has also recommended gas as a substitute for coal.

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[118] Q 122

[119] Q 369

[120] *op. cit.*

[121] Transitional fuels are temporary energy sources used in the move from fossil fuels to low carbon emitting energy sources

[122] Intermittency refers to the variability of output according to changes in weather

65. Highlighting the importance of gas as a transitional fuel, Professor Dieter Helm noted that gas provides "one short-term option to do less damage than coal" (see Box 4), but is "not a permanent solution", and might therefore require strong regulation to ensure that industry moves away from gas.[123] The European Economic and Social Committee (EESC) also suggested that gas should be considered as a temporary substitute for the most polluting sources of energy, but noted it should play a limited role as a transition fuel.[124] Professor Helm highlighted the concern that prolonged use of gas could result in a 'lock-in' to carbon-based plant and infrastructure. He suggested that regulations in the form of "emissions performance standards", for example, could be employed to prevent this from occurring.[125]

BOX 4

Comparative greenhouse gas emissions of fossil fuels

Greenhouse gas emissions: gas vs. coal[126]

Gas 300–350 gCO_2/KWh[127]

Coal 600–800 gCO_2/KWh

Lignite 800–1,000 gCO_2/KWh

These figures clearly demonstrate how coal and lignite are both far more carbon emitting than gas (with lignite being worse than coal). It is because of the high carbon emitting nature of coal and lignite that there is a high preference for the alternative use of gas. Furthermore, if CCS was applied to the use of gas, this would help reduce its greenhouse gas emissions even further.

66. Dr Gross supported these views when he stated that in the short-to medium term it is important that we have gas as a back-up, but in a similar attempt to avoid a gas 'lock-in', we would "need to make sure that the inbuilt incentive to use that plant more than our carbon targets would suggest is overcome".[128]

67. The role of gas in energy security was also emphasised by witnesses, but this will be discussed in greater detail in Chapter 6.

68. **Gas has an important role as a transitional fuel, in moderating the cost of energy while larger renewable resources are further developed, and in balancing the system as the scale of intermittent inputs rises. However, further gas investment also carries a risk of 'lock-in' to carbon-based plant and infrastructure. Regulation, indicated well in advance, may be required in order to manage the transition to further decarbonisation, whether by CCS or by moving beyond gas.**

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123 Q 119

124 EESC

125 Q 119

126 Q 53

127 Grammes of carbon dioxide per kilowatt hour

128 QQ 99–100

Unconventional gas-shale gas

BOX 5

Unconventional gas

Unconventional Gas

The term unconventional refers to the source rather than the nature of the gas itself. Shale gas and coal-bed methane are examples of unconventional gas.[129]

Shale Gas

Gases are extracted directly from shale (a sedimentary rock). This has a low permeability and so does not release gas easily. To overcome this, the rock is fractured ('stimulated') to yield commercial volumes of gas. In the UK, there are several layers of shale that have potential for exploitation. The largest resources are estimated to be in the Upper Bowland Shale of the Pennine Basin (underlying Lancashire and Yorkshire), with further resources in the Wessex and Weald Basins (underlying Sussex, Hampshire and Dorset).[130]

Deposits of shale gas can be found elsewhere throughout Europe. In particular, there is a notable concentration of shale gas basins in eastern Europe.[131]

69. Shale gas (see Box 5) was described as a "global game changer"[132] and an "unexpected revolution"[133]. In considering this energy source, several witnesses were open-minded about the development of shale gas in the EU but emphasised the need for clear regulation. Mr Tindale, for example, noted that whilst the use of shale gas in the short-term is a possibility, it is "not low carbon enough without CCS", suggesting that CCS might be introduced alongside the exploitation of shale gas to reduce carbon emissions.[134] Others, however, raised concerns over the exploitation of shale gas in the EU compared to elsewhere in the world. Mr Froggatt suggested that shale gas may be difficult to develop in the EU as, first, it does not have the infrastructure and, second, "the licensing process will be different".[135] For Ms Fiona Hall MEP, it would be controversial to extract shale gas in Europe due to the continent's high population density, suggesting that the global competitive advantage for the EU lay in renewable energy.[136]

70. Some witnesses, such as Professor Helm, took a more positive approach, emphasising that the discussion of the regulatory issues relating to shale gas should be set against the alternative of coal. He argued that, while there were environmental problems associated with shale gas, it was still "phenomenally better" than coal, particularly given that coal leaks methane, leaches heavy

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129 *Unconventional Gas*, Parliamentary Office of Science and Technology (PostNote 374, April 2011)

130 *ibid.*

131 *Unconventional Gas in Europe*, The Economist, 2 February 2013

132 Q 47

133 Q 81

134 Q 2

135 Q 47

136 Fiona Hall MEP

metals, pollutes the water table, requires an intensive amount of energy and damages the health of coalminers.[137]

71. Ms Tzavela MEP called specifically on the UK to take a lead in the exploitation of shale gas. Whilst accepting that shale gas presented a challenge for the EU, she argued that it could be developed enough to allow the EU to exploit its own shale gas resources. Ms Tzavela MEP claimed, however, that shale gas would be "a success story in Europe" if it was led by the UK, which she attributed to the UK's well-established business and regulatory environments.[138]

72. We were told by the Commission that a framework proposal regarding shale gas is due late in 2013, which will consider how the exploration and exploitation of shale gas "from the point of view of the environment, climate and energy policies" can be conducted sensibly.[139] The Commission accepted that there were still a number of issues to be resolved—such as the environmental impact of shale gas extraction—but were clear that Member States should "definitely not close the door" on the possibility of future shale gas extraction if these issues can be resolved.[140] The Commission also put forward the option of importing shale gas in the form of liquid natural gas (LNG) (see Chapter 6) from the US, rather than exploiting it in the EU, and holding on to indigenous EU reserves until a future date.[141]

73. Witnesses said that obstacles to the exploration of shale gas included high population density and "the likelihood of local objections", with notable scepticism on whether these obstacles could be overcome.[142] In particular, Professor Jonathan Stern warned that people in the EU do not understand the sheer scale on which drilling would need to take place for shale gas. He cited the US, for example, which drills over 45,000 wells per year, whereas not even 100 wells have been drilled across the entire EU.[143] According to Professor Stern, and supported by evidence received from EDF, the "environmental intolerance to the scale of the drilling that needs to be done" in order to develop shale gas is likely to prevent significant exploitation of shale gas in the EU until after 2020.[144]

74. A further potential problem with the use of shale gas is that it is nowhere near as developed in the EU as it is in the US. Whilst further regulated developments might be welcome, much more research is still required. The EU is unlikely to recreate a similar US 'shale gas revolution', and should not assume it can. The amount of shale gas resource and reserves are still largely unknown and can vary by study.[145] The Parliamentary Office of Science and Technology's paper on UK shale gas potential states that "Estimates of UK shale gas are at an early stage of development", and that there is "uncertainty

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[137] Q 119
[138] QQ 241–242
[139] Q 267
[140] Q 267
[141] *ibid.*
[142] Q 171
[143] Q 146
[144] *ibid.*, EDF
[145] EDF

in resource estimates".[146] One estimate from the British Geological Survey puts UK potential at approximately 150 billion cubic metres (bcm), and another from the US Energy Information Administration suggests around 570 bcm.[147] Neighbouring regions, such as North Africa, may also have shale gas reserves that, if exploited, could be utilised by the EU.[148]

75. **We agree that a regulatory structure for the exploitation of shale gas in the EU should be developed. We caution, however, that fundamental structural differences (including population density, geology, planning and legal factors) make it highly questionable that the EU could repeat the US experience. The EU is unlikely to compete on the basis of cheap fossil fuels. Creation of such a false hope would undermine the policy stability required to attract investment. We therefore conclude that there is some uncertainty about the likely extent of EU-produced shale gas. The EU must take into account the further exploitation of shale gas in neighbouring regions and the implications of this for EU energy policy.**

Coal and lignite

BOX 6

Lignite

Lignite is the lowest rank of coal with the lowest energy content. Lignite coal deposits tend to be relatively young coal deposits that were not subjected to extreme heat or pressure, containing 25%–35% carbon.[149] Lignite can also contain high sulphur content.

76. There appears to be a revival in the demand for coal and lignite (see Box 6) in the EU, which Professor Helm referred to as a "dash for coal".[150] Coal represents 25% of EU electricity generation, and 40% of UK generation. The Scientific Alliance drew attention to the fact that coal is presently "the most economic fuel to burn in Europe".[151] Various witnesses cautioned against dramatisation of this phenomenon, which has been driven partly by the low carbon price under the ETS, partly by cheap coal prices in the US due to the shale gas revolution, partly (in Germany) by the move away from nuclear energy and partly by the UK carbon floor price and closures under EU environmental regulations.[152]

77. In exploring coal and lignite development in Germany, it became clear that, while many projects have been planned, very few are reaching the commercialisation stage. Dr Neuhoff pointed out that, of eight new plants that had been expected to be operational in Germany by 2013/2014, technical difficulties have delayed investment. Six were still expected to be

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146 *UK Shale Gas Potential*, Parliamentary Office of Science and Technology (PostBox, January 2013)

147 *ibid.*

148 *Europe's Shale Boom lies in North Africa as Algeria woos Exxon*, Bloomberg News, 26 November 2012

149 *Coal explained*, US Energy Information Administration

150 Q 121

151 Scientific Alliance

152 Q 35, Q 104, Q 106, Q 110, Q 119, Q 336

completed but two projects had been stalled due to legal reasons, and may not be built. Of all the other planned projects, only three remain possible.[153] Mr Froggatt expressed his view that “there is a significant difference between what is under proposal or planning and what will actually be built in Germany”, believing that “what will be built will be significantly less”.[154]

78. For the whole of the EU, the ECF reported a similar situation, and of 112 announced projects (since the early 2000s), only two or three have reached construction stage.[155] Despite these somewhat faltering figures, witnesses nevertheless conceded the continued importance of coal: there still remains the prospect of 20 new, largely lignite, plants; coal still represents around 25% of all EU electricity generation; and subsidies are still available in Poland and Romania for new coal plants.[156]

79. The apparent surge in coal is linked to generation, not capacity—that is, there has been an increase in coal usage as opposed to capacity change. The Confederation of UK Coal Producers (CoalPro) said that the “scandalously high” price of gas (which is more than double the cost for coal) has resulted in an increase in the burning of coal.[157] In the UK, for example, coal burn was up 40% from 28 million tonnes to 39 million tonnes in the first 9 months of 2012, which was similar to the situation in Germany.[158] A low carbon price under the ETS has also been cited as a contributing factor, as is, in Germany, the phasing out of nuclear energy.

80. WWF claimed that we are not seeing “a coal renaissance”,[159] and the Commission argued that there will be a “rebirth of investment in gas rather than coal as a complement to renewables”.[160] Additionally, the ECF observed that this surge in coal is unlikely to be sustained given the national policies in place to disincentivise the use of coal. For example, Denmark has opted to establish a tax on coal, and Finland has made a similar pledge to phase out the use of all coal.[161]

81. Moreover, the capacity of the EU’s coal fleet is likely to be hit by application of the EU Large Combustion Plant Directive (LCPD) and the Industrial Emissions Directive (IED) (see Appendix 6), which will lead to the closures of some coal plants.[162] The ECF estimated closures following the LCPD at 20 GW[163] across the EU,[164] with 8 GW of closure in the UK (including 5 GW by March 2013).[165] ECF referenced BNEF figures, which identified that, of 207 GW of coal capacity across the entire EU, 124 GW is not

153 Dr Karsten Neuhoff supplementary evidence

154 Q 35

155 Q 104

156 Q 104, Q 106, Q 110

157 Q 104

158 Q 104

159 Q 336

160 Q 63

161 Q 109

162 Q 202, Oil & Gas UK

163 Total available EU generation capacity is around 800 GW, with around 80 GW in the UK (Eurelectic)

164 Q 104

165 Q 107

compliant with IED.[166] Whilst closures following the IED are unclear, only one UK plant has thus far taken the decision to invest to meet the IED requirements, suggesting that all other remaining plants may choose to shut down. This would have significant consequences given that coal currently provides nearly 40% of UK power.[167]

82. **We note with concern the resurgence of coal in the EU. While significant closures are expected to take place as a result of EU environmental Directives, we observe that new plants compliant with those Directives are in preparation. We warn that, if the price of carbon under the ETS languishes for long, its credibility as a deterrent to new coal investment will be lost. The further development of coal in circumstances where CCS is not a proven technology would carry a high risk, not only in terms of climate change (and EU credibility), but also economic risk of stranded assets.**

Renewable energy

BOX 7

Renewable energy

EU legislation defines renewable energy as energy from renewable non-fossil sources, namely: wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.[168]

83. The Committee heard that renewable energies (see Box 7) represented 6% of total EU power generation in 2011, and were evolving swiftly.[169] According to WWF, in 2012, 77% of the increase in EU energy capacity additions came from renewable sources.[170] WWF also referred to a report from the European Wind Energy Association, which showed that there were 1.1 GW of offshore wind added in 2012, with figures of 1.4 GW and 1.9 GW anticipated for 2013 and 2014 respectively.[171] Taking Germany as an example, Mr Froggatt pointed out that, over the past three years, approximately 7 GW per annum of solar energy has come online, with a solar capacity now standing at around 30 GW.[172] ABB Limited identified that the renewable energy sector in the UK alone currently accounts for 110,000 jobs, with an expected growth to 400,000 by 2020.[173] These clearly indicate rapid growth rates. At the same time, the costs of renewable energy are coming down. While they are still all more expensive than fossil fuels, renewable sources such as onshore wind, for example, were highlighted by Mr Tindale as only a little more expensive than

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[166] Q 105

[167] Q 107

[168] Directive 2003/54

[169] Q 171: This figure represents renewable energies excluding large hydro, and only includes hydro up to 50MW

[170] Q 318

[171] *ibid.*

[172] Q 35

[173] ABB Limited

gas.[174] As is evident from the table of levelised costs in Appendix 7, this does assume, however, the existence of a robust carbon price.

84. All the scenarios in the Commission's Energy 2050 Roadmap find that renewable energy must play a part in the future of EU energy. In particular, Mr Tindale emphasised that renewable energies have an important role to play in energy security by reducing reliance on imported fossil fuels with their volatile prices and potential political dependency.[175] There are, however, concerns relating to public acceptance, which render some renewable energies, such as onshore wind, challenging to exploit.[176]

85. Renewable energy support schemes are already in place across the EU. There has been a recognition, echoed by the Secretary of State, that subsidies under those schemes were initially set at unsustainably high levels.[177] The Commission indicated that support schemes are national and of varying quality in terms of their effectiveness. The Commission suggested that there was an emerging view that feed-in premia (a fixed premium (£/MWh) paid to the generator for each unit of electricity in addition to the market price) have been more successful than other support systems.[178] We heard that support should be temporary and should, wherever possible, be phased out—including for expensive technologies, such as offshore wind, which are moving closer to market viability (the target price for offshore wind is £100 per MWh by 2020 at 2011 prices).[179] It was also argued that the harmonisation of support schemes might be helpful. Professor Helm argued against support schemes for expensive but relatively mature technologies, such as offshore wind. We explore this argument further in Chapter 5.

86. A particular challenge facing some renewable energies is that of tackling intermittency. Dr Gross noted that there are "very real electrical engineering issues" surrounding intermittency that must be considered, particularly relating to system balancing and response—that is, the speed of change. For example, if the wind output is dropping very quickly in the opposite direction to increasing demand, one needs to be able to manage the lull.[180] It was argued that intermittency can be tackled in four ways: by improving interconnection; boosting the strategic use of electricity through smart technologies (such as smart meters, grids and appliances); developing electricity storage; and through capacity payments, which would encourage investment in gas power.[181] In discussing the issue of intermittency, RenewableUK stressed the importance of physical interconnection, to allow the trading of resources across borders, and regulatory intervention—market coupling and market integration. It claimed that being able to trade across borders will "dampen the volatility and equalise the prices more across Europe".[182] As discussed in paragraph 62, it was suggested that gas could be

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[174] Q 5

[175] Q 11

[176] QQ 60, 283

[177] Q 88, Q 138, Q 173, Q 174

[178] Q 261

[179] Q 98, *Offshore Wind Cost Reduction*, The Crown Estate, May 2012

[180] Q 99

[181] Q 37

[182] Q 97

used as a short-term mechanism to cope with intermittency, whereas ENTSO-E stressed the importance of grid development.[183] There are some renewable energy—such as tidal power and biomass—that are not subject to intermittency. As an increasing amount of wind power comes on to the grid, the challenge will be greater and demand-side response will become more important.[184] We explore interconnection in greater detail in Chapter 6.

87. The Commission expressed its view that the integration of variable sources of energy is technically feasible—pointing to Spain, Germany and Denmark as examples. However, this would require significant development of the grid infrastructure. It warned that, otherwise, there could be a repeat of the problem experienced in connection with Germany, where neighbouring countries were flooded with surplus electricity.[185]

88. **There are a range of renewable energy technologies at various stages of development. A number of onshore renewable resources, including wind, could be close to cost-competitive with present fossil fuel prices if the carbon price was more robust, but they are impeded in particular by public opposition as well as strategic uncertainties about energy prices and policy.**

89. **For much of northern Europe, including the UK, offshore renewable energy will require sustained investment, including by way of support schemes, to bring down costs. We would not support harmonisation of national support schemes but welcome work by the Commission to identify examples of best practice. We agree that support schemes should be temporary and phased out as a technology progresses towards commercial viability.**

90. **We accept that the increasing development of renewable energy has implications for the continuity of supply due to the intermittent nature of some renewable energy generation. This challenge should not be underestimated, but nor need it be an obstacle to the further development of renewable energy. It can be overcome through demand-side response, interconnection, storage and gas generation, although the necessity for gas to play this role should recede over the medium- to long-term.**

91. **We conclude from the German energy transformation thus far that, in practice, the safe and reliable introduction of high levels of renewable power requires coordination with neighbouring Member States.**

Nuclear

92. We received limited evidence on nuclear power. Most of those who commented were not overly optimistic about its role in future EU energy policy. Mr Tindale supported it as a bridge technology, given that it is expected to take "several decades" to achieve 100% renewable energy.[186] The

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183 Q 295

184 Q 37, Q 97, Q 99, Q 152, Q 295, Q 333, European Commission

185 European Commission supplementary evidence

186 Q 10

CBI similarly suggested that nuclear power could be part of a balanced energy mix.[187]

93. We were warned by witnesses such as Mr Froggatt that nuclear power remains politically divisive among Member States, highlighting the fact that there is no EU consensus on the role of nuclear power. For example, whereas Germany has declared its intention to move away from nuclear power entirely, France relies quite significantly on nuclear, and Belgium has reversed its previous decision to phase out nuclear power.[188]

94. Professor Helm was similarly cautious about the prospect of nuclear new builds. He noted that the costs involved at present are very uncertain and also drew attention to the German situation where nuclear reduction has led to coal growth—something we have already identified as undesirable.[189] Professor Stern considered substantial new nuclear build in Europe to be unlikely, largely due to the negative environmental and financial costs, but also due to cautious attitudes in the aftermath of the Fukushima nuclear incident in Japan.[190] We were also informed about the uncertainties in financing nuclear projects across Europe. It was concluded by WWF that, even setting aside its environmental concerns relating to nuclear power, current economic difficulties make it "extremely unlikely" that much nuclear capacity will be built in the UK or the EU over the next 20 years.[191] WWF cited a paper which argued that the complexity and continually rising costs—as well as making appropriate safety, waste management and decommissioning arrangements—associated with nuclear energy would always limit its role in the power sector "worldwide".[192] BNEF identified recent examples of such difficulties in Europe, noting that an "unfortunate characteristic" of recent nuclear projects such as the Olkiluoto EPR in Finland and the Flamanville EPR in France were cost overruns and delays.[193] WWF claimed that issues surrounding insurance and liability further exacerbate the large financial costs associated to nuclear power. Whilst corporate liability for any nuclear accident is capped at around £1 billion by European law, the "taxpayer would pay for the clean-up of any major accident". WWF cited the example of the Fukushima incident, in which compensation costs are estimated to be £35 billion, with the total clean-up costs likely to exceed £160 billion. Therefore, it concluded, if the nuclear industry were to insure itself properly, the electricity would be unaffordable.[194]

95. It was also argued that, from a UK perspective, similar construction delays and cost overruns would be expected. For example, Centrica (who own British Gas), had the option of taking a 20% stake in the UK's nuclear new build programme in a partnership with EDF. Centrica, however, now appears to have opted out of nuclear in the UK and may write off £200

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187 Q 322

188 Q 45

189 Q 136

190 Q 151

191 WWF supplementary evidence

192 *The Dream That Failed*, The Economist, 10 March 2012

193 BNEF supplementary evidence

194 WWF supplementary evidence

million.[195] BNEF noted that Centrica had reportedly spent £1 billion in upfront costs through to the end of 2012, but feared that the cost escalation of the proposed Hinkley Point projects from £4.5 billion to £7 billion each suggests there may be better investment opportunities elsewhere.[196] Whilst the UK Government announced that they were granting planning permission to EDF to construct Hinkley Point C on 19 March 2013, questions still remain over the electricity price required to fund its construction.[197]

96. WWF warned that there may be additional political and legal barriers to the construction of new nuclear plants. It argued that the UK's current Electricity Market Reform (EMR) proposals on nuclear were "a clear breach of the Coalition Agreement's commitment not to subsidise nuclear power".[198] Furthermore, WWF claimed that the EMR proposals would constitute illegal state aid under EU law as tendering for nuclear energy does not correspond with the legal requirements of the internal energy market.[199]

97. The House of Commons Energy and Climate Change Committee's recent report on nuclear power in the UK concluded that, although the UK has failed to deliver nuclear new build, this does not pose a significant threat to energy security. There could, however, be increased indirect security threats, such as an increased reliance on imported gas.[200]

98. **There is not, and there never has been, consensus among Member States with regard to the role of nuclear energy. In the UK and elsewhere, financing remains problematic, both in terms of securing investment and with costs overrunning. Nuclear remains a low carbon option, but its future is uncertain in the EU. Important issues relating to state aid, liability and waste remain to be resolved and must be addressed by Member States and the Commission. Failure to agree the terms of significant new nuclear investment will inevitably increase reliance on alternative energy sources.**

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195 *Centrica unplugs UK nuclear plants*, The Times, 4 February 2013

196 WWF supplementary evidence

197 *Hinkley Point C: Building challenges*, BBC News, 19 March 2013

198 WWF supplementary evidence

199 *ibid.*

200 Energy and Climate Change Committee, 6th Report (2012–13): *Building New Nuclear: the challenges ahead* (HC 117)

CHAPTER 4: DELIVERING POLICY CLARITY—2030 FRAMEWORK

99. The European Commission's 2011 'Roadmap for moving to a competitive low carbon economy in 2050' identified a 40% greenhouse gas reduction target by 2030 as "the most cost-effective pathway" to 2050.[201] EU legislation, though, is currently limited to a 2020 target with a supporting framework. There has therefore been a debate about whether an EU framework, including a target accompanied by further supporting measures, should be set out until at least 2030.

100. The Commission responded to the debate by issuing a Green Paper on 27 March 2013 to consult on a new framework. The paper reflected demands that climate goals have to take account of the economic crisis, but still pressed for a low carbon economy that is less dependent on fossil fuel imports. It consulted on possible future targets such as a 40% cut in carbon emissions over 1990 levels and for 30% of energy needs to be met by renewable sources, both by 2030.[202] The Green Paper will now be the subject of discussion before legislation is proposed.

101. There was a consensus amongst the evidence received that clarity and consistency is required about what will be the energy and climate change framework until 2030. This was highlighted as necessary to provide more certainty for investment, and also because inertia in the energy system could make it much more expensive to make rapid carbon reductions later on. It was argued that maintaining steady progress towards well-defined goals was the most efficient approach, and that industry needed long-term visibility of these goals.[203] Moreover, a clear 2030 framework was highlighted as important to ensure that the EU has a credible and deliverable figure in mind before the UNFCCC conference in Paris in 2015, when it is hoped to secure a substantial new international climate change agreement.[204]

102. For a number of witnesses, such as Vestas, the strategic objective for a 2030 policy must be a continued reduction in greenhouse gas emissions.[205] This objective had to include a 2030 target as a necessary stepping stone, as otherwise there was the fear that people would "kick the can down the road and not do anything".[206]

103. **Member States must be under no illusion: failure to agree a 2030 framework will restrict investment, with subsequent implications for energy costs, climate change ambitions and energy security. A comprehensive framework must be underpinned by a greenhouse gas reduction target set at the suggested level of 40% compared to 1990 levels, and in line with at least an 80% reduction by 2050.**

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201 COM(2011) 885

202 COM(2013) 169

203 Q 2, Q 189, Q 190,Q 192, Q 209, Q 211, Q 315, ABB Limited, CER, DECC, ETI, WWF

204 Q 230

205 ABB Limited, E.ON, EDF, Vestas, WWF

206 Q 197

EU Emissions Trading System

104. It was stressed that green investment requires a supportive carbon price. Professor Helm stated that "If there is no carbon price, there is no money to be made from reducing carbon", meaning that without a carbon price, there will be little if no investment in green technologies.[207] In acknowledging the necessity of a carbon price to support green investment, the vast majority of witnesses stressed that the current carbon price under the EU's Emissions Trading System (ETS) is too low.[208] The evolution of prices until May 2012 is set out below (see Figure 1). Since then, prices have hovered around the €5 mark, and recently dipped as low as €2.75 on the primary market.[209]

FIGURE 1

Evolution of carbon prices[210]

Source: Intercontinental Exchange. Data for front-year futures contracts with delivery in December

105. The ETS was intended to perform a multitude of roles. As a market-based approach to achieve the most efficient emission reductions, it was also expected to help incentivise low carbon investment in the EU, was linked internationally as part of the EU's contribution to global climate goals (including support for low-cost emission reduction in developing countries) and was intended to be a source of funding for innovation (such as for carbon capture and storage (CCS)). There was agreement among witnesses ranging from the Commission to EDF that, in essence, the ETS market design has worked in contributing towards delivering efficient emissions reductions. Meeting these reduction targets, however, cannot be solely attributed to the ETS, but rather, is due to a combination of factors, including: the economic recession; weak original targets; the contribution made by renewable energy; an oversupply of imported overseas credits[211];

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207 Q 140

208 Q 9, Q 95, Q 123, Q 125, Q 191, Q 248, CER, Fiona Hall MEP

209 European Energy Exchange

210 COM(2012) 652

211 Overseas credits are awarded to emissions reduction projects outside the EU and can be sold to operators in the EU (and elsewhere) to count towards domestic (EU) emissions reductions. The ETS has only accepted credits that qualify under (and are monitored by) the UN under the Kyoto Protocol, and excludes land-use-based credits; additional restrictions apply from 2013

and a greater import of energy-intensive products. The resulting low demand for emission allowances has resulted in a price—and level of uncertainty—that has not encouraged low carbon investment and has significantly reduced the amount of funding available for innovation through the NER-300 (see paragraph 57 and Appendix 4).[212]

106. Professor Helm noted that the ETS had produced a "short-term, volatile and low price",[213] and along with other witnesses called for reform of the ETS in order to increase the carbon price. There was widespread agreement that the ETS required reform for a number of reasons: the need for clarity for industry investment; the potential economic benefits of low carbon investment; the economic risks associated with stranded investments in higher carbon energy; innovation and energy security benefits; and the climate and diplomatic benefits to be derived by the EU from taking a lead.[214]

107. Some witnesses questioned the benefit of reforming the ETS, noting that the EU accounts for only about 10% of overall global carbon emissions. CoalPro described an expensive EU system as "utter futility" given this.[215] However, others noted that a credible EU climate policy remains globally crucial, and that other regions are following the EU's lead: California and Australia have now implemented an ETS, the South Korean Parliament has legislated one to start in 2015 and China has seven pilot ETS programmes as part of its current Five-Year Plan.[216]

108. The Commission has published a paper setting out ways in which it believes reform could take place.[217] Most of the options focus on reducing directly the supply of allowances, but also include the option of price guarantee measures such as a floor price. This could take the form of a stated minimum reserve price on future auctions of ETS allowances. Prices in the existing market would rise as the current surplus was used up, until the market required allowances from auctions bought at or above the reserve price. The UK introduced a unilateral floor price from 1 April 2013 for its power sector, implemented with a carbon tax.

109. Many witnesses were supportive of the idea of a floor price, and suggested that price uncertainty in the ETS is a major impediment to investment.[218] It was also emphasised by Mr Wolf that determinants of the price of carbon needed to be as predictable as possible.[219] Some referred to the potential benefits of a floor price in reducing the real and perceived risks around low carbon investment, such as the shale gas displacement impact on coal.[220] In addition, a floor price would greatly reduce the uncertainties around revenues. Although the ETS was originally projected to raise several hundred

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212 Q 67, Q 113, Q 181, Q 199

213 Q 123

214 Q 95

215 Q 113

216 *Emissions trading: Cap and trade finds new energy*, Nature, Vol. 491, November 2012

217 COM(2012) 652

218 Q 12, QQ 28–29, Q 95, Q 123, Q 169, Q 199

219 Q 214

220 Q 95

billion Euros in the period up to 2020, current prices mean revenues will only be a small fraction of that.

110. A number of witnesses expressed concern about the political difficulty of agreeing a floor price, pointing in particular to resistance from the Commission.[221] The Commission itself conveyed unease about the complexity of Member State politics, and the risks of 'managing the market', including concern that discussing a floor price would also provoke discussion of a ceiling price.[222] The Californian system has both a floor and a ceiling to create a wide 'price corridor'.

111. There were a number of other suggestions about how the carbon market might be reformed, all of which were included as options in the Commission's paper on possible future reform of the ETS (see paragraph 108). WWF, for example, suggested a change to a 2.6% cap reduction[223] annually from the present through to 2050, rather than the current 1.74%.[224] The Commission and SSE similarly supported the development of a framework between 2020–30 that incorporated a "more restrictive target", which they deemed would help ensure a higher carbon price.[225] WWF and the Secretary of State considered that a more supportive price would be delivered by the permanent retirement of a number of allowances.[226] Others, such as Mr Dan Jorgensen MEP, argued that the possibility of off-setting to other countries, outside the EU, should be ended.[227] WWF also pointed to the issue of oversupply of imported overseas credits, which it said are largely responsible for general oversupply.[228]

112. On the proposal to 'backload' (see Appendix 4) the auctioning of allowances until later in Phase III (which ends in 2020) the Commission was clear that "explicit support" from the UK and Germany was required, warning that failure to adopt the proposal would suppress the carbon price even further.[229] Witnesses considered backloading to be a necessary and helpful first step, but stressed that the longer-term trajectory must be clear.[230] The Secretary of State confirmed that the UK would be willing to support the proposal as long as it was linked to a deal setting out a timetable for deciding on longer term structural reform of the ETS, which should include the permanent retirement of allowances.[231] It was stressed by the CBI, however, that before short-term adjustments could be made, such as with backloading, it was first necessary to be certain about the long-term direction of energy and climate change policy—in particular, beyond 2020.[232] The proposal was rejected by

221 Q 89, Q 199, Q 249

222 Q 258. In contrast to a floor price, which defines a minimum charge on emissions, a ceiling price defines a fixed price at which additional allowances are made available in excess of the cap

223 Under the ETS, the cap is an absolute total of emissions allowed to be emitted by all participants. It is set by the Commission and each participant is allocated an individual limit or cap for their own emissions

224 Q 312

225 Q 67, Q 199

226 Q 312, Q 374

227 Q 249

228 Q 312

229 Q 219

230 Q 28

231 Q 374

232 Q 312

the European Parliament on 16 April 2013 and will be reconsidered by the European Parliament and Member States.

113. **The recession and other factors have made the ETS marginal in terms of driving emissions reduction. Its history and current design render it ineffective at achieving its other goals. Experience has demonstrated the extreme sensitivity of the ETS to unanticipated developments.**

114. **We support the backloading proposal to amend the ETS in the short-term but we agree with some of our witnesses that it will be ineffectual without a commitment to a timetable for longer-term structural reform. This should be agreed by 2015 in advance of the Paris international climate change negotiations.**

115. **The dominant options for rejuvenating the ETS include tightening the cap and setting a floor price. The uncertainty in revenues makes it impossible for governments to budget effective use of ETS revenues, and the price collapse has reduced the major source of expected EU finance for CCS.We therefore conclude that a floor price would simultaneously increase investor confidence and help to stabilise possible financing for infrastructure, low carbon innovation and related applications.**

116. **A combination of both tightening the cap and introducing a floor price, seen as part of a package to attract new investment and support efficiency and innovation, may help to alleviate some of the political opposition to both options. Structural reform is important to restore credibility and meet the multiple goals of the ETS, but a clear trajectory for a reduction in the cap over the period to 2030 would remain important.**

Renewable energy target

117. There was a divergence of views among witnesses on the desirability of a 2030 renewable energy target as part of the 2030 framework. Several supported such a target on the basis that the 2020 target has stimulated investment. Mr Tindale and SSE noted how the 2020 target has driven investment into renewable energy,[233] by setting out clear targets against which to invest.[234] Mr Tindale identified another argument in favour of a renewable energy target, pointing out its possible role in persuading the public to support other low carbon alternatives, such as nuclear power, in the medium-term in the knowledge that renewable energy was being further developed.[235]

118. A number of witnesses agreed that the 2020 target had been helpful but were unwilling at this stage to commit to a 2030 target. ScottishPower said that a 2020 target was helpful, but whilst it "would not rule out" a target beyond 2020, this target might be "a more indicative target", allowing Member States greater flexibility.[236] BNEF agreed that the 2020 target had offered

[233] Q 9

[234] Q 195

[235] Q 9

[236] Q 197

appropriate "investment certainty"—including sufficient flexibility to Member States over which renewable energy sources to support—but considered it was too early to set a 2030 target.[237] It stressed that much could happen in 18 years, especially in terms of the potential for economic and technological changes.[238]

119. Others, meanwhile, were opposed to any form of a renewable energy target, arguing that it favoured one set of (potentially expensive) technologies over another. Mr Atherton, for example, commented that a renewable energy target would be unhelpful, such as the target the UK signed up to in 2006, which effectively locked us into "very immature, very technically uncertain and very expensive" technologies—in other words, offshore wind.[239] Mr Atherton further argued that the deadline for meeting the 2020 target should be delayed by at least five years, and Professor Helm shared his scepticism about the wisdom of the 2020 target.[240] EDF also rejected the idea of a renewable energy target, believing it to be "misguided", viewing it as having undermined the carbon market itself, with concerns that it would lead to permanent subsidies (to the cost of the consumer).[241]

120. The Secretary of State suggested that an electricity decarbonisation target should be explored instead, claiming that the "logic for a decarbonisation target in the UK is quite strong".[242] Such an idea was, however, rejected by RenewableUK, who noted the need for more precision about the type of technologies required and in what quantities they would be necessary.[243]

121. **A strengthened and more effective ETS can provide a broad underpinning for the most cost-effective low carbon technologies, but it cannot support all of the necessary transformations. An EU-wide renewable energy target beyond 2020 is desirable, and so we therefore support a renewable energy target up to 2030. Failing that, a 2030 decarbonisation target at the EU level for the power sector should be set. Member States could then set their own specific renewable energy targets, which should be reported to the Commission.**

Energy efficiency

122. There was a general consensus that energy efficiency is a crucial component of the EU's energy transformation. Oil & Gas UK noted that efficiency could help save energy, and was also economically beneficial with important implications for affordability and competitiveness.[244] A number of witnesses were supportive of inclusion within the 2030 framework of an energy efficiency target of some form, as well as some demand-side response policies.[245]

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237 Q 173

238 Q 177

239 Q 174

240 Q 143, QQ 176–177

241 Q 195, Q 197

242 Q 376

243 Q 99

244 Q 72

245 Fiona Hall MEP

123. In 2012, the EU adopted an Energy Efficiency Directive (EED) (see Appendix 6), which some witnesses, including the Secretary of State, were hopeful would lead to a significant energy reduction in the EU. It requires Member States to set their own national targets in order to meet the EU-wide objective of a 20% reduction by 2020 compared to 2007 levels. Progress will be assessed by 30 June 2014. Mr Jorgensen MEP stated his view that the EED will probably result in an energy reduction of 25% across the EU.[246] On the other hand, we heard regret about the limited ambition of the EED and its failure to incorporate Combined Heat and Power (CHP).[247] Witnesses were split on the economic viability of further development of CHP and district heating,[248] although the latter has proved successful in other EU Member States, such as Denmark which, according to the CIBSE, are "conspicuously outperforming the UK".[249]

124. SSE also emphasised that much more needs to be done to improve energy efficiency, energy reduction and energy management, especially as these can make significant contributions to affordability and competitiveness.[250] It stressed that, the more that affordability becomes an issue, the more important it becomes to ensure that a future framework incorporates "demand-side targets and demand-side policies".[251]

125. The Committee also considered the extent to which there is a 'rebound effect', whereby consumers and businesses increase their energy-consuming activities in response to energy efficient methods reducing their effective energy costs. WWF thought that this was a possible consequence, and therefore that any efficiency targets should consider focusing on net energy savings rather than purely on energy efficiency or be accompanied by measures to deter such a rebound.[252]

126. **The EU has adopted the EED which needs to be implemented across Member States. We would support further consideration as to the introduction of binding EU-level targets on energy consumption by 2030, consideration which should be informed by the Commission's assessment in 2014 of the implementation of the EED.**

127. **There are important helpful technologies, such as community heating systems and CHP, which must be further developed. The potential 'rebound effect' reinforces the need for energy efficiency policy to be complemented by measures to price carbon appropriately.**

Energy-intensive industries

128. Certain industries, such as cement and aluminium, are particularly reliant on energy. For these industries, energy makes up a significant proportion of

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246 Q 248

247 Combined Heat and Power (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process. CHP generates electricity whilst also capturing usable heat that is produced during this process

248 A district heating scheme comprises a network of insulated pipes used to deliver heat (in the form of either hot water or steam), from the point of generation to an end user

249 CIBSE

250 Q 195

251 *ibid.*

252 Q 311

their total costs. Some of our witnesses considered whether these industries, which are particularly affected by changes in energy costs, required specific policies.[253] By way of example, the UK Government have announced specific support measures to electro-intensive industries in relation to the UK carbon floor price. The CBI was particularly insistent on the need to ensure support for such industries, noting that the policy framework has to help "specific businesses as well as the consumers facing challenges".[254]

129. INEOS argued that energy-intensive industries make a significant environmental and economic contribution to the green economy, stressing that they must be protected from the effect of punitive fiscal decarbonisation measures on energy prices. It cited Germany and France as examples of best practice in this regard, in the form of tax rebates and long-term energy contracts respectively.[255]

130. Other witnesses noted that many businesses are increasingly wary of measures that may hamper competitiveness and increase short-term operating costs. The IPPR noted that some businesses view ambitious climate change policies in the UK and EU as potentially self-defeating if they lead to carbon leakage (where production and the consequent emissions are displaced to countries with less stringent carbon regulation).[256] The IPPR did qualify, however, that it has found no evidence of carbon leakage occurring, stating that costs attributed to climate change measures as a proportion of total energy costs facing energy-intensive industries are still relatively small (although these costs are projected to increase). It argued, therefore, that the aim should be a set of policies that enable innovative businesses and start-ups to capture new low carbon growth opportunities, whilst assisting existing and hard-to-treat industries to adapt their business models to the transition. IPPR suggested three potential policies that could be implemented at EU level to support energy-intensive industries: raising the carbon price to provide a better incentive for low carbon innovation; expanding the ETS to include imported energy-intensive goods to prevent future carbon leakage; and ensuring that ETS revenues are spent on low carbon projects.[257]

131. In our report on the 2008 revision of the ETS,[258] we acknowledged that some sectors of industry may be at risk of carbon leakage as a result of high energy prices. Our preference was for global sectoral agreements to be reached in order to put these industries on an even footing with their non-EU competitors. In the meantime, we argued, special provisions should be made within the ETS for those industries, such as free allocation of allowances.

132. Acknowledging the drawbacks of continued free allowances in the long-term, and the difficulty of constructing global sectoral agreements to fully factor in carbon costs, it might also be possible to include importers in the ETS (Article 10b of the ETS Directive) or to impose a tax on carbon-intensive imports from third countries. While Professor Helm was supportive of this

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[253] Q 25, Dr Karsten Neuhoff supplementary evidence

[254] Q 307

[255] INEOS

[256] IPPR. See also QQ 25–28, Q 249, Dr Karsten Neuhoff, EDF, ScottishPower supplementary evidence

[257] IPPR

[258] European Union Committee, 33rd Report (2007–08): *The Revision of the EU's Emissions Trading System* (HL Paper 197)

approach, the Commission warned not only of the administrative complexities, but also the risk of over-or under-taxing imports. Additionally, the Commission expressed fear that "retaliation and trade measures" would follow in other jurisdictions. Professor Helm rejected that argument, suggesting that a tax would be justified on environmental grounds.[259]

133. **We agree that energy costs have a disproportionate impact on a small number of energy-intensive industries and that this is an issue to be addressed in the post-2020 framework. In order to make a full evidence-based position for that framework possible, we recommend that the Commission explore urgently the various options, such as: free allocation of allowances under the ETS; global sectoral agreements; and any global trade-compatible measure that could equalise costs between domestic and third country producers. Some income derived from the auctioning of allowances under an ETS with a floor price could be offered to assist energy-intensive industries to develop and adopt innovative energy efficient technologies.**

The politics of a 2030 framework

134. We heard much scepticism surrounding the prospects for reaching an agreement on the 2030 framework. It was observed by witnesses such as Mr Froggatt and Mr Davies MEP that the economic crisis since 2008 has entirely altered the political dynamic, particularly given that everyone was now "nervous about spending any money".[260]

135. Regarding the ETS, Professor Helm noted that there was a great deal of political capital invested, meaning that scrapping it would be an "enormous setback", and unlikely to be an option favoured by the Commission or Member States—therefore, the ETS must instead be improved.[261] On that basis, the development of future policy should be understood as being about economic competitiveness and growth, in addition to decarbonisation. According to Professor Helm, to present an argument in this manner would prove "more fruitful" than if it was based solely on climate change.[262]

136. The Commission argued that targets and burden sharing needed to be set in such a manner that none of the Member States felt that they were "losing out", and indeed that the outcome was of economic benefit.[263] The SSE stressed the difficulty of coming to an agreement because of the differing interests among the 27 Member States. Consequently, that would make it challenging to come up with anything other than "suboptimal" or "lowest-common-denominator" positions.[264] As a result, flexibility may well have an important part to play in achieving an agreement.[265] Ultimately, as the Commission observed, any future agreement could (and may need to) be

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259 QQ 129–131, Q 223

260 Q 52, Q 253

261 Q 123

262 Q 137

263 Q 269

264 Q 198

265 *ibid.*

reached by a qualified majority[266] rather than unanimously among the Member States.[267]

137. Witnesses also drew our attention to the 2015 deadline for a new international climate change agreement under the UNFCCC, with the culminating conference to be held in Paris. This deadline should exert pressure on the EU to agree a position on a 2030 framework ahead of the international negotiations, a view that was expressed by Mr Davies MEP.[268] Regarding the 2013 UNFCCC Conference to be held in Warsaw this November, the government of Poland noted that any decisions taken must maintain "the political momentum for global climate agreement" on the agreed schedule—that is, to be adopted in 2015 and enter into force by 2020.[269]

138. **We conclude that the future framework can and should be seen and articulated as an economic opportunity for all Member States. It must overhaul the ETS as an instrument for supporting strategic investment both by industry and, through revenues raised, for supporting innovation (for example, in CCS and offshore turbines), European infrastructure investment and energy efficiency. Provisions on the ETS must form part of a package along with policies on renewable energy and associated infrastructure, energy efficiency, and energy-intensive industries. We note that the unanimous support of all Member States may not be required, as any future agreement could be reached with a qualified majority.**

266 The EU's system of voting whereby a decision among Member States needs to be supported by at least 55% of Members (currently 15 out of 27) and representing Member States comprising at least 65% of the EU population

267 Q 258

268 Q 253

269 Poland, Ministry of Environment

CHAPTER 5: RESEARCH AND INNOVATION

The role of research and innovation

139. There was widespread agreement that funding for research and development (R&D) and support for innovation in the energy sector are very important, not least in order that the EU can take the global lead in moving away from fossil-fuel dependency at an affordable price. According to the ETI, for example, "innovation is vital to help reduce our energy consumption", and to "deliver our energy needs with a far lower carbon content, at prices which do not damage our competitiveness and in ways that generate broad economic benefits".[270] ABB Limited, the EESC, the Florence School of Regulation (FSR), the ECF and E.ON all agreed that investment in research into low carbon energy technologies and initiatives could have a positive economic effect.[271]

140. We were warned of threats to the EU's future competitiveness if it failed to boost its innovation capacity. While its level of investment in low carbon energy in 2011 was $94 billion, comparing favourably to the amount of $50 billion invested by each of the US and China, the EU's level of investment was expected to be lower in 2012.[272] Both the European Commission and the Secretary of State argued that carbon capture and storage (CCS) would be developed in countries such as the US and China if it was not demonstrated soon in the EU.[273] Mr Zenghelis observed that clean energy and energy efficiency were two of the "magic growth sectors" included in China's most recent Five-Year Plan.[274] Several witnesses pointed to the fact that China was developing a strong base in the manufacture of renewable energy equipment, notably for the solar industry.[275]

141. In terms of boosting R&D, Dr Neuhoff argued that the EU needed to develop a clear strategy to trigger innovation and a shift to low carbon processes and products, including commercialisation. According to ABB Limited, ETI, RenewableUK and the WWF, more certainty on the direction of energy policy was needed, so that investors could begin more comfortably to make the substantial investments needed to create a sustainable energy market. The IPPR argued that, by pooling investments and sharing risk, EU governments were likely to increase the attractiveness of major innovation projects to private sector investors. The ETI's experience pointed to the value of partnership between public and private sectors, and taking a strong evidence-based approach to targeting research and innovation. According to the FSR, public support, whether in the form of loans, prizes or grants, needed to be tailored to the features of each project.[276]

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270 ETI

271 Q 123, ABB Limited, EESC, E.ON,FSR

272 Q 171

273 Q 66, Q 368

274 Dimitri Zenghelis

275 Q 43, Q 88, CER, EUI, Scientific Alliance

276 ABB Limited, ETI, FSR, IPPR, Dr Karsten Neuhoff supplementary evidence, RenewableUK, WWF

142. We discussed with witnesses the extent to which support should focus on embryonic technologies, or whether it should also extend to helping relatively new technologies reach commercial viability. Professor Helm was vocal in his view that the emphasis should be on researching new technologies that had the potential to achieve the longer-term goals, such as tidal, next-generation solar, negative emission technologies to replicate photosynthesis and demand-side response technologies such as batteries and smart networks. His preference would be increased support for research into those technologies, rather than spending money on the commercialisation of more mature, but still relatively expensive, technologies such as offshore wind power.[277]

143. On the other hand, a number of witnesses noted that development work could also help reduce the costs of building and operating existing technologies such as offshore wind.[278] The Secretary of State argued that research also required deployment and that "if you simply focus in on the researching of new technologies, you are never going to get there". Referring specifically to offshore wind, he observed that companies "are learning how to do it more efficiently and more cheaply every day". He added that "it would be bizarre" if the UK did not try to exploit what, in offshore wind, was a "fantastic resource".[279] The FSR and IET agreed that there was economic benefit to be derived from acting as a pioneer.[280]

144. **Innovation is central to the EU's future competitiveness, but the EU risks being eclipsed by others, including the US and China. Two main factors could undermine energy innovation in Europe: inadequacy of finance; and uncertainty about the future policy framework. Both of these could be addressed by an adequate 2030 framework, particularly if this included a reformed ETS which made direct links to innovation through the use of carbon revenues and greater certainty over long-term price trends.**

The EU's approach

145. The EU's approach to research and innovation in the area of energy is spearheaded by its Strategic Energy Technology (SET) Plan, which was proposed by the Commission in 2007. It now represents the technology development pillar of the EU's Energy 2020 Strategy. Key technologies identified in the plan for 2020 are: second generation biofuels; smart grids; CCS; energy efficiency in buildings, transport and industry; wind (particularly offshore wind); photovoltaic and concentrated solar power; nuclear fission (including waste management); and new materials for SET Plan technologies.[281] The Commission emphasised the importance of developing advanced, second generation biofuels given the need to move away from those biofuels that are causing concern about their impact on land use.[282]

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277 Q 134

278 QQ 263–264, E.ON, SSE

279 Q 380

280 FSR, IET

281 COM(2007) 723

282 Q 66, Q 270

146. The SET Plan will be supported primarily by the Horizon 2020 Programme, the new EU programme for investment in research and innovation, running from 2014 to 2020. The Commission's proposed budget for the programme over that period was around €80 billion. While final agreement on the budget is yet to be reached, it is likely to represent a substantial increase from the amount devoted to the current framework programme, which is €50.5 billion, of which €2.35bn was earmarked for energy.[283] Horizon 2020, by contrast, includes a new societal challenge 'Secure, Clean and Efficient Energy', with a suggested budget of €6.5 billion for non-nuclear energy research for the period 2014–2020. Futhermore, under the EU's Risk Sharing Financing Facility, €1.1 billion is earmarked for energy-related projects. This will be managed by the EIB. The Euratom proposal covering the period 2014–2018 foresees €1 billion for fission and fusion activities. In addition, €2.7 billion will be available as the EU's contribution to the international nuclear fusion project, ITER.

147. We received mixed views in relation to the SET Plan. The Commission explained that, when the original research budgets for the EU for the period 2007–13 were drawn up, no major priority was given to energy. In recognition of that gap, the SET Plan was established in an attempt to mobilise public and private funding monies for researching major issues such as biofuels, storage and smart grids. The Commission noted, however, that it had not resulted in any major reorientation of national research budgets: only EU and private funds support the SET Plan in a significant way. A particular example of that was CCS, which had failed to attract the necessary finance by Member States (see Chapter 3). In terms of the future development of the SET Plan, DECC indicated that the UK had been supporting proposals for marine energy technologies to be included in the SET Plan quickly. The SET Plan should be under ongoing review so that it could incorporate new technologies as they emerge. Those technologies currently expected to have an important role for the EU in 2050 include: energy storage; trans-European energy networks; new technologies for energy efficiency; nuclear fusion; hydrogen fuel cell vehicles; and generation IV nuclear fission. The CIBSE emphasised demand-side response technologies as key, as did the ETI alongside bioenergy, CCS and nuclear power.[284]

148. DECC confirmed that funding to deliver the SET Plan remained an issue and set out the scale of the challenge: "Activity under the Plan is estimated to require spending of up to €80bn over 10 years (a threefold increase on average cumulative EU and Member State spending in this area over recent years)". It went on to observe that "there continues to be an expectation that Member States and the private sector will ramp up their funding, which seems impractical in the present financial climate". DECC noted that the low carbon price under the EU Emissions Trading System (ETS) meant that there was significantly less funding than expected to spend on the first phase of projects under the NER-300 programme (see paragraph 57). That stream of funding was highlighted by WWF, which emphasised the importance of reinvesting some revenues from the ETS into the development of new low carbon technologies.[285]

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[283] Decision 1982/2006

[284] Q 66, CIBSE, DECC, EIT

[285] DECC, WWF

149. Similar doubts as to the source of financing for the SET Plan were expressed by the EESC, describing the required expenditure as "massively underestimated". The EESC therefore recommended that appropriate financing plans supported by the Commission, Member States and industry be drawn up.[286] Professor Newbery described the SET Plan as reasonably sensible but observed that it lacked "the mechanism to mobilise sufficient funding through collective action, and the institutions to ensure that any such money is well-spent".[287] SSE expressed a concern that Member States and the Commission were not taking an appropriate share of risk on energy technology development, which could partly explain the difficulties in mobilising funding. Both SSE and RenewableUK argued that the SET Plan should have a devoted budget line under Horizon 2020.[288]

150. The Commission observed that Horizon 2020 would allow a "significant increase in our energy research and innovation expenditure in the EU budget".[289] This was described as "welcome but still inadequate" by the Centre for European Reform (CER), particularly as the EU's "future prosperity will depend on staying at the technological frontier".[290] SSE agreed that "a major increase" in R&D was needed. It called for administrative hurdles related to EU research programmes to be removed and flexibility considered for bottom-up initiatives.[291]

151. RenewableUK suggested that one third of the non-nuclear energy research budget under Horizon 2020 be spent on the SET Plan and that the remaining two thirds be spent on renewable energies and on energy efficiency. WWF agreed that a strong focus of funding should be on renewable energy and warned against moves to extend the Horizon 2020 energy budget to cover the gas sector. This was partly because the gas industry was already investing in research, an assertion confirmed by the Energy Networks Association (ENA).[292]

152. As highlighted in paragraph 146, an EIB Risk Sharing Finance Facility will be available to support Horizon 2020. This facility, which is aimed at R&D, has so far resulted in loans amounting to over €9.5 billion, of which around 15% has been in the area of energy, particularly in the solar and wind power sectors and in energy efficiency. The facility, which shares the risk between the EU budget and the EIB, allows projects to be supported that would otherwise be too risky for the EIB to support on its own.[293]

153. The CER was critical of EU funding for the international nuclear fusion project, ITER, arguing that the EU should cancel its participation in the project: "Even if it works eventually, ITER will not generate electricity for the grid until 2040 at the earliest, so fusion will contribute little to efforts to control climate change or to increase energy security."[294] It was explained

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286 EESC

287 Professor David Newbery

288 SSE, RenewableUK

289 Q 66

290 CER

291 SSE

292 ENA, RenewableUK, WWF

293 Q 174

294 *op. cit.*

that the budget of the project had tripled since 2001. In our report, 'EU Financial Framework from 2014', we strongly regretted the delays, cost overruns and management difficulties that had beset ITER.[295] While we did not argue against EU participation, we emphasised the need for improved financial management.

154. The Committee was also told about the 'Smart Cities and Communities' European Innovation Partnership (EIP), which is encouraging consortia of industry to link up with cities to promote the most innovative ways of using energy, water and transport.[296] The EESC highlighted the EIP as of particular benefit. On the more general principle of EIPs, it emphasised that there must be close ties with stakeholders at national, regional and local level with a view to taking account of particular national and regional features.[297]

155. We heard about some of the work in which the private sector is investing. For example, ABB Limited is supporting the development of the UK wave and tidal sector by providing components, systems and expertise. EDF highlighted two tidal stream and wave projects, in Brittany and in the French Overseas Territory of Réunion, which are focused on demonstrating the potential commercialisation of both technologies. ABB Limited has also developed and delivered the first battery energy storage device which is connected to a local distribution network. This allows the network to manage power flows and voltage levels on part of the system. By contrast, EDF is not undertaking any new work in the area of battery storage. The company does not see significant market opportunities for this technology at an industrial scale. [298]

156. **Funding to support research and innovation activities across all areas will be increased for the next financing period running from 2014 to 2020. Clarity on how it will divide between the various priorities is now required.** The EU's research and innovation policy is explored further in our report, 'The Effectiveness of EU Research and Innovation Proposals.[299]

157. **We are alarmed at the degree of evidence that we have heard to suggest that the SET Plan is at risk of failing to deliver its objectives due to inadequate funding. We conclude that the Commission must, as a matter of urgency, revise the SET Plan with a view not only to the technologies on which it should concentrate but also to how the SET Plan will be financed. Such work must be undertaken in partnership with Member States, the private sector and the EIB.**

158. **The EIB's risk-sharing finance ability will be of particular value in the context of the market's reluctance to lend to certain Member States because of budget deficits.**

159. **In terms of the future focus of investment in R&D, we agree with those witnesses who emphasised the increasing importance of**

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295 European Union Committee, 13th Report (2010–11): *EU Financial Framework from 2014* (HL Paper 125)

296 Q 270

297 EESC

298 ABB Limited, EDF supplementary evidence

299 European Union Committee, 15th Report (2012–13): *The Effectiveness of EU Research and Innovation Proposals* (HL Paper 162)

demand-side technologies and so an increased focus on areas such as storage and smart meters would be helpful. As regards renewable energy, further work on advanced biofuels would be helpful, as it would on solar and tidal energies.

160. **We welcome innovative approaches to energy, including those that might be developed through innovation networks such as the new Smart Cities EIP. The value of such partnerships is dependent on their ability to engage with local, regional and national actors.**

CHAPTER 6: INTERCONNECTION AND ENERGY SECURITY

161. In its November 2012 Communication on making the internal energy market work, the European Commission re-iterated the requirement that, by 2014, cross-border markets for gas and electricity must be up and running across the EU and the implementation of plans to modernise and smarten EU grids should be well under way.[300] The Commission recognised, however, that Member States are not on track to meet the 2014 deadline. An important way in which greater integration of markets can be facilitated is by further developing energy interconnection between Member States.

162. Most of the evidence that we received on interconnection focused on electricity. The Commission highlighted that, whilst levels of electricity interconnection are evolving,[301] the levels of interconnection between the UK and mainland Europe, and between the Iberian Peninsula and mainland Europe, are much more limited than, for example, the 20–30% of interconnection between Belgium and the Netherlands.[302]

163. Ofgem confirmed that it is seeking to facilitate greater interconnection between the UK and other countries, noting that it has "consulted on and developed a regime to try to facilitate more interconnection".[303] We heard from ENTSO-E that, for interconnectors, there has been a "soft target" of 10% for interconnectivity across Member States for some time, on which it noted progress has been made.[304] It was noted however, that there have been problems of interconnection within some Member States as well as between them. Ofgem stated that in some countries there are issues relating to congestion, such as is the case in both the south of England and Norway[305], where the existing onshore grid would need strengthening to accommodate major trade flows.[306] The most commonly cited example of interconnection issues within a Member State was Germany, whereby northern German wind energy is transmitted to the south of Germany via neighbouring countries (see paragraph 177).

164. Greater interconnection, it was argued, could help with the reduction of costs, particularly by making more efficient use of renewable energy. Mr Tindale claimed that increased interconnection would enable the use of the intermittent renewable energy sources that are currently being wasted due to the lack of a grid to take them anywhere.[307] On an EU scale, Mr Tindale suggested that solar energy could be transported from southern Europe to northern Europe, and wind generation from northern Europe to

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300 COM(2012) 663

301 See *Map of interconnection between EU Member States* on http://www.publications.parliament.uk/pa/ld201213/ldselect/ldeucom/161/161/entsomap.pdf provided by ENTSO-E (http://www.entsoe.eu)

302 Q 27

303 Q 341

304 Q 278

305 Norway is not an EU Member State but is a member of the European Economic Area to which the EU's internal energy market legislation applies

306 *ibid.*

307 Q 20

southern Europe.[308] Other witnesses, such as WWF, agreed that increased interconnection could reduce costs and provide opportunities.[309]

165. The Committee explored the practicality of transferring energy large distances across Europe, and was informed that the current capacity of the EU grid is generally at a maximum of 400 kilovolts (KV).[310] ENTSO-E noted that, in order to transport electricity at the extent required to tackle renewable intermittency, higher voltages will be necessary. National Grid explained that whilst the 400 KV was deemed appropriate for the existing Alternating Current (AC) system—given the size of the UK and other EU Member States—higher voltages would be needed for much longer distances (such as is already the case in countries such as the US or China).[311] If pursued, this would require significantly higher pylons than are currently used.

166. National Grid noted that High Voltage Direct Current (HVDC) lines can be used to transfer electricity efficiently across such long distances without voltage restrictions. One such example was the new 600 KV underwater HVDC line down the west coast of the UK from Scotland to northern Wales.[312] ABB Limited informed us that it recently completed the East-West interconnector project, enabling the transfer of power between the UK and Ireland, which is the first such interconnector project in the UK to use “innovative HVDC light technology to transfer large amounts of power at low loss levels”.[313]

167. In terms of costs, National Grid informed us that one kilometre of high-capacity 400 KV AC overhead line costs approximately £1.5–2 million, while the cost for placing them underground is around 10 times higher. HVDC, meanwhile, is comparable to AC overground, and cheaper underground, but requires converter stations at each end. A one GW HVDC link, for example, would incur costs of approximately £200 million per station. It was noted that, overall, HVDC was more economical over a long distance.[314]

168. **It is cost-efficient and urgent to develop electricity interconnections between Member States in order to support both the further deployment of renewable energies and attempts to secure the EU’s energy supplies. We conclude that the full benefits of interconnection will be derived only from greater deployment of HVDC lines, allowing electricity to be transported over a long distance at an economical cost.**

Visions of the future grid

169. There were alternative visions for future grid development. One suggestion was through a ‘supergrid’. National Grid’s generic definition of a supergrid was: “a European grid with much interconnection and much more capacity

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[308] Q 20
[309] Q 331
[310] Q 296
[311] Q 352
[312] *ibid.*
[313] ABB Limited
[314] Q 346

to move power between countries".[315] Others envisioned a future supergrid allowing multiple different energy sources to be drawn on—for example, balancing the biomass in central Europe, hydro in the Nordic regions, offshore wind in the North Sea and solar in southern Europe.[316] This position was recognised by the Commission, who commented that "the bigger the grid, the more likely it is you will be able to manage diversified sources of energy across that grid by different technologies".[317] Although acknowledging political consensus would be required, Mr Zenghelis commented that an integrated and efficient supergrid could allow for more efficient investment.[318]

170. There was, however, a view expressed that the European grid should be developed incrementally, rather than on the basis of a defined plan, with the proviso that the different spokes could be linked together in the future. The Commission referred to this as being "grid-ready", with the different elements capable of being part of something bigger.[319] There was some support for this option. National Grid mentioned the idea of an 'overlay grid', which it described as a "step along the way" to a supergrid, potentially starting off with one or two large HVDC links.[320] Ofgem also noted that its initial studies suggested that a "radial" (that is, incremental) system would be more effective than "meshing the grid", citing the connection of nine offshore wind farms in 2012, of which six were in the UK.[321]

171. A different vision was outlined by Mr Froggatt who described a "much more distributed system"[322] that involved more local balancing.[323] National Grid also alluded to similar systems, suggesting a future that might include micro production and domestic generation, indicating less need for a supergrid and more need for "micro-grids", a prospect that was supported by Ofgem.[324] The IET considered that an energy market in distributed generation connected at distribution level "is conceivable" but would require considerable work given the small scale of such generation and the burden of complexity for very small players to engage in a market-based system. Developments in storage and aggregation services could, however, assist with this process.[325]

172. Several witnesses also discussed the development of a North Sea grid, which is evolving through the North Seas Countries Offshore Grid Initiative and of which Ofgem and the Agency for the Cooperation of Energy Regulators (ACER) (the pan-EU body for energy regulators) were involved in the

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315 Q 353

316 Q 49

317 Q 62

318 Q 211

319 Q 273

320 Q 353

321 Q 345. See also, *The European Offshore Wind Industry–key trends and statistics 2012*, European Wind Energy Association, January 2013

322 Distributed energy resource systems are small-scale power generation technologies used to provide an alternative to or an enhancement of the traditional electric power system. It is also known as 'micro-generation'

323 Q 49

324 Q 353

325 IET

establishment. National Grid explained that there was significant potential in the North Sea to develop a grid that will allow maximum benefit to be derived from offshore wind.[326] An existing challenge, however, is that interconnectors have one—currently evolving—regulatory regime, whereas offshore transmission has another. Ofgem cited their Integrated Transmission, Planning and Regulation (ITPR) project, which is currently looking at "all of these challenges about how different bits of transmission and interconnection could be co-ordinated".[327]

173. **We agree with our witnesses that an increasingly interconnected grid will need to be developed incrementally, rather than on the basis of a top-down grand plan. Nevertheless a stronger element of network planning—nationally and regionally—could be very beneficial in the transition to a more renewable-based and secure system. The move to greater interconnection is not incompatible with the development of distributed generation, but the potential offered by distributed generation must be recognised more clearly in energy strategies.**

Energy Infrastructure Regulation

174. An important recent development has been the agreement on a new trans-European Energy Infrastructure Regulation[328], which has three key aims: to identify major strategic lines of interconnection (Projects of Common Interest (PCIs)); to reduce planning procedures to three and a half years with a possible extension to four years and three months; and to ensure that national regulators act together to create favourable conditions for PCIs to be financed (through the new Connecting Europe Facility (CEF) and private finance).[329] Several witnesses, including Mr Tindale, Mr Froggatt, Professor Peter Cameron and the Commission, agreed that the proposed planning procedure deadline was a particularly helpful proposal to prevent long delays.[330] The issue of financing was explored in Chapter 2, including through the EIB. We heard support for the use of the new CEF to help finance the PCIs, and witnesses were agreed that overcoming permitting delays was very important.

175. **We welcome recent agreement on the trans-European Energy Infrastructure Regulation, which identifies PCIs and establishes common rules on permit granting procedures. The Regulation must now be implemented with urgency.**

Public acceptance

176. Public acceptance is a major determinant of existing policies and proposals. The Committee noted the abrupt reversal of policy to nuclear production in Germany in line with public concern. Public acceptance can be particularly problematic in relation to the development of infrastructure. The Commission named an example of this as the construction of overland electricity link across the Pyrenees, which has been under discussion and

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[326] Q 344

[327] *ibid.*

[328] COM(2011) 658. At the time of publication, a text had been agreed but was yet to be adopted

[329] Q 62

[330] Q 21, Q 55, Q 62, Q 86

delayed for over 30 years.[331] Given the public opposition, it seems likely that an underground link will now be constructed instead, but at a significantly greater cost.[332] ENTSO-E also recognised that public acceptance was one of the main obstacles to making progress with physical assets, particularly compared to the past, noting that there is perhaps "not the same consensus around the public acceptability of what benefits the investments will bring".[333]

177. It was therefore considered imperative by witnesses to demonstrate to the public that failure to undertake certain projects would have significantly high costs, highlighting in particular the difference in costs between overground and underground cables. One way suggested to achieve more effective communication was through a long-term strategic plan demonstrating that new lines were linked to overall energy policy goals—namely, climate protection, renewable energy integration, security of supply and market integration.[334] Public resistance could also pose a problem from within Member States. In Germany, for example, more than 30 GW of wind energy from northern Germany must be transported to southern Germany by utilising surrounding networks of neighbouring countries to the east (such as in Poland and the Czech Republic). Despite plans to build north-south lines within the German grid to retain more of that power, public opposition "has delayed this for many years already".[335] In another example of attempts to overcome the issue of public resistance, WWF referred to its involvement in the Renewables Grid Initiative, in which it works with 14 non-governmental organisations and 11 Transmission System Operators (TSOs) (organisations equivalent to the UK's National Grid) to examine ways of overcoming "bottlenecks" in infrastructure development that are also acceptable to the public.[336]

178. **We acknowledge that public concerns can be a significant obstacle to the development of interconnections. In that context, the public awareness dimension of EU energy policy becomes pivotal: a local decision can have significant pan-European implications in terms of energy cost and energy security. The Commission must consider as part of its future policy framework how it and Member States can work together to communicate effectively the benefits of cross-border energy connections. We agree that providing a clear indication that a project is part of a strategic transition towards an increasingly interconnected grid could help overcome local objections to projects. Early engagement and consultation with the public and other interest groups is similarly important. The Renewables Grid Initiative, involving environmental NGOs and TSOs, is a welcome attempt to tackle the public awareness issue.**

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331 Q 20

332 Q 272

333 QQ 278–279

334 Q 280

335 Q 284

336 Q 332

Regulatory obstacles

179. The Committee received mixed messages on the extent of regulatory obstacles to the further development and effective management of an interconnected grid. The Commission observed that national regulators can, in some instances, act as an obstacle. Although ACER exists to coordinate national regulators, there are instances where they disagree on the amount of money operators can earn on interconnections. For example, the transfer of cheap gas from Germany to Denmark was restricted by the German regulator because there was insufficient analysis on the impact of such projects on German consumers.[337] There is a need, therefore, for a combined analysis of the costs and benefits to both sides of borders. A further obstacle identified by ENTSO-E related to commercial tensions as, in some Member States, interconnections are the role of national TSOs, whereas the UK regulatory approach is designed for competitive 'merchant' investors, meaning that compatibility between the regulatory systems needs to be found.

180. ACER, National Grid and Ofgem argued that they were all working to overcome these obstacles. Ofgem pointed to the swifter development of offshore wind in the UK compared to Germany as evidence of the emerging success of a streamlined system. Despite huge ambitions, Germany only had one offshore wind farm fully connected to the grid in 2012, which Ofgem claimed was because of "delays from the incumbent TSOs".[338] ACER, however, observed that whilst its tasks and responsibilities have already been expanded on a number of occasions by the EU institutions, this has occurred without a similar expansion in its budget, leaving ACER insufficiently financed to fulfil all of its tasks effectively.[339]

181. In line with the third internal energy market package, under which ENTSO-E was created, network codes have been developed to assist the management of interconnection. Network codes are now being applied. These codes will establish common rules to enable network operators, generators, suppliers and consumers to operate more effectively within the market. A further challenge will be the effective integration of retail and wholesale markets, with a smart grid approach.

182. **There remain economic and regulatory obstacles to integrated interconnection and transmission, which are crucial to the completion of the internal energy market. We encourage Member States to support regulators, through ACER, and TSOs, through ENTSO-E, in their efforts to overcome those obstacles. A review of budgetary support to ACER in particular would be helpful to ensure that it has a sufficient budget to allow it to deliver its important role. The ultimate goal of more effective regulatory cooperation must be a pan-EU energy market, working for the benefit of EU consumers.**

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337 Q 62

338 Q 344

339 Q 350

Gas supply

183. Interconnection of gas supplies is an important consideration in relation to both Member State and EU energy security. Energy companies using gas pipelines to transport gas often use much less capacity than they have reserved, preventing other parties from using the pipelines efficiently. As a consequence, in 2012, the Commission adopted Congestion Management Procedures to ensure increased efficiency in gas pipeline capacity.[340]

184. Furthermore, gas corridors are critically important with a view to energy security, as noted by the Commission, which explained that there is continued emphasis "on the development of a pipeline to the Caspian region: Azerbaijan, eventually Turkmenistan, and perhaps southwards towards Iraq".[341] E.ON also pointed to the development of gas corridors to the EU in order to improve security of supply.[342]

185. In commenting on the role of gas in relation to energy security, Professor Cameron noted how Bulgaria, for example, is 100% dependent on Russia for its gas, and Mr Froggatt agreed that Russian gas dependency was a key issue.[343] Although any suggestion that Russia might hold the EU to ransom was rejected by Professor Stern,[344] such high levels of dependency leave countries vulnerable in the event of other disruptions (such as the Russia-Ukraine dispute over pricing in 2009). DECC noted that, following the disruption of gas supplies from Russia to the EU in 2009 as a result of Russia's dispute with Ukraine, investments in physical infrastructure were being made to enable gas to flow more freely around the EU. This would ensure that, in times of shortage, gas could flow where it was most needed.[345]

186. The development of liquid natural gas (LNG) was highlighted as a potentially important method to help ensure greater energy security. This technology allows gas to be transported via tankers and does not rely on fixed pipelines, meaning that it can be transported with greater ease; this could therefore result in less dependency on individual countries. Mr Froggatt stated that LNG "brings energy security in a way you do not have just with pipelines", and further noted how the LNG markets in the UK and the Netherlands, for example, were already developing at a quick pace.[346] That said, a possible drawback of LNG is that as the fuel can be transported with increased ease, it can be delivered (or diverted) to countries where the price is more attractive. This is a particular concern with regards to the Asian energy market, where gas commands a higher price than Europe and where demand for gas increased after the Fukushima incident in 2011.[347]

187. The storage of gas plants was also highlighted as a key issue, notably for the UK, which only has storage capacity of "4% of average annual consumption".[348] This is of particular concern when the UK figure is

340 Decision 2012/490

341 Q 60

342 E.ON

343 Q 51, Q 188

344 Q 144

345 DECC, EDF

346 Q 50

347 *Gas Tanker Takes Shortcut to Asia*, Wall Street Journal, 3 December 2012

348 *Plans to increase Britain's gas storage capacity left in tatters by credit crunch*, The Guardian, 12 January 2009

compared with the capacity of other European countries such as Germany and France, which are 21% and 24% respectively.[349] This point was stressed by Professor Stern, who emphasised "that we do not have nearly enough storage in the UK", either for short-term disruptions or for strategic disruptions, and especially for a market the size of the UK.[350] The House of Commons Energy and Climate Change Committee reported in 2011 that increased storage capacity is necessary if gas is to be used as a transitional fuel.[351]

188. **There are considerable financial and political uncertainties as to the sources and costs of future gas supply. It is clear that a range of sources and methods of transportation are critical. We support the Commission's attempts to improve efficiency in gas pipeline capacity. We urge the UK Government to examine the potential for a regulatory framework to increase gas storage.**

Capacity mechanisms

189. The UK and other Member States are proposing to introduce capacity mechanisms, whereby suppliers would be paid (following a competitive tendering process) to assure a supply of electricity. E.ON highlighted to us that, in addition to the UK, France, Spain and Italy have all introduced (or are introducing) capacity mechanisms of different types, to "ensure sufficient fossil plant remains in operation or is built where generation is increasingly taken up by intermittent wind generation".[352] In the UK case, this would largely be applied through gas-powered generation, and has been proposed in the Energy Bill.

190. The Commission considered it understandable that Member States would wish to protect their consumers and security of supply, but argued this should be done in a way that takes account of neighbouring countries and exploits the benefits of cooperation with these neighbours.[353] We heard that capacity mechanisms should only be introduced after the consideration of interconnection, storage, grid improvement and policy developments in order to allow for demand-side response.[354] National Grid, for example, argued that interconnection "clearly" has big security of supply benefits.[355]

191. In their submission to the Commission's consultation about capacity mechanisms, DECC acknowledged that security of supply relates not only to domestic capacity but also to demand-side response and to interconnection. Their view was that capacity mechanisms should not be open-ended and should not, ideally, be required in a functioning single energy market.

192. UK witnesses were largely convinced that, for the moment, interconnection could not be relied upon to produce power at times of UK shortage. ScottishPower, for example, pointed out that there had been situations when

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349 *Plans to increase Britain's gas storage capacity left in tatters by credit crunch*, The Guardian, 12 January 2009

350 Q 148

351 Energy and Climate Change Committee, 8th Report (2010–12): *The UK's Energy Supply: Security or Independence?* (HC 1065)

352 E.ON

353 Q 60

354 Q 68

355 Q 340

the UK price signals did not work—when the price signals would have suggested import, the interconnectors were exporting. It therefore saw it as "right and proper" to consider a supply security mechanism, which it believed would play a role in "keeping the lights on".[356]

193. Furthermore, concerns were expressed that current gas prices, compared to those of coal, did not make gas an attractive investment, thus requiring a capacity mechanism.[357] ScottishPower stressed that capacity mechanisms "of one sort or another" have been embedded in the UK privatised electricity market for most of its history—such as free carbon allowances under Phases I and II of the EU Emissions Trading System (ETS) (between January 2005 and December 2012)—and that during the only four year period in which such a system did not exist, a number of power stations hit financial difficulties.[358] ScottishPower observed that despite having planning permission for a number of new gas plants, they were unlikely to continue to invest unless a capacity mechanism was introduced.[359] SSE noted its agreement with ScottishPower, and criticised the timing of the first capacity payments from 2018, which it argued was "rather later" than its (or Ofgem's) analysis suggests would be appropriate.[360]

194. Whilst generally accepting that there may be a case in support of a capacity mechanism, both National Grid and Ofgem warned that "The devil is in the detail",[361] and checks must be in place to ensure that there was no distortion, a position with which ENTSO-E and E.ON agreed.[362] Professor Stern insisted that there was substantial unused gas capacity. He pointed to the fact that, in 2012, UK Combined Cycle Gas Turbines (CCGTs) were running at 40% load factor. Furthermore, 4 GW of CCGTs are currently mothballed and 10 GW are fully permitted, but not yet built.[363]

195. **In the short-term, we accept the need to introduce legislative powers for a capacity mechanism that seeks to ensure domestic security of energy supply, whether in the UK or elsewhere. The issue will be particularly acute after 2015, as more coal plants are retired under the Large Combustion Plant and Industrial Emissions Directives.**

196. **We are concerned that excessive reliance by large numbers of Member States on capacity mechanisms designed to support fossil fuel power station investment will add costs to electricity and may exacerbate the risk of fossil fuel 'lock-in'. For this reason, we consider it important that any capacity mechanism gives at least equal weight, and potentially should prefer, the inclusion of interconnection and of active demand-side response measures as alternate or additional ways of ensuring security of supply.**

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[356] Q 192

[357] Dr Karsten Neuhoff, ScottishPower

[358] Q 196

[359] QQ 201–202

[360] Q 201

[361] Q 351

[362] Q 300, E.ON

[363] Q 153

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

Chapter 2: Investment and costs

197. **We recommend that the Commission includes energy policy within its annual growth strategy and that Member States be encouraged, through the European Semester, to consider how their fiscal policies can contribute to unlocking investment in the energy sector** (paragraph 18).

198. We agree with the evidence presented that the time is right for infrastructure investment, including in energy, because it can have a multiplier effect, it can provide secure energy at a stable cost and it can boost technological advance. Low carbon generation and system infrastructure in particular can provide domestic energy production for decades at low and stable operating costs but at a high capital cost. We conclude that such investment is particularly appropriate at a time of historically low interest rates and recession. The potential to utilise underemployed financial resources, at low financing costs, while providing a secure indigenous supply for future growth means that investment, particularly in low carbon energy, could make a material and enduring contribution to European economic recovery (paragraph 24).

199. Investment in low carbon energy will undoubtedly create jobs, but we caution that the case is not yet clear as to the extent to which net new jobs will be generated in the EU. We recognise the significant job creation potential of energy efficiency and energy connectivity developments (paragraph 28).

200. We conclude that there is a crisis of investment, which needs to be overcome if the estimated €1 trillion of investment required in the EU's energy system to 2020 is to be released. The balance sheets of utility companies have slumped. Public funding can make a small but catalytic contribution. The bulk of the financing will therefore rely on institutional investment (paragraph 38).

201. **We recommend that the Commission and Member States work urgently with investors, including pension funds, to ensure their awareness of the opportunities, to identify obstacles and to propose solutions, such as the development of instruments to allow the pooling of resources in order to mitigate risk and encourage investment. Initiatives such as the EIB's Project Bond Initiative should be appropriately financed and promoted within the investment community. The EIB has a particular role in that promotion, but responsibility falls also to the Commission and Member States** (paragraph 39).

202. **It is evident to us that a clear and credible EU energy and climate change policy through to 2030 is a pre-requisite for attracting investment and must therefore be adopted as a matter of urgency.** Failure to invest, or investment at high financing costs due to perceived policy risk, could push up the overall cost of energy to consumers (paragraph 40).

203. Energy pricing is, rightly, attracting attention as a factor of competitiveness and affordable energy should certainly be a goal of policy makers. The impact of the required energy transformation on retail bills, for industry and consumers, is uncertain. Ultimately, retail bills depend on a combination of taxation, energy efficiency and, most significantly, potentially volatile energy costs driven by business cycles and uncertainty. Policy makers cannot totally

control volatility but their actions can mitigate its impact. We consider that bills are more likely to increase long-term if delays in developing a clear policy framework fail to ensure adequate and timely investment, including and particularly relating to low carbon sources which do not depend on global fossil fuel markets (paragraph 49).

204. Failure to stabilise bills could provoke a serious political backlash. This underlines the need for governments and energy suppliers to convey a transparent and credible narrative to their consumers about the objectives of energy policy. As recommended by the Commission, specific measures must be defined at national and local levels to tackle fuel poverty (paragraph 50).

Chapter 3: The energy mix

205. We recommend that consideration should be given to annual obligatory reporting by Member States to the Commission on their national energy policies, with assessments conducted by the Commission on the implications of emerging policies for neighbouring countries and the EU as a whole. This must extend to assessment of the compatibility of national policies with EU rules on state aid, on which we recommend the Commission provides further clarity (paragraph 54).

206. In terms of worldwide electricity generation, CCS could make a larger contribution than anything else to reducing greenhouse gas emissions. The EU has a common interest in the development of CCS because of its common decarbonisation target and availability of significant carbon storage capacity (paragraph 60).

207. We consider that, in relation to both coal and gas, CCS is technically feasible, but faces both financial and political obstacles. We urge the UK Government to deliver and build on its commitments to support pilot projects and stress the importance of an EU CCS portfolio including at least one CCS project applied to gas (paragraph 61).

208. Where possible, CCS should be developed in industrial clusters so that it can be applied to industry as well as the power sector, thereby allowing its by-products to be used for industrial purposes (paragraph 62).

209. It is particularly disturbing that as the need for CCS has increased, the effort to deliver it appears to have diminished. The slow progress of CCS thus far and its importance to EU energy policy suggest that a stronger incentive needs to be developed at EU and Member State level. This requires a stable source of national and EU funding and a credible carbon price or regulatory approach. Such an approach should include a provisional target date for requiring CCS to be applied to any new fossil fuel power stations, based on the results of pilot projects (paragraph 63).

210. Gas has an important role as a transitional fuel, in moderating the cost of energy while larger renewable resources are further developed, and in balancing the system as the scale of intermittent inputs rises. However, further gas investment also carries a risk of 'lock-in' to carbon-based plant and infrastructure. Regulation, indicated well in advance, may be required in order to manage the transition to further decarbonisation, whether by CCS or by moving beyond gas (paragraph 68).

211. We agree that a regulatory structure for the exploitation of shale gas in the EU should be developed. We caution, however, that fundamental structural

differences (including population density, geology, planning and legal factors) make it highly questionable that the EU could repeat the US experience. The EU is unlikely to compete on the basis of cheap fossil fuels. Creation of such a false hope would undermine the policy stability required to attract investment. We therefore conclude that there is some uncertainty about the likely extent of EU-produced shale gas. The EU must take into account the further exploitation of shale gas in neighbouring regions and the implications of this for EU energy policy (paragraph 75).

212. We note with concern the resurgence of coal in the EU. While significant closures are expected to take place as a result of EU environmental Directives, we observe that new plants compliant with those Directives are in preparation. We warn that, if the price of carbon under the ETS languishes for long, its credibility as a deterrent to new coal investment will be lost. The further development of coal in circumstances where CCS is not a proven technology would carry a high risk, not only in terms of climate change (and EU credibility), but also economic risk of stranded assets (paragraph 82).

213. There are a range of renewable energy technologies at various stages of development. A number of onshore renewable resources, including wind, could be close to cost-competitive with present fossil fuel prices if the carbon price was more robust, but they are impeded in particular by public opposition as well as strategic uncertainties about energy prices and policy (paragraph 88).

214. For much of northern Europe, including the UK, offshore renewable energy will require sustained investment, including by way of support schemes, to bring down costs. We would not support harmonisation of national support schemes but welcome work by the Commission to identify examples of best practice. We agree that support schemes should be temporary and phased out as a technology progresses towards commercial viability (paragraph 89).

215. We accept that the increasing development of renewable energy has implications for the continuity of supply due to the intermittent nature of some renewable energy generation. This challenge should not be underestimated, but nor need it be an obstacle to the further development of renewable energy. It can be overcome through demand-side response, interconnection, storage and gas generation, although the necessity for gas to play this role should recede over the medium-to long-term (paragraph 90).

216. We conclude from the German energy transformation thus far that, in practice, the safe and reliable introduction of high levels of renewable power requires coordination with neighbouring Member States (paragraph 91).

217. There is not, and there never has been, consensus among Member States with regard to the role of nuclear energy. In the UK and elsewhere, financing remains problematic, both in terms of securing investment and with costs overrunning. Nuclear remains a low carbon option, but its future is uncertain in the EU. Important issues relating to state aid, liability and waste remain to be resolved and must be addressed by Member States and the Commission. Failure to agree the terms of significant new nuclear investment will inevitably increase reliance on alternative energy sources (paragraph 98).

Chapter 4: Delivering policy clarity—2030 framework

218. Member States must be under no illusion: failure to agree a 2030 framework will restrict investment, with subsequent implications for energy costs,

climate change ambitions and energy security. A comprehensive framework must be underpinned by a greenhouse gas reduction target set at the suggested level of 40% compared to 1990 levels, and in line with at least an 80% reduction by 2050 (paragraph 103).

219. The recession and other factors have made the ETS marginal in terms of driving emissions reduction. Its history and current design render it ineffective at achieving its other goals. Experience has demonstrated the extreme sensitivity of the ETS to unanticipated developments (paragraph 113).

220. We support the backloading proposal to amend the ETS in the short-term but we agree with some of our witnesses that it will be ineffectual without a commitment to a timetable for longer-term structural reform. This should be agreed by 2015 in advance of the Paris international climate change negotiations (paragraph 114).

221. The dominant options for rejuvenating the ETS include tightening the cap and setting a floor price. The uncertainty in revenues makes it impossible for governments to budget effective use of ETS revenues, and the price collapse has reduced the major source of expected EU finance for CCS. We therefore conclude that a floor price would simultaneously increase investor confidence and help to stabilise possible financing for infrastructure, low carbon innovation and related applications (paragraph 115).

222. A combination of both tightening the cap and introducing a floor price, seen as part of a package to attract new investment and support efficiency and innovation, may help to alleviate some of the political opposition to both options. Structural reform is important to restore credibility and meet the multiple goals of the ETS, but a clear trajectory for a reduction in the cap over the period to 2030 would remain important (paragraph 116).

223. A strengthened and more effective ETS can provide a broad underpinning for the most cost-effective low carbon technologies, but it cannot support all of the necessary transformations. An EU-wide renewable energy target beyond 2020 is desirable, and so we therefore support a renewable energy target up to 2030. Failing that, a 2030 decarbonisation target at the EU level for the power sector should be set. Member States could then set their own specific renewable energy targets, which should be reported to the Commission (paragraph 121).

224. The EU has adopted the EED which needs to be implemented across Member States. We would support further consideration as to the introduction of binding EU-level targets on energy consumption by 2030, consideration which should be informed by the Commission's assessment in 2014 of the implementation of the EED (paragraph 126).

225. There are important helpful technologies, such as community heating systems and CHP, which must be further developed. The potential 'rebound effect' reinforces the need for energy efficiency policy to be complemented by measures to price carbon appropriately (paragraph 127).

226. We agree that energy costs have a disproportionate impact on a small number of energy-intensive industries and that this is an issue to be addressed in the post-2020 framework. In order to make a full evidence-based position for that framework possible, we recommend that the Commission explore urgently the various options, such as: free allocation of

allowances under the ETS; global sectoral agreements; and any global trade-compatible measure that could equalise costs between domestic and third country producers. Some income derived from the auctioning of allowances under an ETS with a floor price could be offered to assist energy-intensive industries to develop and adopt innovative energy efficient technologies (paragraph 133).

227. We conclude that the future framework can and should be seen and articulated as an economic opportunity for all Member States. It must overhaul the ETS as an instrument for supporting strategic investment both by industry and, through revenues raised, for supporting innovation (for example, in CCS and offshore turbines), European infrastructure investment and energy efficiency. Provisions on the ETS must form part of a package along with policies on renewable energy and associated infrastructure, energy efficiency, and energy-intensive industries. We note that the unanimous support of all Member States may not be required, as any future agreement could be reached with a qualified majority (paragraph 138).

Chapter 5: Research and innovation

228. Innovation is central to the EU's future competitiveness, but the EU risks being eclipsed by others, including the US and China. Two main factors could undermine energy innovation in Europe: inadequacy of finance; and uncertainty about the future policy framework. Both of these could be addressed by an adequate 2030 framework, particularly if this included a reformed ETS which made direct links to innovation through the use of carbon revenues and greater certainty over long-term price trends. (paragraph 144).

229. Funding to support research and innovation activities across all areas will be increased for the next financing period running from 2014 to 2020. Clarity on how it will divide between the various priorities is now required. (paragraph 156).

230. We are alarmed at the degree of evidence that we have heard to suggest that the SET Plan is at risk of failing to deliver its objectives due to inadequate funding. We conclude that the Commission must, as a matter of urgency, revise the SET Plan with a view not only to the technologies on which it should concentrate but also to how the SET Plan will be financed. Such work must be undertaken in partnership with Member States, the private sector and the EIB (paragraph 157).

231. The EIB's risk-sharing finance ability will be of particular value in the context of the market's reluctance to lend to certain Member States because of budget deficits (paragraph 158).

232. In terms of the future focus of investment in R&D, we agree with those witnesses who emphasised the increasing importance of demand-side technologies and so an increased focus on areas such as storage and smart meters would be helpful. As regards renewable energy, further work on advanced biofuels would be helpful, as it would on solar and tidal energies (paragraph 159).

233. We welcome innovative approaches to energy, including those that might be developed through innovation networks such as the new Smart Cities EIP. The value of such partnerships is dependent on their ability to engage with local, regional and national actors (paragraph 160).

Chapter 6: Interconnectivity and energy security

234. It is cost-efficient and urgent to develop electricity interconnections between Member States in order to support both the further deployment of renewable energies and attempts to secure the EU's energy supplies. We conclude that the full benefits of interconnection will be derived only from greater deployment of HVDC lines, allowing electricity to be transported over a long distance at an economical cost (paragraph 168).

235. We agree with our witnesses that an increasingly interconnected grid will need to be developed incrementally, rather than on the basis of a top-down grand plan. Nevertheless a stronger element of network planning—nationally and regionally—could be very beneficial in the transition to a more renewable-based and secure system. The move to greater interconnection is not incompatible with the development of distributed generation, but the potential offered by distributed generation must be recognised more clearly in energy strategies (paragraph 173).

236. We welcome recent agreement on the trans-European Energy Infrastructure Regulation, which identifies PCIs and establishes common rules on permit granting procedures. The Regulation must now be implemented with urgency (paragraph 175).

237. We acknowledge that public concerns can be a significant obstacle to the development of interconnections. In that context, the public awareness dimension of EU energy policy becomes pivotal: a local decision can have significant pan-European implications in terms of energy cost and energy security. The Commission must consider as part of its future policy framework how it and Member States can work together to communicate effectively the benefits of cross-border energy connections. We agree that providing a clear indication that a project is part of a strategic transition towards an increasingly interconnected grid could help overcome local objections to projects. Early engagement and consultation with the public and other interest groups is similarly important. The Renewables Grid Initiative, involving environmental NGOs and TSOs, is a welcome attempt to tackle the public awareness issue. (paragraph 178).

238. There remain economic and regulatory obstacles to integrated interconnection and transmission, which are crucial to the completion of the internal energy market. We encourage Member States to support regulators, through ACER, and TSOs, through ENTSO-E, in their efforts to overcome those obstacles. A review of budgetary support to ACER in particular would be helpful to ensure that it has a sufficient budget to allow it to deliver its important role. The ultimate goal of more effective regulatory cooperation must be a pan-EU energy market, working for the benefit of EU consumers (paragraph 182).

239. There are considerable financial and political uncertainties as to the sources and costs of future gas supply. It is clear that a range of sources and methods of transportation are critical. We support the Commission's attempts to improve efficiency in gas pipeline capacity. We urge the UK Government to examine the potential for a regulatory framework to increase gas storage. (paragraph 188).

240. In the short-term, we accept the need to introduce legislative powers for a capacity mechanism that seeks to ensure domestic security of energy supply, whether in the UK or elsewhere. The issue will be particularly acute after

2015, as more coal plants are retired under the Large Combustion Plant and Industrial Emissions Directives (paragraph 195).

241. We are concerned that excessive reliance by large numbers of Member States on capacity mechanisms designed to support fossil fuel power station investment will add costs to electricity and may exacerbate the risk of fossil fuel 'lock-in'. For this reason, we consider it important that any capacity mechanism gives at least equal weight, and potentially should prefer, the inclusion of interconnection and of active demand-side response measures as alternate or additional ways of ensuring security of supply (paragraph 196).

APPENDIX 1: LIST OF MEMBERS AND DECLARATIONS OF INTEREST

The members of the Sub-Committee which conducted this inquiry were:

Baroness Byford (joined February 2013)
The Earl of Caithness
Lord Cameron of Dillington
Lord Carter of Coles (Chairman)
The Earl of Courtown (resigned January 2013)
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Lord Maclennan of Rogart
Baroness Parminter
Lord Plumb
Lord Renton of Mount Harry
Lord Whitty

Declaration of Interests

Baroness Byford
No relevant interests

The Earl of Caithness
No relevant interests

Lord Cameron of Dillington
Landowner with family interests in renewable energy schemes

Lord Carter of Coles
No relevant interests

The Earl of Courtown
No relevant interests

Lord Giddens
No relevant interests

Baroness Howarth of Breckland
No relevant interests

Lord Lewis of Newnham
Chairman, Advisory Committee to Veolia Environmental Services

Lord Maclennan of Rogart
Chairman, Firth Tidal Energy Limited

Baroness Parminter
Trustee, the Institute for Public Policy Research (IPPR)

Lord Plumb
Agricultural Development
Farming

Lord Renton of Mount Harry
No relevant interests

Lord Whitty
Chair, Lehman-Chesshire Trust (energy efficiency and fuel poverty charity)

The following Members of the European Union Committee attended the meeting at which the report was approved:

Lord Boswell of Aynho (Chairman)
Lord Bowness
Lord Cameron of Dillington
Lord Carter of Coles
Lord Dear
Baroness Eccles of Moulton
Lord Foulkes of Cumnock
Lord Hannay of Chiswick
Lord Harrison
Lord Maclennan of Rogart
Lord Marlesford
Baroness O'Cathain
Lord Richard
The Earl of Sandwich
Baroness Scott of Needham Market
Lord Teverson
Lord Trimble

During consideration of the report the following interests were declared:

Lord Cameron of Dillington
Landowner with family interests in renewable energy schemes

Lord Maclennan of Rogart
Chairman, Firth Tidal Energy Limited

A full list of registered interests of Members of the House of Lords can be found at http://www.parliament.uk/mps-lords-and-offices/standards-and-interests/register-of-lords-interests

Professor Michael Grubb acted as Specialist Adviser for this inquiry and declared the following relevant interest:

Senior Advisor for Sustainable Energy Policy, Office of Gas and Electricity Markets (Ofgem)

APPENDIX 2: LIST OF WITNESSES

Evidence is published online at www.parliament.uk/hleud and available for inspection at the Parliamentary Archives (020 7219 5314)

Evidence received by the Committee is listed below in chronological order of oral evidence session and in alphabetical order. Those witnesses marked with * gave both oral evidence and written evidence. Those marked with ** gave oral evidence and did not submit any written evidence. All other witnesses submitted written evidence only.

Oral evidence in chronological order

*	(QQ 1–33)	Centre for European Reform (CER)
		Dr Karsten Neuhoff
**	(QQ 34–59)	Antony Froggatt
*	(QQ 60–70)	European Commission
*	(QQ 71–80)	Oil & Gas UK
**	(QQ 81–92)	Professor Peter Cameron, University of Dundee
**	(QQ 93–103)	Dr Robert Gross, Imperial College
*		RenewableUK
**	(QQ 104–117)	Confederation of UK Coal Producers (CoalPro)
*		European Climate Foundation (ECF)
**	(QQ118–140)	Professor Dieter Helm, University of Oxford
*	(QQ 141–156)	Professor Jonathan Stern, Oxford Institute for Energy Studies
**	(QQ 157–170)	European Investment Bank (EIB)
**	(QQ 171–185)	Peter Atherton
*		Bloomberg New Energy Finance (BNEF)
*	(QQ 186–202)	EDF Energy, ScottishPower and SSE
**	(QQ 203–215)	Martin Wolf
*		Dimitri Zenghelis
*	(QQ 216–236)	European Commission
*	(QQ 237–247)	Fiona Hall MEP
**		Niki Tzavela MEP
**	(QQ 248–253)	Chris Davies MEP
		Dan Jorgenson MEP
*	(QQ 254–277)	European Commission
**	(QQ 278–304)	European Network of Transmission System Operators for Electricity (ENTSO-E)
*	(QQ 305–338)	World Wildlife Fund (WWF)
**		Confederation of British Industry (CBI)

*	(QQ 339–357)	National Grid
**		Office of Gas and Electricity Markets (Ofgem)
		Agency for the Cooperation of Energy Regulators (ACER)
*	(QQ 358–380)	Department of Energy and Climate Change (DECC)

Alphabetical list of all witnesses

	ABB Limited
	Agency for the Cooperation of Energy Regulators (ACER) (QQ 339–357)
**	Peter Atherton (QQ 171–185)
*	Bloomberg New Energy Finance (BNEF) (QQ 171–185)
**	Professor Peter Cameron, University of Dundee (QQ 81–92)
**	Confederation of British Industry (CBI) (QQ 305–338)
*	Centre for European Reform (CER) (QQ 1–33)
	Chartered Institution of Building Services Engineers (CIBSE)
**	Confederation of UK Coal Producers (CoalPro) (QQ 104–117)
	Juan Pablo Davico
**	Chris Davies MEP (QQ 248–253)
*	Department of Energy and Climate Change (DECC) (QQ 358–380)
	E.ON
*	EDF Energy (QQ 186–202)
	Energy Networks Association (ENA)
	Energy Technologies Institute (ETI)
**	European Network of Trasmission System Operators for Electricity (ENTSO-E) (QQ 278–304)
*	European Climate Foundation (ECF) (QQ 104–117)
*	European Commission (QQ 60–70) (QQ 216–236) (QQ 254–277)
	European Economic and Social Committee (EESC)
**	European Investment Bank (EIB) (QQ 157–170)
*	Fiona Hall MEP (QQ 237–247)
	The Florence School of Regulation (FSR)
**	Antony Froggatt (QQ 34–59)
**	Dr Robert Gross, Imperial College (QQ 93–103)
**	Professor Dieter Helm, University of Oxford (QQ 118–140)
	INEOS
	Institute for Public Policy Research (IPPR)
	Institution of Engineering and Technology (IET)

** Dan Jorgenson MEP (QQ 248–253)

Sir Donald Miller F.R Eng, FRSE

National Farmers' Union (NFU)

* National Grid (QQ 339–357)

* Dr Karsten Neuhoff (QQ 1–33)

Poland, Ministry of Environment

Professor David Newbery Sc.D. (Cantab.) Ph.D. (Cantab.) M.A. (Cantab.)

** Office of Gas and Electricity Markets (Ofgem) (QQ 339–357)

* Oil & Gas UK (QQ 71–80)

* RenewableUK (QQ 93–103)

Scientific Alliance

* ScottishPower (QQ 186–202)

SmartestEnergy Ltd

* SSE (QQ 186–202)

* Professor Jonathan Stern, Oxford Institute for Energy Studies (QQ 141–156)

** Niki Tzavela MEP (QQ 237–247)

Vestas

Dr Joseph Wheatley PhD

** Martin Wolf (QQ 203–215)

* World Wildlife Fund (WWF) (QQ 305–338)

* Dimitri Zenghelis (QQ 203–215)

APPENDIX 3: CALL FOR EVIDENCE

The EU Sub-Committee on Agriculture, Fisheries, Environment and Energy of the House of Lords, chaired by Lord Carter of Coles, is conducting an inquiry into *EU energy: decarbonising and boosting growth*. The Sub-Committee seeks evidence from anyone with an interest.

Written evidence is sought by 3 October 2012. Public hearings will be held over the period October 2012–February 2013. The Committee aims to report to the House, with recommendations, in May 2013. The report will receive responses from the Government and the European Commission, and may be debated in the House.

In October 2011, the European Commission published an Energy Roadmap to 2050.[364] It explores the challenges posed by decarbonisation in the context of ensuring security of energy supply and competitiveness. The Roadmap emphasises the critical importance of energy efficiency and a switch to renewable energy resources, with gas playing a key role in the transition.

The EU has set itself the target of reducing greenhouse gas emissions by 80–95% by 2050 over 1990 levels. Energy has a pivotal role to play in that transition. Energy is core to every sector of economic life, including households and manufacturing. As the EU seeks to recover economically and to drive forward growth, energy policy is crucial.

We will seek to establish how energy can both be decarbonised and contribute to the EU's economic recovery. We are interested to examine too whether consumer preferences over the energy mix, such as onshore wind and nuclear power, may have implications for prices.

We will make policy recommendations to the Commission and Member States, including the UK, accordingly. At this stage of our inquiry, we are interested in comments covering all forms of energy. We seek views on natural gas particularly, due to the central role afforded to it by the Commission as critical for the transformation of our energy system. Research and innovation are highlighted in the Roadmap and we wish to include them in our study. Our inquiry is focused on energy supply but we recognise that submissions may wish to comment on demand and energy efficiency issues insofar as they affect energy supply.

The Sub-Committee seeks evidence on any aspect of this topic, and particularly on the following questions:

Energy's contribution to economic growth

(1) The dominant theme of the Commission's Energy 2050 Roadmap is decarbonisation, with a particular focus on renewables. How can energy policy make its contribution to both decarbonisation and to economic growth? In what specific ways can energy drive economic growth in the EU?

[364] COM(2011) 885

A common EU approach to transforming the energy system

(2) To what extent will a common European approach help keep the costs of transforming the energy system down and assure security of EU energy supply? Where do you see economic growth and decarbonisation benefitting from a common approach to generation, transmission, distribution and storage? And what are the risks?

The Internal Market in Energy

(3) The internal market in energy is focused on transmission. Should competition in the rest of the supply chain be given greater consideration? What economic opportunities might arise from such consideration? What risks arise?

Reducing the costs of energy for business and consumers

(4) Energy is a significant manufacturing input and household cost. Is it appropriate to seek to reduce the costs of energy in order to boost EU competitiveness and, if so, how can it be achieved in addition to energy efficiency? To what extent might price reductions jeopardise attempts to decarbonise? What implications, if any, do consumer preferences over the energy mix, such as onshore wind and nuclear power, have for price?

Gas

(5) Do you agree with the Commission that "Gas will be critical for the transformation of the energy system", until at least 2030 or 2035? What mechanisms are required to boost the role of gas, securing appropriate investments, but on the proposed interim basis? Does an active renewables policy require gas in support of it? Should the EU encourage the development of unconventional gas?

Research and innovation

(6) We would welcome views on how the EU can most effectively support research and innovation as catalysts for decarbonising energy and driving growth, and how EU energy policy can be sufficiently flexible to take into account emerging new technologies.

APPENDIX 4: GLOSSARY

Backloading	Refers to a proposed amendment to the ETS. The amendment would postpone the auctioning of 900 million allowances from 2013–2015 to later in Phase III of the ETS, which ends in 2020. The backloading does not affect the overall volume of allowances to be auctioned in Phase III, only the distribution of auction volumes over the eight-year period (the 'auction time profile').
Cap reduction	Under the ETS, the cap is an absolute total of emissions allowed to be emitted by all participants. It is set by the Commission and each participant is allocated an individual limit or cap for their own emissions. The cap is reduced over time so that total emissions fall. In 2020, emissions from sectors covered by the ETS will be 21% lower than in 2005.
Capacity mechanism	A capacity mechanism aims to help secure energy supply by giving energy providers financial incentives to provide reliable energy capacity. The UK Government's Electricity Market Reform initiative includes an example of such a mechanism, referred to as a 'capacity market'.
Carbon capture and storage (CCS)	A technology that involves capturing carbon dioxide from fossil fuel power stations (or large industrial sources), transporting it mainly via pipelines and then storing it safely onshore or offshore in deep underground structures such as depleted oil and gas reservoirs or deep saline aquifers. It is estimated that the total reduction in emissions per unit of electricity from the use of CCS is around 70%.
Carbon ceiling price	A maximum price at which allowances to emit carbon dioxide under the ETS may be sold at auction.
Carbon floor price	A minimum price at which allowances to emit carbon dioxide under the ETS may be sold at auction. The UK has had a floor price since 1 April 2013.
Carbon leakage	Where production and the consequent emissions are displaced to countries with less stringent carbon regulation.
Combined Heat and Power (CHP)	Technology that integrates the production of usable heat and power (electricity), in one single, highly efficient process. CHP generates electricity whilst also capturing usable heat that is produced during this process.

Contracts for difference	Under the UK Government's Electricity Market Reform initiative, contracts for difference will lower the risks to potential investors in low carbon technologies (such as renewables, CCS and nuclear) by paying generators the difference between the market price for electricity (the reference price) and the estimated long term price needed to bring forward investment in that technology (the strike price).
Distributed system	Distributed energy resource systems are small-scale power generation technologies used to provide an alternative to or an enhancement of the traditional electric power system. It is also known as 'micro-generation'.
District heating	A district heating scheme comprises a network of insulated pipes used to deliver heat (in the form of either hot water or steam), from the point of generation to an end user.
EU Emissions Trading System (ETS)	A 'cap and trade' system, whereby a 'cap' or limit (which is reduced over time) is set on the total amount of certain greenhouse gases that can be emitted by factories, power plants and other installations in the system. Within the cap, companies receive or buy emission allowances which they can trade with one another as needed. They can also buy limited amounts of international credits from emission-saving projects around the world. The limit on the total number of allowances available ensures that they have a value. After each year a company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed.
European Atomic Energy Community (Euratom)	Euratom is an international organisation that was founded in 1957 with the purpose of creating a specialist market for nuclear power in Europe, developing nuclear energy and distributing it to its member states while selling the surplus to non-member states. While legally distinct from the EU, it has the same membership and is governed by the EU's institutions.
European Coal and Steel Community (ECSC)	The ECSC was designed to integrate the coal and steel industries in western Europe. The original members of the ECSC were France, West Germany, Italy, Belgium, the Netherlands, and Luxembourg. The organisation subsequently expanded to include all members of the European Economic Community (later renamed the European Community) and the EU. When the treaty establishing the organisation expired in 2002, the ECSC was dissolved.

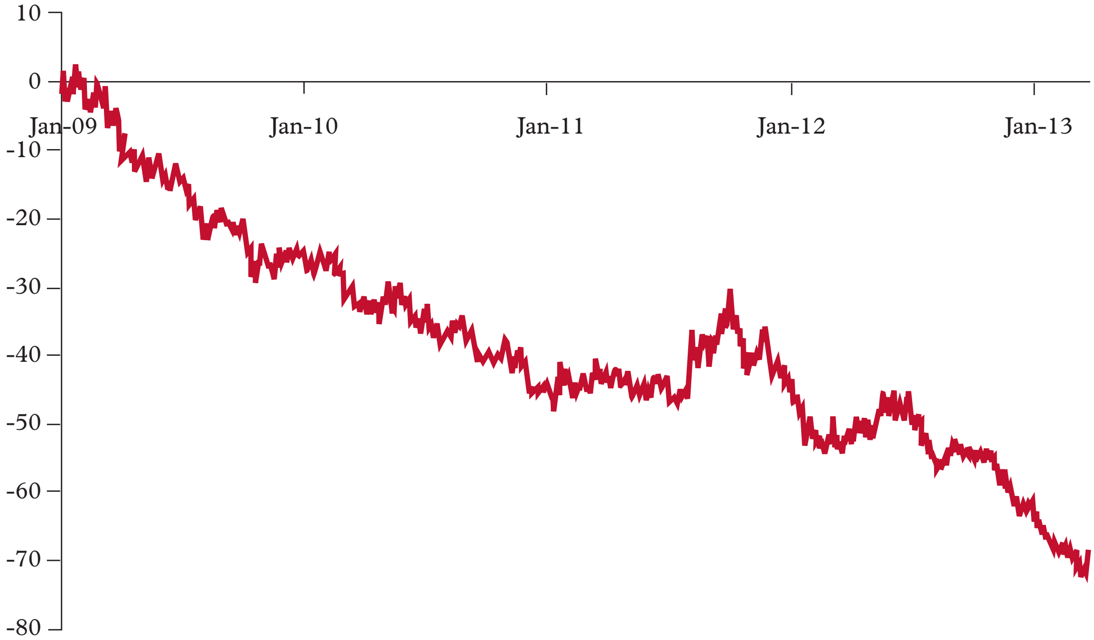
Front End Engineering and Design (FEED)	FEED studies are best practice for complex projects in the engineering and construction industry. FEED studies typically follow on from initial high-level plans, and allow project developers to refine designs and, for example, source quotes from suppliers. This is intended to give greater certainty on costs before the project developer commits significant funding on construction.
Fuel poverty	A household is currently said by DECC to be in fuel poverty if it needs to spend more than 10% of its income on fuel to maintain a satisfactory heating regime.
Interconnection	For the purposes of this report, interconnection is the physical connection of two or more energy systems that allows for the sale or exchange of electricity between different Member States.
Intermittency	Refers to the variability of output according to changes in weather.
Investment grade	Credit ratings are opinions about credit risk published by a rating agency. Investment grades range from BBB- to AAA, with the latter being the highest rating and most likely to attract investment.
Levelised cost	The average cost over the lifetime of a plant, per MWh of electricity generated.
Lignite	The lowest rank of coal with the lowest energy content. Lignite coal deposits tend to be relatively young coal deposits that were not subjected to extreme heat or pressure, containing 25%–35% carbon. In addition, lignite can also contain high sulphur content.
NER-300	Launched by the European Commission in 2008, it is intended to provide financial support for the development of innovative low-carbon technologies, at commercial scale, across the EU. Funding derives from the sale of 300 million allowances (or rights to emit one tonne of CO_2) in the New Entrants' Reserve of the EU ETS.
Overseas credits	Awarded to emissions reduction projects outside the EU and can be sold to operators in the EU (and elsewhere) to count towards domestic (EU) emissions reductions. The ETS has only accepted credits that qualify under (and are monitored by) the UN under the Kyoto Protocol, and excludes land-use-based credits; additional restrictions apply from 2013.
Qualified majority	The EU's system of voting whereby a decision among Member States needs to be supported by at least 55% of Members (currently 15 out of 27) and representing Member States comprising at least 65% of the EU population.

Renewables	EU legislation defines renewables as energy from renewable non-fossil sources, namely: wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.
Shale gas	Gas that is extracted directly from shale (a sedimentary rock). This has a low permeability and so does not release gas easily. To overcome this, the rock is fractured ('stimulated') to yield commercial volumes of gas.
Supergrid	A European grid with much interconnection and much more capacity to move power between countries.
Transitional fuel	Transitional fuels are temporary energy sources used in the move from fossil fuels to low carbon emitting energy sources.
Trilemma	The triple challenge of balancing climate change commitments with the need to maintain security of supply whilst ensuring that energy remains affordable to consumers and industry.
Unconventional gas	Unconventional gas refers to the source rather than the nature of the gas itself. Shale gas and coal-bed methane are examples of unconventional gas.

APPENDIX 5: SHARE PRICES OF MAJOR EU ENERGY COMPANIES

FIGURE 2

Performance of EU utilities share prices (Euro Stoxx) against other share prices (Stoxx 600)



Note: The wider market is indexed to 100

Source: Bloomberg

APPENDIX 6: EU ENERGY LEGISLATION AND PROPOSALS

Existing EU energy legislation

Large Combustion Plant Directive (2001)[365]

The revised Large Combustion Plant Directive (LCPD) applies to combustion plants with a thermal output of 50 megawatts (MW) or more. The LCPD aims to reduce acidification, ground level ozone and particles throughout Europe by controlling emissions of sulphur dioxide and nitrogen oxides and dust (particulate matter) from large combustion plants in power stations, petroleum refineries, steelworks and other industrial processes running on solid, liquid or gaseous fuel.

Combustion plants must meet at least the emission limit values given in the LCPD. An exemption was allowed for those not operated for more than 20,000 hours starting from 1 January 2008 and ending no later than 31 December 2015. Once plants have operated those hours, they must either cease operation or comply with the Directive. The Directive will be superseded by the Industrial Emissions Directive (IED) on 1 January 2016.

EU Emissions Trading System (2003)[366]

A ‘cap and trade’ system, whereby a ‘cap’ or limit (which is reduced over time) is set on the total amount of certain greenhouse gases that can be emitted by factories, power plants and other installations in the system. Within the cap, companies receive or buy emission allowances which they can trade with one another as needed. They can also buy limited amounts of international credits from emission-saving projects around the world. The limit on the total number of allowances available ensures that they have a value. After each year a company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed.

Security of Supply Directive (2005)[367]

The 2005 Security of Supply Directive created measures aimed at safeguarding security of electricity supply so as to ensure the proper functioning of the EU internal market for electricity, an adequate level of interconnection between Member States, an adequate level of generation capacity and balance between supply and demand.

Climate and Energy Package (2008)[368]

The 2008 climate and energy package set three key targets (known as the “20-20-20 targets”) by 2020: a 20% reduction in EU greenhouse gas emissions from 1990 levels, to be strengthened to 30% in the event of an adequate international climate change deal; a 20% improvement in the EU’s energy efficiency; and for 20% of EU energy consumption to be derived from renewables. The package comprised four pieces of legislation intended to deliver these targets, and included: (1) reform

365 Directive 2001/80

366 Directive 2003/87

367 Directive 2005/89

368 Directives 2009/28, 2009/29 and 2009/31; Decision 406/2009

of the EU Emissions Trading System (EU ETS); (2) national targets for non-EU ETS emissions; (3) national renewable energy targets; and (4) a legal framework for the use of carbon capture and storage (CCS).

Third Internal Energy Market Package (2009)[369]

The third internal energy market package was adopted in 2009, and includes key provisions for the proper functioning of the gas and electricity energy markets, including new rules on unbundling of networks, rules strengthening the independence and the powers of national regulators and rules on the development of the functioning of retail markets to the benefit of consumers. The internal energy market is scheduled to be completed by 2014.

Industrial Emissions Directive (2010)[370]

The Industrial Emissions Directive (IED) involved the coalescing of seven existing directives into one:

- the LCPD,[371] including strengthened ELVs for such plants and a limited life time derogation until 2023 exempting plants from meeting the ELVs on certain grounds, one of which is non application of the similar exemption provided under the LCPD;
- the Integrated Pollution Prevention and Control Directive;
- the Waste Incineration Directive;
- the Solvent Emissions Directive; and
- the three existing directives on Titanium dioxide on (i) disposal, (ii) monitoring and surveillance and (iii) programmes for the reduction of pollution.

With the exception of the LCPD, the above Directives will be replaced on 7 January 2014.

Energy Efficiency Directive (2012)[372]

The Energy Efficiency Directive was adopted in October 2012 and established a framework of measures for the promotion of energy efficiency within the EU in order to achieve the 20% energy efficiency target by 2020.

EU energy legislation proposals

Connecting Europe Facility[373]

The Connecting Europe Facility (CEF), which was proposed by the European Commission for the next multi-annual financial framework 2014–2020, would provide €30 billion to boost energy, transport and digital networks, aimed at filling in the missing links in the EU's Single Market. Of that €30 billion, €5.1 billion

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369 Directives 2009/72 and 2009/73; Regulations 714/2003 and 715/2003

370 Directive 2010/75

371 Note: The LCPD and IED do not concern themselves with carbon emissions

372 Directive 2012/27

373 COM(2011) 665

would be spent on the energy sector.[374] The CEF would develop the internal energy market through better interconnection, and support Projects of Common Interest to help ensure that no Member State is isolated or dependent on a single energy source, enhance security of supply and contribute to sustainable development.

EU Emissions Trading System-Backloading Amendment[375]

In Phase III of the ETS (2013–2020), approximately 40% of these allowances will be given out for free to EU ETS installations, whilst the rest will be auctioned with the revenues going to Member States. In November 2012, the Commission proposed an amendment to the ETS to introduce 'backloading'. The amendment would postpone the auctioning of 900 million allowances from 2013–2015 to later in Phase III of the ETS, which ends in 2020. The backloading does not affect the overall volume of allowances to be auctioned in Phase III, only the distribution of auction volumes over the eight-year period (the 'auction time profile').

Note: This proposal was rejected by the European Parliament on 16 April 2013 and will be reconsidered by the European Parliament and Member States.

Trans-European Energy Infrastructure Regulation[376]

The trans-European Energy Infrastructure Regulation proposal sets out new guidelines for trans-European energy networks. It lists and ranks these networks according to the objectives and priorities laid down, projects eligible for EU assistance, and introduces the concept of 'project of European interest'. The guidelines also aim to strengthen project coordination and fully incorporate new Member States.

374 Amounts agreed at the European Council of 8–9 February 2013, but yet to be finalised

375 Draft Commission Regulation (EU) No …/.. of XXX amending Regulation (EU) No 1031/2010 in particular to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013–2020

376 COM(2011) 658

APPENDIX 7: LEVELISED COST ESTIMATES FOR PROJECTS STARTING IN 2018 (10% DISCOUNT RATE)

Central Levelised Costs, £/MWh	Gas-CCGT	Gas-CCGT with post combustion CCS FOAK	Coal-ASC with FGD	Coal-ASC with post combustion CCS FOAK	Nuclear-NOAK	Offshore Wind R3	Onshore Wind >5 MW UK	Solar 250-5,000 KW
Pre-Development Costs	0	1	0	1	4	6	2	-
Capital Costs	8	24	21	47	50	76	68	104
Fixed O&M	3	4	5	10	9	31	17	25
Variable O&M	0	2	1	3	3	-	3	-
Fuel Costs	48	55	28	37	5	-	-	-
Carbon Costs	26	4	57	9	-	-	-	-
CO2 Transport and Storage	-	5	-	11	-	-	-	-
Decommissioning and Waste Fund	-	-	-	-	2	-	-	-
Total Levelised Cost	85	94	113	116	73	113	90	129

Acronyms: ASC = Advanced Supercritical Coal; CCS = Carbon Capture and Storage; CCGT = Combined Cycle Gas Turbine; FGD = Flue Gas Desulphurisation; FOAK = First of a Kind; NOAK = Nth of a Kind; O&M = Operating and Maintenance

Source: DECC (Selected technologies at 2012 prices)

APPENDIX 8: HOUSEHOLD AND INDUSTRY ELECTRICITY PRICES (SECOND HALF 2011 (1) (€/KWH)

TABLE 1

Household electricity prices

Country (by Total Price from lowest-highest)	Total Price	Energy & Supply	Network Costs	Non-recoverable Taxes & Levies
Bulgaria	0.087	0.042	0.030	0.015
Estonia	0.104	0.032	0.045	0.028
Romania	0.109	0.032	0.050	0.026
Lithuania	0.122	0.049	0.052	0.021
Greece	0.124	0.073	0.028	0.024
Latvia	0.134	0.054	0.056	0.024
Poland	0.135	0.057	0.048	0.030
Finland	0.137	0.058	0.045	0.034
France	0.142	:	:	:
Czech Republic	0.147	0.046	0.075	0.026
Slovenia	0.149	0.061	0.054	0.034
Hungary	0.155	:	:	:
United Kingdom	0.158	0.117	0.033	0.008
Luxembourg	0.166	0.071	0.072	0.023
Malta	0.170	0.140	0.022	0.009
Slovakia	0.171	0.065	0.074	0.032
Netherlands	0.184	0.078	0.056	0.050
EU-27 (Average)	0.184	:	:	:
Portugal	0.188	0.063	0.044	0.081
Austria	0.197	0.080	0.064	0.052
Sweden	0.204	0.064	0.070	0.071
Italy	0.208	0.099	0.044	0.066
Ireland	0.209	0.115	0.060	0.033
Spain	0.209	0.093	0.076	0.041
Belgium	0.212	0.076	0.084	0.052
Cyprus	0.241	0.167	0.036	0.038
Germany	0.253	0.081	0.059	0.114
Denmark	0.298	0.068	0.064	0.166

Note: Range for annual consumption of Household group DC: [2,500 KWh-5,000KWh]

Symbols:

: No data available

Source: Eurostat

TABLE 2

Industrial electricity prices

Country (by Total Price from lowest-highest)	Total Price	Energy & Supply	Network Costs	Non-recoverable Taxes & Levies
Austria	:	:	:	:
Bulgaria	0.067	0.051	0.015	0.001
Estonia	0.075	0.032	0.033	0.010
Finland	0.075	0.050	0.018	0.007
Romania	0.080	0.052	0.028	0.000
France	0.081	:	:	:
Sweden	0.083	0.055	0.027	0.001
Denmark	0.093	0.046	0.035	0.012
Netherlands	0.094	0.063	0.020	0.011
Poland	0.094	0.060	0.030	0.005
Slovenia	0.096	0.067	0.022	0.008
Hungary	0.100	:	:	:
Luxembourg	0.100	0.071	0.025	0.004
Portugal	0.101	0.059	0.031	0.012
Lithuania	0.104	0.049	0.054	0.000
United Kingdom	0.104	0.074	0.026	0.005
Czech Republic	0.108	0.071	0.036	0.001
Latvia	0.110	0.067	0.043	0.000
Greece	0.111	0.081	0.017	0.013
EU-27 (Average)	0.112	:	:	:
Belgium	0.115	0.068	0.033	0.013
Spain	0.116	0.077	0.033	0.006
Germany	0.124	0.066	0.024	0.034
Slovakia	0.126	0.060	0.062	0.004
Ireland	0.129	0.091	0.035	0.003
Italy	0.167	0.098	0.024	0.046
Malta	0.180	0.158	0.022	0.000
Cyprus	0.211	0.179	0.025	0.007

Note: Range for annual consumption of Industry group IC: [500 KWh-2,000KWh]

Symbols:

: No data available

Source: Eurostat

APPENDIX 9: LIST OF ABBREVIATIONS

AC	Alternating Current
ACER	Agency for the Cooperation of Energy Regulators
ASC	Advanced Supercritical Coal
BCM	Billion Cubic Metres
BNEF	Bloomberg New Energy Finance
BTU	British Thermal Units
CBI	Confederation of British Industry
CCGT	Combined Cycle Gas Turbines
CCS	Carbon Capture and Storage
CEF	Connecting Europe Facility
CER	Centre for European Reform
CHP	Combined Heat and Power
CIBSE	Chartered Institution of Building Services Engineers
CoalPro	Confederation of UK Coal Producers
DECC	Department of Energy and Climate Change
ECF	European Climate Foundation
ECSC	European Coal and Steel Community
EED	Energy Efficiency Directive
EESC	European Economic and Social Committee
EIB	European Investment Bank
EIP	European Innovation Partnership
ENA	Energy Networks Association
ENTSO-E	European Network of Transmission System Operators for Electricity
ETI	Energy Technology Institute
ETS	Emissions Trading System
EU	European Union
Euratom	European Atomic Energy Community
FEED	Front End Engineering and Design
FGD	Flue Gas Desulphurisation
FOAK	First of a Kind
FSR	The Florence School of Regulation
GDP	Gross Domestic Product
gCO_2	Grammes of Carbon Dioxide
GW	Gigawatts

HVDC	High Voltage Direct Current
IEA	International Energy Agency
IED	International Emissions Directive
IET	Institution of Engineering and Technology
IPPR	Institute for Public Policy Research
ITPR	Integrated Transmission, Planning and Regulation
KV	Kilovolts
KWh	Kilowatt Hour
LCPD	Large Combustion Plant Directive
LNG	Liquid Natural Gas
MW	Megawatts
MWh	Megawatt Hour
NFU	National Farmers' Union
NOAK	Nth of a Kind
O&M	Operating and Maintenance
Ofgem	Office of Gas and Electricity Markets
PCIs	Projects of Common Interest
R&D	Research and Development
TSO	Transmission System Operator
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund