

Research Paper

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Staying Connected

Key Elements for UK–EU27 Energy Cooperation After Brexit

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Summary

- Negotiations over the terms of ‘Brexit’ are likely to be lengthy, complex and difficult. Energy is one policy area in which it may be easier for the UK and future EU27 to find common ground.
- Energy cooperation over the past decades has helped European countries to enhance their geopolitical security, respond to growing climate threats, and create a competitive pan-European energy market. Maintaining close cooperation in this field, and the UK’s integration in the European internal energy market (IEM), will be important for the UK and the EU27 post-Brexit.
- Strong UK–EU27 energy cooperation could help ensure that existing and future interconnectors – physical pipes and cables that transfer energy across borders – between the UK, Ireland and the continent are used as efficiently as possible. As European economies, including the UK, look to decarbonize further, interconnectors will help minimize the costs of operating low-carbon electricity systems, and help lower electricity prices for UK consumers.
- The UK and the EU27 have identified the special relations between the UK and the Republic of Ireland as a priority for negotiations. Any future agreement needs to maintain the Single Electricity Market (SEM) across the island of Ireland, as failure to do so could result in an expensive duplication of infrastructure and governance.
- EU funds and European Investment Bank (EIB) loans account for around £2.5 billion of the UK’s energy-related infrastructure, climate change mitigation, and research and development (R&D) funding per year. Replacing these sources of finance will be necessary to ensure that the UK’s energy sector remains competitive and innovative.
- The UK intends to leave Euratom, the treaty which established the European Atomic Energy Community and which governs the EU’s nuclear industry. This process – dubbed ‘Brexatom’ – will have a significant impact on the functioning of the UK’s nuclear industry, particularly in respect to nuclear material safeguards, safety, supply, movement across borders and R&D. Achieving this within the two-year Brexit time frame will be extremely difficult. The UK will need to establish a framework that it can fall back on to ensure nuclear safety and security.
- Remaining fully integrated with the IEM would require the UK’s compliance with current and future EU energy market rules, as well with some EU environmental legislation. The UK government, British companies and other relevant stakeholders will need to maintain an active presence in Brussels and European energy forums, so that constructive and informed engagement can be sustained.
- Without a willingness to abide by the jurisdiction of the European Court of Justice (ECJ), and in the absence of a new joint UK–EU compliance mechanism, the UK may be required to leave the EU Emissions Trading System (ETS) – an instrument in the UK’s and EU’s fight against climate change. Leaving the ETS would be complicated, even more so if the UK leaves before the end of the ETS’s current phase (2013–20). To maintain carbon pricing in some form outside of the ETS, the UK would need to either establish its own emissions trading scheme, which would be complicated and time-consuming; or build on the carbon floor price and introduce a carbon tax. Either of these potential solutions would need political longevity to be effective.

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- It is in both the UK's and the EU27's interests for the UK to continue to collaborate on energy policy with EU and non-EU member states. The best way to achieve this would be to establish a robust new pan-European energy partnership: an enlarged European Energy Union. In particular, such a partnership could offer a useful platform for aligning EU policies with those of third countries, including the UK, Norway and Switzerland, while allowing them to fully access the IEM and push forward common initiatives. Experience suggests that the EU27 would be more receptive to working within an existing framework or multilateral approach (as with the European Energy Community) than to adopting a bilateral approach (as the EU currently does in its energy relations with Switzerland).

1. Introduction

1.1 The referendum and the Brexit process

In most respects the negotiations over the UK's exit from, and future relationship with, the EU promise to be fraught and complex. However, energy policy is an area in which compromise may be relatively easier to achieve: there is already considerable strategic alignment between the EU and the UK on energy and climate security, and energy policy could attract special attention due to the critical importance of real-time trade in electricity across the English Channel. This research paper makes the case for a strong pan-European energy partnership, as the UK and the EU seek to redefine their international roles post-Brexit.

In March 2017, the UK government triggered Article 50 of the Treaty on European Union to begin formal negotiations on its withdrawal from the EU. The UK will be the first member state to leave the EU, and the process of withdrawing is fiendishly complex. David Davis, the secretary of state for exiting the EU, has suggested that these discussions 'may be the most complicated negotiations of all time'.¹

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Negotiating the terms of the UK's departure from the EU will involve multiple challenges, including the following:

Firstly, there are concerns that the two-year negotiating window² will leave insufficient time to reach an agreement on the terms of Brexit before European Parliament elections and the appointment of a new European Commission in June 2019.

Secondly, it is unclear whether the negotiations on the terms of Britain's exit from the EU can run in parallel with discussions on a future bilateral relationship – or even whether sector-specific dialogues, including on energy cooperation, could take place during this process. Prime Minister Theresa May, in her letter to the president of the European Council, Donald Tusk, triggering Article 50, stated: '[W]e believe it is necessary to agree the terms of our future partnership alongside those of our withdrawal from the EU.'³ Shortly thereafter, the European Parliament passed a resolution which noted that 'should substantial progress be made towards a withdrawal agreement then talks could start on possible transitional arrangements' on the future relationship.⁴ In contrast, Michel Barnier, the

¹ Mason, R., (2016), 'Brexit talks may be most complicated negotiation ever, says Davis', *Guardian*, 12 September 2016, www.theguardian.com/politics/2016/sep/12/brexit-talks-may-be-most-complicated-negotiation-ever-says-minister (accessed 6 Apr. 2017).

² Article 50 (3) TEU states that the UK and the European Council may choose to extend these negotiations beyond the two-year time frame, although this will require unanimous agreement in the European Council.

³ May, T. (2017), Letter to President Tusk of the European Council, triggering Article 50, 29 March 2017, www.gov.uk/government/uploads/system/uploads/attachment_data/file/604079/Prime_Ministers_letter_to_European_Council_President_Donald_Tusk.pdf (accessed 9 Apr. 2017).

⁴ European Parliament (2017), 'European Parliament resolution of 5 April 2017 on negotiations with the United Kingdom following its notification that it intends to withdraw from the European Union (2017/2593(RSP))', www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2017-0102+0+DOC+XML+V0//EN&language=EN (accessed 9 Apr. 2017).

European Commission’s chief negotiator, has said that the process should ‘devote the first phase of negotiations exclusively to reaching an agreement on the principles of the exit’.⁵

Thirdly, with the repatriation of EU competence to the UK, it is unclear what role the UK’s devolved administrations will play in determining and coordinating future UK energy policy under existing devolution settlements. Scotland, in particular, may look to pursue a more prominent role in determining future UK and Scottish energy cooperation with the EU27.⁶

As a consequence, the EU27 and the UK may need to consider a transitional arrangement to cover the period between the UK’s withdrawal in 2019 and the entry into force of any new trade agreement between both parties. This was hinted at in the UK government’s white paper in February 2017, which stated that ‘to avoid a disruptive cliff-edge [...] we should consider the need for phasing in any new arrangements [...] as the UK and the EU move towards a new partnership’.⁷ How long this arrangement would take to negotiate and how it would work in practice are as yet unclear, although the European Parliament stated that ‘they must be strictly limited in time, not exceeding three years’.⁸

There are, however, some lower-profile policy areas in which it may be easier for the UK and the EU27 to find common ground, particularly where joint action is mutually beneficial and necessary to achieving key policy objectives. One important example of this is the energy sector, where the EU has been actively looking to deepen cooperation across the continent to enhance geopolitical security, meet environmental targets, and contribute to competitive energy markets.

1.2 Energy is different

Although energy cooperation did not figure prominently in the referendum campaign or debates since the June 2016 vote, there are five key reasons why both the UK and the EU27 should treat energy, and in particular electricity, as a special case:

1. The provision of energy is a vital public service. Maintaining reliable and affordable energy supplies is essential for the normal functioning of the economy, even if responsibility for energy generation and distribution primarily rests with the private sector. If energy prices are high or if energy supply is disrupted, there is an immediate impact on the whole of society.
2. Electricity is difficult and expensive to store, to a greater extent than oil and gas. Consequently, ensuring real-time availability and system stability requires a clear regulatory framework and government oversight.
3. The necessary decarbonization of the energy sector will increase the use of variable renewable energy sources, such as wind and solar photovoltaics. The efficiency of these sources will be enhanced by cross-border trade in electricity, for example as excess supply in some regions is transferred to other regions.

⁵ European Commission (2017), ‘Statement by Michel Barnier at the plenary session of the European Parliament’, 5 April 2017, http://europa.eu/rapid/press-release_SPEECH-17-881_en.htm (accessed 9 Apr. 2017).

⁶ Scottish Government (2016), *Scotland’s Place in Europe*, www.gov.scot/Resource/0051/00512073.pdf (accessed 7 Apr. 2017).

⁷ HM Government (2017), *The United Kingdom’s exit from and new partnership with the European Union*, Cm 9417, www.gov.uk/government/uploads/system/uploads/attachment_data/file/589191/The_United_Kingdoms_exit_from_and_partnership_with_the_EU_Web.pdf (accessed 12 Feb. 2017).

⁸ European Parliament (2017), ‘European Parliament resolution of 5 April 2017 on negotiations with the United Kingdom following its notification that it intends to withdraw from the European Union (2017/2593(RSP))’ (accessed 9 Apr. 2017).

4. Electricity and, to a large extent, gas are networked industries, dependent on infrastructure for the delivery of services. Much of this infrastructure is already in place, which means that energy cannot easily be transferred to other markets. This makes electricity and gas different from ordinary goods and more like transport and IT, where a special approach with the EU may also be needed.
5. Electricity is not traded globally, unlike most other products and services that are subject to international competition. Furthermore, in its classification by the World Trade Organization (WTO), electricity is treated as both a good and a service and is therefore subject to different tariffs and rules.⁹

1.3 The context – the internal energy market

The UK's and EU's energy and climate change policies have evolved together and are strategically aligned. The EU's internal energy market (IEM), and subsequent packages of energy legislation in 1996, 2003 and 2009, were created with the aim of facilitating 'market access, transparency and regulation, consumer protection, support interconnection [between member states], and [ensuring] adequate [and continual] levels of supply' across Europe.¹⁰ These instruments have also become central to the EU's internal and external relations: for example, membership of the IEM has been important for relations between the UK and the Republic of Ireland, as Northern Ireland and the Republic of Ireland run a single joint electricity market (see Box 3).

The UK has gone from being a net exporter of energy at the turn of the century to relying on imports for 38 per cent of its total consumption in 2015 – most of this external supply has originated from, or been delivered through, the EU or Norway.

In addition to policy alignment, membership of the IEM has helped the UK maintain lower wholesale prices and transaction costs for utilities and – by extension – consumers, as well as keep energy supply secure. This is particularly important given that the UK has gone from being a net exporter of energy at the turn of the century to relying on imports for 38 per cent of its total consumption in 2015¹¹ – most of this external supply has originated from, or been delivered through, the EU or Norway. This structural shift in the UK's supply profile is mainly a result of the depletion of domestic oil and gas reserves, lower production levels for economic reasons, and – more recently – the cessation of domestic deep coal mining (although the increase in the use of renewable energy is starting to slow this trend – see Figure 1).

Some have reported that the UK government has already listed energy as an area requiring specific attention in the negotiations with the EU. In addition, a leaked document to *The Times* revealed that the government was considering presenting several additional bills alongside the so-called 'Great Repeal Bill' (which would see all existing EU laws transposed into UK law), including legislation on emissions trading and nuclear safeguards.¹²

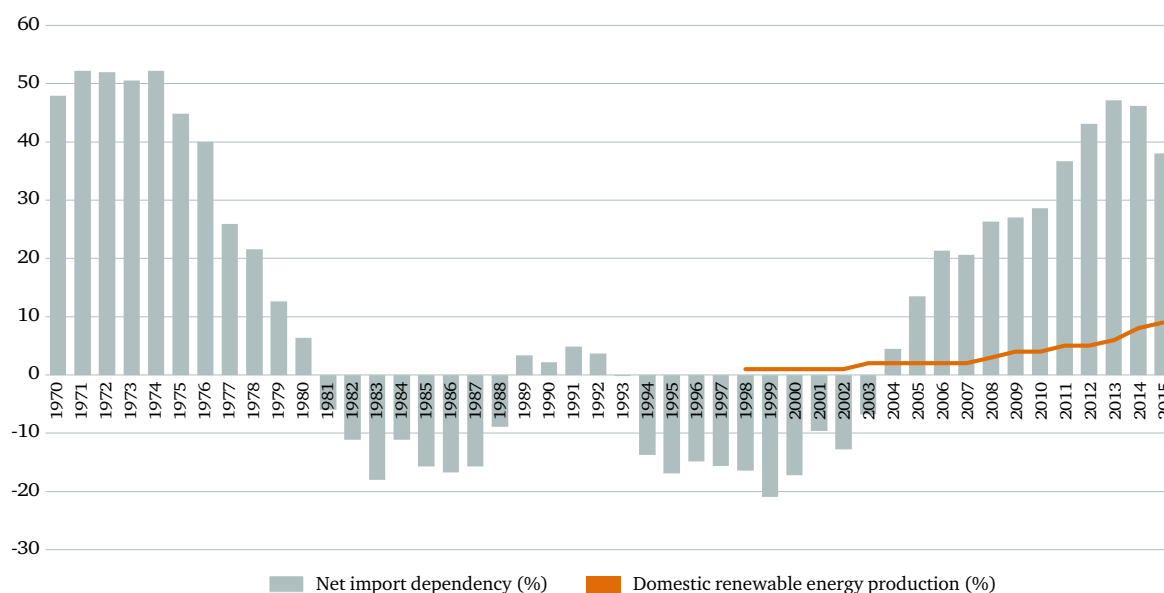
⁹ Marceau, G. (2010), 'The WTO in the emerging energy governance debate', World Trade Organization, www.wto.org/english/res_e/publications_e/wtr10_forum_e/wtr10_marceau_e.htm (accessed 12 Feb. 2017).

¹⁰ Stoerring, D. (2016), 'Fact Sheets on the European Union – Internal energy market', European Parliament, www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuld=FTU_5.7.2.html (accessed 23 Jan. 2017).

¹¹ Department for Business, Energy & Industrial Strategy (2016), *Digest of United Kingdom Energy Statistics (DUKES)*, 'Energy: Chapter 1', www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes (accessed 13 Feb. 2017).

¹² Coates, S. (2017), 'Brexit faces fresh hurdles, leaked Whitehall papers reveal', *The Times*, 14 March 2017; Coates, S. (@SamCoatesTimes) (2017), 'Exc: Gvt doc prepared around November revealing "priority" list of sectors for Brexit talks. List in full!', Tweet, 10 February 2017, <https://twitter.com/SamCoatesTimes/status/829991502973632512> (accessed 12 Feb. 2017).

Figure 1: The UK's net energy import dependency



Source: *Digest of United Kingdom Energy Statistics (DUKES)* (2016).

1.4 The EU's energy relationships

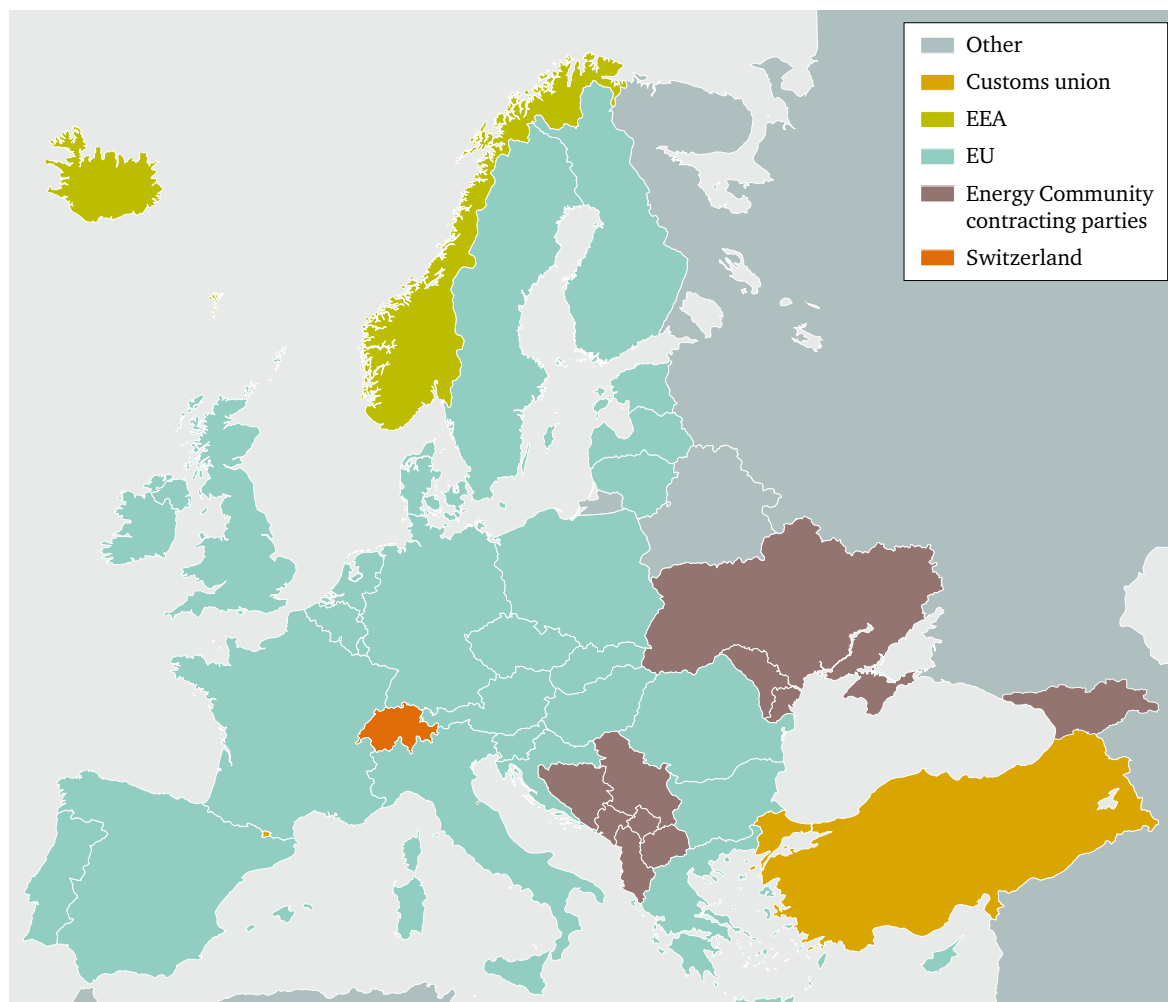
The EU has built a number of energy relationships with neighbours that have different levels of integration in the IEM, as well as trading arrangements with supply and transit countries (see Figure 2). As a result, an independent UK could still access the IEM; however, the level of integration would almost certainly depend on the final outcome of UK–EU27 trade and/or political negotiations.

The EU's existing external relationships are as follows:

- **EEA** – The EU's closest external relationships are with the three European Free Trade Association (EFTA) countries that are also members of the European Economic Area (EEA): i.e. Iceland, Norway and Liechtenstein. By virtue of EEA membership, these countries are required to adopt the internal market *acquis* in most areas, including energy – although there are exceptions, such as in energy standards for buildings. EEA states are also generally granted a delay on implementation of legislation. They participate fully in the IEM. The EFTA Court, EFTA Surveillance Authority and Joint Parliamentary Committee are responsible for legislative monitoring, implementation and enforcement, in an arrangement analogous to the mechanisms for enforcement within the EU.
- **EFTA-only (Switzerland)** – Switzerland is not a member of the EEA, but is in EFTA. It has negotiated a series of bilateral agreements with the EU in different policy areas over the last 20 years. For energy, it has 'partial voluntary alignment' on interoperability to allow basic energy trade.¹³ Further progress in electricity, and many other areas, is expected.

¹³ PiE (2016), *Power in Europe*, 736, 24 October 2016, Platts, p. 14.

Figure 2: The EU’s external energy relationships in 2016



Source: Chatham House.

- Energy Community** – The treaty establishing the Energy Community was signed in 2005, with the aim of assisting some of the EU’s neighbours (with aspirations for EU membership) to liberalize their energy sectors. The Energy Community includes all EU member states and nine contracting parties (Albania, Bosnia and Herzegovina, Georgia, Kosovo, the Former Yugoslav Republic of Macedonia, Moldova, Montenegro, Serbia and Ukraine). Armenia, Norway and Turkey participate as observers. As with EEA countries, Energy Community countries are part of the synchronous electricity grid in Europe and are expected to adopt the relevant energy *acquis* to join the IEM.¹⁴ While no one body is responsible for enforcement, procedures exist for handling negotiation and mediation in disputes: for example, the Energy Community Ministerial Council issues recommendations, and adopts infringement procedures and opinions. The European Commission is currently reviewing a more formal enforcement mechanism as part of the reform process for the Energy Community.¹⁵

¹⁴ ENTSO-E (2016), ‘Development of Transmission Infrastructure in Europe: ENTSO-E’s Ten Year Network Development Plan’, presentation, 14 January 2016, www.cigre-seerc.org/Images/files/ENTSO-E%20Ten%20Year%20Network%20Development%20Plan.pdf (accessed 13 Mar. 2017).

¹⁵ European Commission (2017), *Second Report on the State of the Energy Union, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank*, COM (2017) 53 final, p. 11, https://ec.europa.eu/commission/sites/beta-political/files/2nd-report-state-energy-union_en.pdf (accessed 13 Mar. 2017).

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- **Customs unions** – The EU has customs union agreements with Andorra, Turkey and San Marino, with their membership applying to specific sectors. In the case of Turkey, some energy trade takes place with neighbouring EU member states (for example, electricity is traded via interconnectors with Greece and Bulgaria), even though Turkey is not legally required to adopt IEM legislation.¹⁶ However, to facilitate energy trade, Turkey has adopted much of the energy *acquis* voluntarily.¹⁷
 - **Other** – The EU also has over 50 preferential trade agreements with countries and organizations around the world (although trade in some energy products is limited by lack of geographical proximity), including with supply countries (such as Norway, Russia, Central Asian and Caucasus states, various OPEC producers and the US); transit countries such as Ukraine; and major consuming countries such as Brazil, Japan, China and India.¹⁸ In addition, the EU is a party to the 1994 Energy Charter, which, among other things, facilitates trade, transit and investment in energy products for more than 50 countries.

1.5 UK–EU27 free-trade agreement (FTA) and energy

The February 2017 white paper was vague on what an energy relationship might look like, although it did state that the UK government is ‘considering all options for the UK’s future relationship with the EU on energy’ and that the UK would be leaving Euratom as well as the EU at the end of the Article 50 process.¹⁹ The shape of any bilateral trade agreement is likely to affect the nature of UK–EU27 energy cooperation in the future, particularly if the UK leaves the single market. As part of the UK’s strategy to become a ‘Global Britain’, Prime Minister Theresa May has stated that the UK will pursue a ‘new, comprehensive, bold and ambitious free trade agreement with the EU’.²⁰ This free-trade agreement (FTA) could be based on:

- The UK being outside the single market;
- Ending ‘the jurisdiction of the European Court of Justice [ECJ]’²¹ over UK laws;
- Limiting the freedom of movement of EU citizens seeking to work and live in the UK;
- Possibly adopting ‘elements of current single market arrangements in certain areas’,²² for example in the production of cars and lorries, as well as in financial services; and
- The UK possibly ‘becoming an associate member of the [EU’s] Customs Union in some way, or remain[ing] a signatory to some elements of it’.²³

These factors suggest that the UK government is considering an overarching deal that could allow for different arrangements for certain sectors, including energy. The British letter triggering Article 50 called for the future trade deal between the UK and EU27 to be of ‘greater scope and

¹⁶ Grubb, M. and Tindale, S. (2016), *Brexit and Energy: Cost, Security and Climate Policy Implications*, European Institute, UCL, www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/files/brexit_and_energy_-_ucl_briefing_note.pdf (accessed 7 Apr. 2017).

¹⁷ Energy Community (2015), *Energy Governance in Turkey: Report on Compliance with the Energy Community Acquis*, www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3894261/25824B882CF017E0E053C92FA8C0EE59.PDF (accessed 7 Apr. 2017).

¹⁸ For more details see <https://ec.europa.eu/energy/en/topics/international-cooperation>.

¹⁹ HM Government (2017), *The United Kingdom’s exit from and new partnership with the European Union*, Cm 9417.

²⁰ Prime Minister’s Office, HM Government (2017), ‘The government’s negotiating objectives for exiting the EU: PM speech’, 17 January 2017, www.gov.uk/government/speeches/the-governments-negotiating-objectives-for-exiting-the-eu-pm-speech (accessed 21 Jan. 2017).

²¹ *Ibid.*

²² *Ibid.*

²³ As a member of the EU, the UK is automatically a member of the customs union and bound by the EU’s common commercial policy. This means that there are no tariffs on imports or exports between members of the customs union. Common external tariffs also apply to imported goods from third countries. The cases of Andorra, Turkey and San Marino show that membership of the customs union can be limited to specific sectors – such as agricultural and coal and steel products in the case of EU trade with Turkey.

ambition than any such agreement before it so that it covers sectors crucial to our linked economies such as financial services and network industries'.²⁴ However, whether these arrangements are legally and politically feasible is unclear. The European Parliament has said that it '[o]pposes any future agreement between the European Union and the United Kingdom that would contain piecemeal or sectorial provisions'.²⁵

Even if the UK and the EU27 pursue a separate agreement on energy, decisions made in other policy areas or as part of a bilateral trade agreement could have important implications for the energy sector. For example:

- Increasing manufacturing costs and administrative requirements could lead to lengthy customs checks and act as a brake on broader UK exports to the EU, including exports of energy products.²⁶
- Divergences between UK and EU standards, state aid rules and rules on procurement – as well as the absence of a joint legal enforcement mechanism – could limit the UK's access to the IEM and be burdensome for businesses with operations across both the UK and EU27. The European Council guidelines for negotiations with the UK noted that any FTA 'must ensure a level playing field, notably in terms of competition and state aid, and in this regard encompass safeguards against unfair competitive advantages through, inter alia, tax, social, environmental and regulatory measures and practices'.²⁷
- Companies with power trading operations could face licencing and value-added tax (VAT) implications, as well as regulations on areas such as trading reciprocity. It remains unclear whether traders will require separate licences to operate in the UK and EU, and whether two sets of reporting and compliance requirements will apply as a result. Additional EU financial regulations, including the 'REMIT' framework linked to preventing market abuse, could also apply.²⁸
- Restrictions on trade and reduced access to skilled workers across the EU could increase the costs of essential infrastructure developments and delay their delivery.²⁹ Employers could find it more difficult to bring foreign expertise from Europe into the UK – at the very least, the administrative burden, delays and cost associated with doing so could increase.³⁰

²⁴ May (2017), Letter to President Tusk of the European Council, triggering Article 50.

²⁵ European Parliament (2017), 'European Parliament resolution of 5 April 2017 on negotiations with the United Kingdom following its notification that it intends to withdraw from the European Union (2017/2593(RSP))'.

²⁶ EEF (2016), *Britain and the EU: Manufacturing an orderly exit*, www.eef.org.uk/resources-and-knowledge/research-and-intelligence/industry-reports/britain-and-the-eu-manufacturing-an-orderly-exit (accessed 21 Jan. 2017).

²⁷ European Council (2017), 'European Council (Art. 50) guidelines following the United Kingdom's notification under Article 50 TEU', press release 220/17, 29 April 2017, www.consilium.europa.eu/en/press/press-releases/2017/04/29-euco-brex-it-guidelines/ (accessed 1 May 2017).

²⁸ For example, the EU's regulation on energy market integrity and transparency (REMIT) requires all suppliers, EU and non-EU, to register with an EU national regulatory authority and comply with ACER reporting obligations. Breaches of this can be sanctioned in certain member states. Allen & Overy LLP (2016), *The implications of Brexit for UK energy*, November 2016, www.allenoverly.com/Brexit-Law/Documents/Sector/AO_BrexitLaw_Implications_of_Brexit_for_UK_energy.pdf (accessed 26 Mar. 2017).

²⁹ EDF (2017), 'Written evidence from EDF Energy, to the Business, Energy and Industrial Strategy Committee on Leaving the EU, Energy and Climate Negotiation Priorities', published January 2017, <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/business-energy-and-industrial-strategy-committee/leaving-the-eu-energy-and-climate-negotiation-priorities/written/44579.html> (accessed 7 Apr. 2017); Energy UK (2017), 'Written evidence from Energy UK to the Business, Energy and Industrial Strategy Committee on Leaving the EU, Energy and Climate Negotiation Priorities', <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/business-energy-and-industrial-strategy-committee/leaving-the-eu-energy-and-climate-negotiation-priorities/written/46070.html> (accessed 7 Apr. 2017).

³⁰ Renewable Energy Association (2017), 'Written evidence from the Renewable Energy Association to the Business, Energy and Industrial Strategy Committee on Leaving the EU, Energy and Climate Negotiation Priorities', <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/business-energy-and-industrial-strategy-committee/leaving-the-eu-energy-and-climate-negotiation-priorities/written/44503.html> (accessed 7 Apr. 2017).

1.6 The closer the better? Energy as a special case in Brexit

This research paper proposes that energy, and particularly electricity, should be treated as a special case in the UK's future relationship with the EU27, although forging a positive and constructive energy partnership will be tricky given the political sensitivities of the Brexit negotiations. For the UK, retaining unfettered access to the IEM – particularly for electricity – is important for energy security and the efficiency of system operation. For the EU27, maintaining close links with the UK's energy market will be important for bolstering the EU's fledgling Energy Union, the goal of which is, *inter alia*, to strengthen energy cooperation across the European continent.³¹ Including the UK – with its political influence, experience in market development and climate policy, and status as a key player in the North Sea region – as part of an enlarged Energy Union could, if successful, provide a sustainable model for regional energy cooperation in Europe and beyond. Both sides will need to convey to consumers and policymakers across Europe the mutual benefits and opportunities from a strong energy relationship – they will need to do this as early as possible in the Brexit negotiations.

This research paper proposes that energy, and particularly electricity, should be treated as a special case in the UK's future relationship with the EU.

The rest of this research paper is divided into three main chapters, plus annexes. Chapter 2 explores the implications of Brexit for UK–EU27 energy cooperation, primarily in the electricity sector, and the possible impacts of disrupting market and political alignment. It also looks at the implications of Brexit for the operational regime for interconnectors and market coupling; the special situation in Ireland; the UK's access to EU grants and loans; the EU Emissions Trading System (ETS); and the Euratom Treaty. Chapter 3 looks at the wider international implications of Brexit for the UK and EU27, and at the opportunities for changes to both sides' energy relationships – for example through an enlarged European Energy Union or independent UK engagement with Paris climate commitments. Chapter 4 of the paper proposes a number of recommendations for governments and policymakers.

³¹ In February 2015, the European Commission adopted a framework for the creation of an Energy Union with the aim of ensuring security of supply, improving cross-border coordination and market operations, increasing energy efficiency, decarbonizing the economy, and broadening research and innovation in these fields. European Commission (2015), *A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*, COM/2015/080 Final, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2015%3A80%3AFIN> (accessed 26 Jan. 2017).

2. Brexit and European Energy

Energy cooperation is unlikely to figure prominently in the negotiations between the UK and the EU27, but it will remain an important element of the future relationship between them, with the role of electricity particularly relevant and complex. Key considerations include the implications of Brexit for interconnection, market coupling and the IEM, and for the nuclear sector; as well as whether the UK will continue to participate in the ETS or have access to EU energy and European funds. As with other sectors, British–Irish relations, in particular the future relationship between Great Britain (GB) and Northern Ireland and the Republic of Ireland, will also require special attention.

Energy cooperation is unlikely to figure prominently in the negotiations between the UK and the EU27, but it will remain an important element of the future relationship between them, with the role of electricity particularly relevant and complex.

2.1 Brexit's implications for oil and gas

This paper does not examine in depth the possible impacts of Brexit on the oil market, which is largely driven by global dynamics and therefore unlikely to be significantly affected by changes in the UK's trading relationships with the EU27 – although the EU does currently influence the upstream industry via environmental standards.³²

Nor does the paper look closely at the gas sector. UK and continental gas markets are physically well integrated, via three interconnectors, and there is little congestion or significant difference in wholesale prices. Some take the view that in the absence of a significant shift in UK energy policy, or in the operational regime of gas interconnectors, Brexit is unlikely to have a major impact on the gas market,³³ especially since the UK produces gas domestically and has the largest liquefied natural gas (LNG) import infrastructure in Europe. However, with falling North Sea production and technical issues around gas storage,³⁴ some changes are under way in the UK gas sector which could pose difficulties. Some long-term interconnection contracts will be up for renewal during the Brexit negotiations.³⁵ Leaving the EU could further complicate existing difficulties around the UK gas supply chain:³⁶ an increase in gas prices would raise not only household energy costs, but also the running costs of gas power stations and therefore electricity prices.

³² House of Lords, European Union Committee (2017), 'Brexit: trade in goods', 16th Report of Session 2016–17, 14 March 2017, www.publications.parliament.uk/pa/ld201617/ldselect/ldeucom/129/129.pdf (accessed 7 Apr. 2017).

³³ Goldberg, S. (2017), 'The Future of UK/EU Energy Co-operation Post Brexit', presentation by Silke Goldberg for Herbert Smith Freehills LLP, 15 February 2017.

³⁴ Bros, T. (2017), *Brexit's impact on gas markets*, Oxford Institute for Energy Studies, www.oxfordenergy.org/wpcms/wp-content/uploads/2017/01/Brexit-impact-on-gas-markets-OIES-Energy-Insight.pdf (accessed 7 Apr. 2017).

³⁵ *Ibid.*

³⁶ *Ibid.*

Box 1: Scotland and North Sea licensing

Joseph Dutton – Exeter University

The energy sector risks that Scotland faces are more specific and therefore more pronounced than those faced by the UK as a whole. In 2015 fields in Scottish waters accounted for 95 per cent of UK oil production and 58 per cent of natural gas output.³⁷

Scotland receives gas from Norway – both directly and indirectly – via three pipelines. Three of the UK's four major oil pipeline terminals are also in Scotland; they receive oil both from North Sea fields and from Norway. The main point of concern for companies focused on production is the oil price, particularly since production costs in UK waters are already relatively high. The midstream and downstream sectors – i.e. processing, distribution and marketing – could also be affected by the UK's Brexit settlement. It is unclear whether the UK–Norway framework agreement on cross-border cooperation on the continental shelf will need to be revised, since it currently operates in compliance with EU law.

In more general terms, energy companies have expressed concerns that leaving the single market will lead to higher supply chain costs, and that multinational companies operating in Scotland will face reduced access to skilled imported labour if the UK tightens immigration rules.³⁸

Oil & Gas UK, an industry body, has expressed concerns that the UK will lose its policy voice in Brussels, making regulatory and legislative stability harder to maintain and reducing access to European energy markets.³⁹ In the renewables sector, the Scottish government is concerned about losing access to EU project funding – particularly for wave and tidal schemes.⁴⁰ There are also worries that after Brexit the Westminster government may roll back its renewable electricity ambitions in the absence of EU renewables targets, thereby putting Scottish jobs and companies at risk.⁴¹ The Scottish government is targeting production of the equivalent of 100 per cent of Scotland's electricity consumption from renewables by 2020.⁴²

Scotland has also noted that the EU's climate and energy objectives are increasingly important to meeting domestic goals – in particular as these objectives facilitate the provision of financial support for innovative clean technologies – and that 'maintaining access to the internal energy market is also a priority for energy stakeholders in Scotland'. Furthermore, Scotland intends to seek a settlement with the EU27 that is 'beyond a relationship based solely on free trade'.⁴³

2.2 The European electricity market

The creation of the IEM has fundamentally changed how the EU and member states legislate in the field of gas and electricity, with many decisions now taken at the European level. This change was in part driven by the realization that a fully functioning IEM would require IEM members to link their domestic electricity markets and improve access to their networks. The main legislation relevant for electricity market integration is shown in Annex 1.

In this sense, the IEM is as much about harmonizing domestic markets as it is about increasing trade between them. Important changes include the liberalization of retail markets, the unbundling of

³⁷ Scottish Government (2016), 'Oil and Gas Production Statistics 2015-16', 14 September 2016, www.gov.scot/Topics/Statistics/Browse/Economy/oilgas1516 (accessed 27 Feb. 2016).

³⁸ IPPR (2016), 'Scottish Energy Policy after Brexit', Workshop notes.

³⁹ Oil & Gas UK (2016), 'Brexit: priorities for the offshore oil and gas industry'.

⁴⁰ IPPR (2016), 'Scottish Energy Policy after Brexit', Workshop notes.

⁴¹ Ibid.

⁴² Scottish Government (undated), 'Renewables policy', www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17612 (accessed 22 Feb. 2017).

⁴³ Scottish Government (2016), *Scotland's Place in Europe*.

generation and supply from networks, the introduction of non-discriminatory access rules, and the establishment of independent national regulatory authorities.⁴⁴ Further harmonization and regionalization of energy markets are on the EU agenda, as seen in the European Commission's publication of the 'Clean Energy for All Europeans' legislative proposals – also popularly known as the 'winter package' – in late 2016.⁴⁵

Interestingly, the introduction of successive European directives did not lead to major changes to the UK's electricity markets and network regulations, since many of these directives were consistent with existing UK policies – a fact that illustrates the UK's historical influence over EU rule-making in this area. That said, two areas in which UK electricity markets have been affected by European policy are electricity trade with other EU member states and, more recently, the inclusion of UK markets in the market coupling mechanism (see below).

2.2.1 Electricity trade: market coupling and interconnectors

Electricity trade between the UK and other EU member states only became physically possible in 1986 with the construction of the 'Interconnexion France-Angleterre' (IFA) interconnector. In 2002 the Moyle interconnector was built to link the GB and Northern Ireland markets. For a long time, interconnection and cross-border electricity trade remained very limited: the two interconnectors accounted for only around 3 per cent of capacity, or around 4 per cent of peak demand, over most of the period to 2010. This was well below the target of 10 per cent of installed capacity by 2005 proposed by the European Council in 2002, subsequently updated in 2014 to an aspiration of 15 per cent by 2030.

From 2010 onwards the situation began to change, in part because of increased financial and technical support from the EU. It also reflected a recognition that increasing wind and solar power would make interconnection more valuable as a balancing resource: because some renewables produce electricity intermittently, interconnectors allow the electricity generated to be fully utilized by transferring it to areas in which demand is greatest. This is particularly important as the power sector continues to decarbonize electricity systems by incorporating variable renewables.⁴⁶ Necessary adjustments will include encouraging the development of storage and demand-side flexibility, and in some cases establishing/expanding capacity markets (as payments can now be made to power stations that are on standby or on reduced operating hours). The UK was the first country in the EU to enable the use of interconnectors in its capacity markets,⁴⁷ a move that highlighted the growing importance of interconnectors in ensuring price stability and security of supply.

In 2011 the 1.2-GW BritNed connector to the Netherlands was completed. This was followed shortly afterwards by the opening of the 505-MW East West Interconnector (EWIC) between Wales and the Republic of Ireland in 2012. These infrastructure additions brought GB interconnection capacity up to a little over 5 per cent of generation capacity (7 per cent at peak demand). Two more interconnectors – Nemo and ElecLink – are currently under construction; they are now expected to come online in 2019. A further six interconnectors are contracted. Together, these eight projects represent a combined capacity addition of 10.2 GW (see Table 1) and an estimated investment

⁴⁴ Dutton, J. (2015), *EU Energy Policy and the Third Package*, Energy Policy Group Working Paper: 1505, University of Exeter.

⁴⁵ European Commission, Directorate-General for Energy (2016), 'Commission proposes new rules for consumer centred clean energy transition', press release, 30 November 2016, <http://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition> (accessed 13 Feb. 2017).

⁴⁶ Heptonstall, P., Gross, R. and Steiner, F. (2017), *The costs and impacts of intermittency – 2016*, UK Energy Research Centre, www.ukerc.ac.uk/publications/the-costs-and-impacts-of-intermittency-2016-update.html (accessed 7 Apr. 2017).

⁴⁷ HM Government (2014), 'Interconnectors to participate in the Capacity Market from 2015', 2 December 2014, www.gov.uk/government/news/interconnectors-to-participate-in-the-capacity-market-from-2015 (accessed 7 Apr. 2017).

of around £8 billion. Significant additional capacity is under consideration. According to the UK Department for Business, Energy & Industrial Strategy’s projections, the UK’s net electricity imports will rise from around 20 TWh in 2016 to 80 TWh in the mid-2020s, making these imports the third-largest ‘source’ of electricity behind renewables and gas.⁴⁸ The EU, through the Connecting Europe Facility, is a source of project development finance for the new interconnectors.

Table 1: Operating, contracted or planned interconnectors

Name	Connects GB to	Capacity (MW)	Contracted or actual date of operation	Estimated cost ^a	Connecting Europe Facility development funding ^b
Operating					
IFA	France	2,000	Since 1986		
Moyle	Northern Ireland	450 MW to NI (of which 295 MW to GB)	Since 2002		
BritNed	Netherlands	1,200	Since 2011		
EWIC	Republic of Ireland	505	Since 2012		
Total		4,155			
Contracted					
ElecLink	France	1,000	Contracted 2016	£590 million	€1.7 million, €0.5 million
Nemo	Belgium	1,000	Contracted 2018	€690 million	
NSN	Norway	1,400	Contracted 2019	€2,000 million	€31.3 million
IFA-2	France	1,000	Contracted 2019	€690 million	€5.9 million
FABLink	France	1,400	Contracted 2020	€750 million	€7.23 million
Aquind	France	2,000	Contracted 2020	£1,100 million ^c	
Viking Link	Denmark	1,000	Contracted 2022	€2,000 million	€14.8 million
NorthConnect	Norway	1,400	Contracted 2021	€1,300 million	€10.7 million
Total		10,200			
Projects of Common Interest or party of ENTSO-E* Ten-Year Network Development Plan					
Belgium-GB-2	Belgium	1,000			
Icelink	Iceland	1,000			
Greenwire	Republic of Ireland	3,000			
Codling Park	Republic of Ireland	500–1,000			
Energy Bridge	Republic of Ireland	5,000			
Irish-Scottish Isles	Northern Ireland	1,200			
Second Interconnector	Belgium	1,000			
		12,700–13,200			

*European Network of Transmission System Operators for Electricity.

^a For cost estimates except where footnoted, see C Offshore (2017), www.4coffshore.com/ (accessed 22 Mar. 2017).

^b European Commission (2017), ‘Funding of projects of common interest’, <http://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest/funding-projects-common-interest> (accessed 22 Mar. 2017).

^c Smartest Energy (2016), ‘£1.1 billion French interconnector plans unveiled’, 21 June 2016, <http://smartestenergy.com/info-hub/the-informer/11bn-french-interconnector-plans-unveiled/> (accessed 22 Mar. 2017).

Sources: National Grid (2016)⁴⁹ except where footnoted.

⁴⁸ Department for Business, Energy & Industrial Strategy (2017), *Updated Energy and Emissions Projections 2016*, www.gov.uk/government/uploads/system/uploads/attachment_data/file/599539/Updated_energy_and_emissions_projections_2016.pdf (accessed 21 Mar. 2017).

⁴⁹ National Grid (2016), *Electricity Ten Year Statement 2016*, www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Electricity-ten-year-statement/ (accessed 21 Mar. 2017).

Interconnectors also facilitate ‘market coupling’, i.e. the arrangements that allow efficient trading of energy (in this case electricity) between markets. There are a number of financial benefits to market coupling (see Annex 2). One is the lowering of wholesale prices across the system, due to larger pools of supply and demand being matched more efficiently (although this may result in prices in exporting countries rising as supply is diverted to other consumer countries). The presence of common market operating systems also lowers intermarket and transaction costs, so trading becomes easier and cheaper. A second benefit of market coupling is more efficient allocation of interconnector capacity through the ‘implicit auctioning’ process (see Box 2).

While market coupling increases the overall benefits from greater electricity interconnection for GB, estimates of these benefits in future years are sensitive to several assumptions – about the structure of the wholesale market; the generation mix (especially the amount of renewable generation from wind, for example); and the wholesale market level. At the same time, benefits to final consumers will depend on retail market structures. With these caveats, a report produced for the European Commission in 2013 estimates the EU-wide benefits of day-ahead trading at €3–4 billion a year, with benefits to GB in the order of €100 million a year or more in the short term (i.e. up to 2020) – see Annex 2. EU-wide benefits from shared balancing services are potentially much higher, up to €40 billion a year by 2030.⁵⁰ Up to the 15 per cent of capacity planned for GB up to the mid-2020s, the specific benefits of further interconnection may be in the order of several £100 million a year (see Annex 3). Modelling suggests that the returns from interconnection decline as its proportion of total demand increases. In addition, compared with domestic power generation funded by consumers, interconnectors benefit from a number of what are in effect subsidies.⁵¹

Once it has left the EU, the UK would still be connected to the European market, but the extent of likely integration in the long term is unclear. At present, the Northwest European coupling area (a fully integrated market) includes Norway, which is linked via its membership of the Nordpool market. Energy Community countries are moving towards market coupling among themselves,⁵² and the eventual aim is the ‘establishment of a single pan-European energy market without internal frontiers, comprising Contracting [i.e. Energy Community] Parties and EU countries’.⁵³

⁵⁰ Newbery, D., Strbac, G., Pudjianto, D. and Noël, P. (2013), *Benefits of an Integrated European Energy Market*, Booz and Company, prepared for DG Energy, European Commission, https://ec.europa.eu/energy/sites/ener/files/documents/20130902_energy_integration_benefits.pdf (accessed 7 Apr. 2017).

⁵¹ These include exemption from network and balancing charges and the Carbon Price Support mechanism – see Aurora Energy Research (2016), ‘Brexit – implications for UK energy’, June 2016, www.auroraer.com/wp-content/uploads/2016/10/Aurora-overview-of-potential-Brexit-and-implications-for-UK-energy.pdf (accessed 7 Apr. 2017).

⁵² Energy Community (2017), ‘The Energy Community Market Coupling Simulator’, www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Instruments/Electricity/Simulator (accessed 21 Feb. 2017).

⁵³ ECRB and ENTSO-E (2015), *Regional action plan for market integration in South East Europe*, Energy Community, www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3678148/13E920DAA7307750E053C92FA8C0E202.PDF (accessed 21 Feb. 2017).

Box 2: The impact of Brexit on the system operation of interconnectors and market coupling
Clara Semal, National Grid

Interconnectors and barrier-free energy trade are important if the UK and EU member states are to meet ambitious decarbonization objectives while retaining low energy prices for consumers. The UK is supportive of interconnectors, and collaboration and common frameworks with its interconnector counterparts will remain crucial for ensuring future market coupling and capacity market integration between the UK and the EU.

In each EU member state, electricity demand and generation fluctuate over the course of the day. Interconnectors thus allow national markets to share production capacity at times of high demand or high generation. The rest of the EU is a significant contributor to the UK's energy mix. During 2014 and 2015, electricity imported via both the IFA (France) and BritNed (Netherlands) interconnectors accounted for around 9 per cent of the UK's annual electricity supply.

This arrangement provides consumers with access to cheaper energy. At the moment, every additional gigawatt of interconnected capacity reduces wholesale energy prices in the UK by 1–2 per cent, although there are limits to the savings achievable. Studies also demonstrate the benefits of interconnection at a pan-European level. The European Network of Transmission System Operators for Electricity (ENTSO-E) found that implementing its Ten-Year Network Development Plan for transmission lines would bring significant savings: this network development would cost about €1.5–2 per MWh of power consumption in Europe over a 15-year period, but the market integration created as a result would reduce bulk power prices by €1.5–5 per MWh.

Market coupling for electricity is structured into specific time frames, and is usually split between 'implicit' and 'explicit' arrangements. Implicit market coupling happens when interconnector capacity and energy are sold together in a single market process, whereas explicit market coupling occurs when capacity and energy are sold as separate products. Due to the risk of information asymmetry when capacity and energy are traded separately at different times, explicit allocation can lead to a more inefficient use of interconnectors. This can reduce social welfare gains, lessen price convergence and lead to more frequent 'reverse flows' – defined as power transmission running in the opposite direction to that implied by price differentials.

Most European markets have now been 'coupled', which means that buyers and sellers in any one country can access markets in other countries, with prices converging as far as interconnection capacity will allow, i.e. until the interconnector capacity is saturated. Prices on power exchanges reflect both local demand and supply, as well as interconnector capacity. Within this framework, electricity generally flows from areas of low price/energy surplus towards areas of high price/energy deficit.

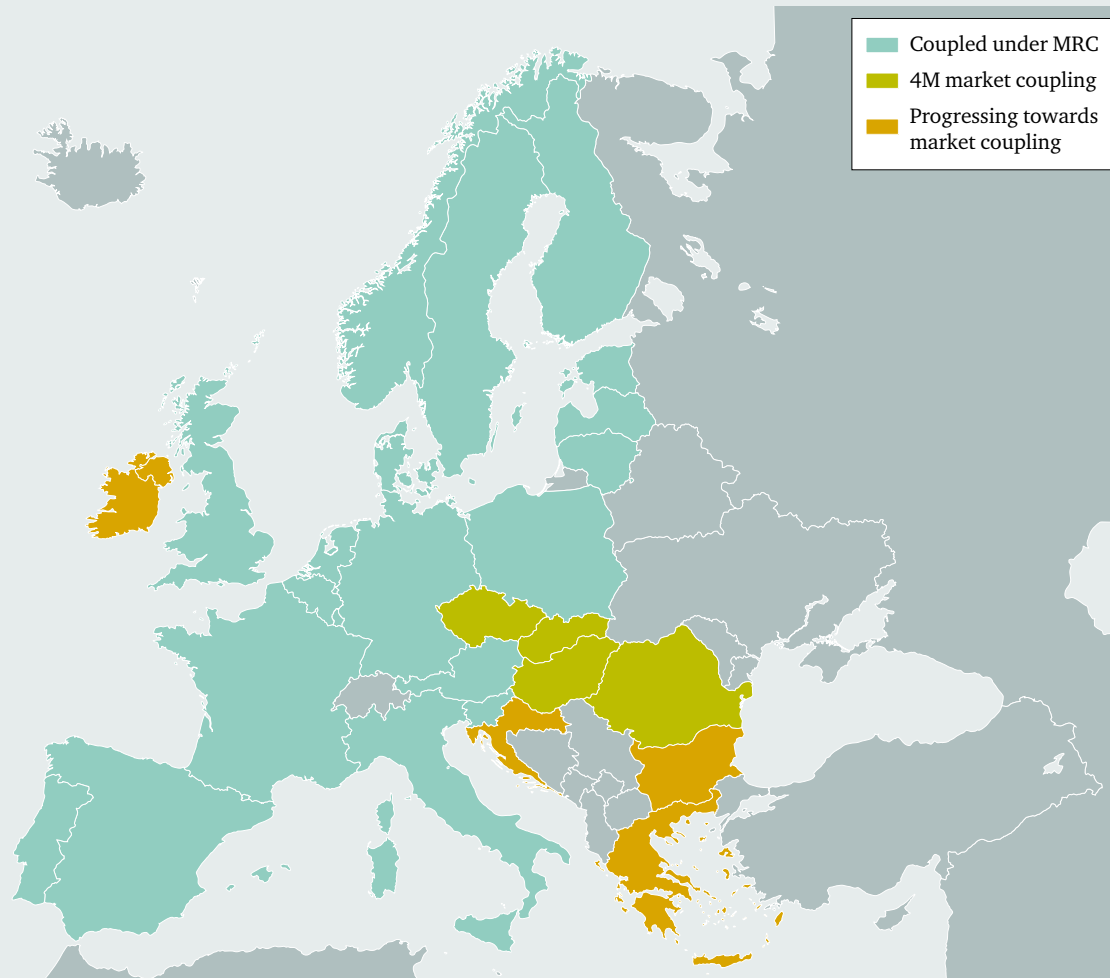
In terms of how the market operates, the transmission system operators (TSOs) make transmission capacities from their own market available to the other markets to which they are coupled. The algorithm Euphemia maximizes overall social welfare by buying and selling energy in the different market areas and allocating the available transmission capacity as appropriate. This process is invisible to market participants.

The market time frames are as follows:

- Forward** Years down to two days ahead of real time
- Day-ahead** One day ahead of real time
- Intraday** Within a day to one hour ahead of real time
- Balancing** From one hour ahead of real time to real time

Market coupling arrangements are at different stages of implementation for each of the time frames. To date, the European focus has been on implementing implicit arrangements in day-ahead market coupling. Day Ahead Multi Regional Coupling (MRC) covers 19 countries, accounting for over 85 per cent of European electricity consumption (see Figure 3). The Day Ahead MRC project between GB and the continent was completed at the start of 2013.

Figure 3: Countries involved in Day Ahead MRC



Source: ENTSO-E (2016).⁵⁴

The EU is hoping to introduce implicit market coupling in the intraday energy market, in an arrangement called XBID (Cross-Border Intraday). Figure 4 shows the markets involved in the project and those that are looking to join, including EU accession countries and the Single Electricity Market (SEM) of Ireland. The project is ongoing, with implicit market coupling between GB and the continent not yet operational for intraday time frames. Until XBID is completed, interconnector capacity will be bought and sold explicitly in the intraday market.

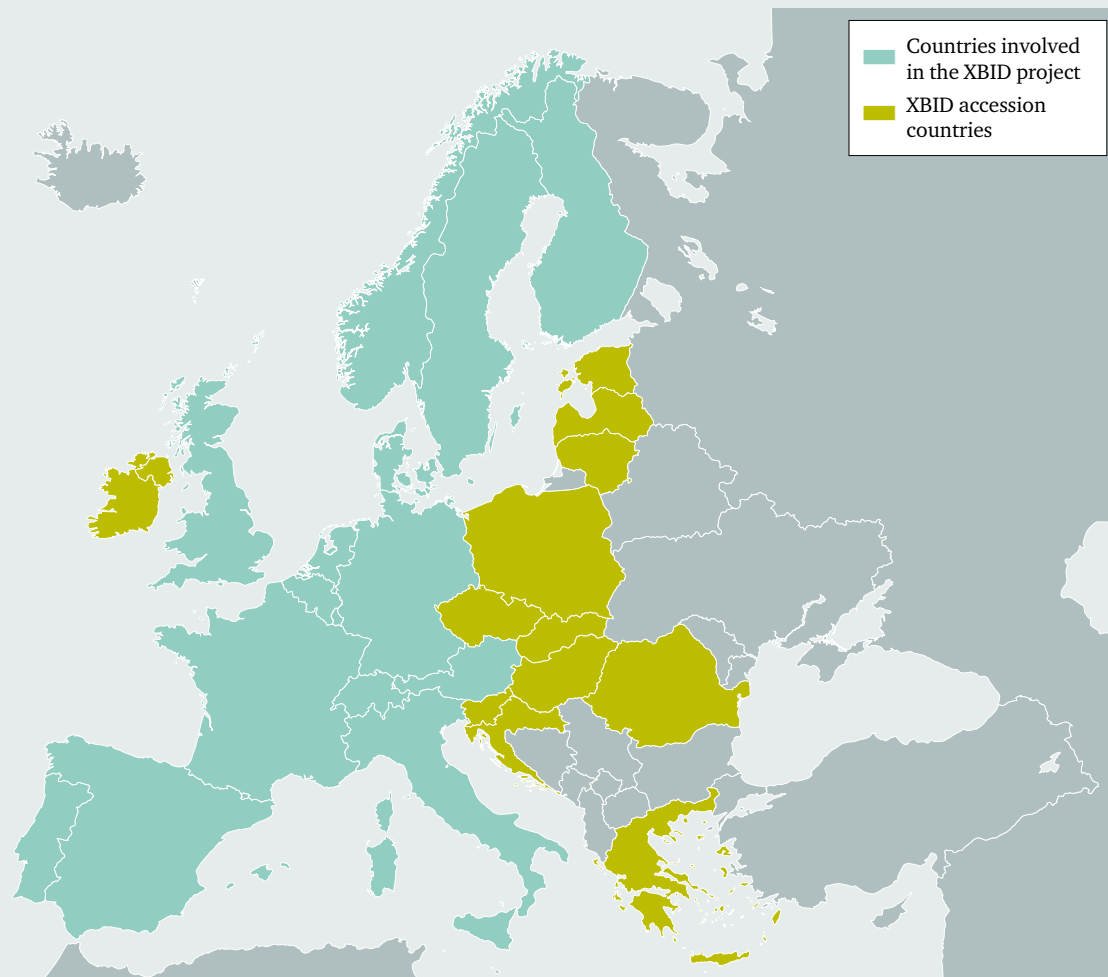
In summary, market coupling arrangements in GB are as follows:

- Forward** Explicit market coupling arrangements
- Day-ahead** Implicit market coupling arrangement since completion of Day Ahead MRC in 2013
- Intraday** Explicit market coupling arrangements, until completion of XBID

Following the UK's decision to leave the EU, it is still unclear whether GB will remain part of current and future market coupling arrangements. This is because these require the active collaboration of GB interconnection counterparts, and market coupling was mostly developed through European legislation

⁵⁴ ENTSO-E (2016), *Report on the progress and potential problems with the implementation of Single Day-Ahead and Intraday Coupling*, 9 August 2016, www.entsoe.eu/Documents/Network%20codes%20documents/Implementation/cacm/160816_LT_ENTSO-E_to_ACER_CACM_Report_on_DA_ID_Coupling_Attachment_1.pdf (accessed 10 Apr. 2017).

Figure 4: Countries involved in XBID



Source: ENTSO-E (2016).⁵⁵

(e.g. the European Network Codes on capacity allocation and congestion management (CACM), and on forward capacity allocation (FCA)). If GB were forced to leave its current and future implicit market coupling arrangements, the exchange of electricity through interconnectors would revert to explicit allocations or an alternative form of market coupling. This would probably raise energy prices for end consumers, have associated negative effects on social welfare, and lead to reverse flows.

Interconnector operations are crucial to GB's market operations and system security. Yet without clear or efficient agreements on these issues, GB TSOs could face increased operational complexity. For instance, interconnectors' operations and service agreements are taken into account by the system operator when assessing GB's need for a capacity market and defining its size. Similarly, it is unclear whether Coreso (a regional TSO platform now integrated in EU legislation under the Regional Security Coordinators concept) could continue to provide interconnection flow forecasts to the TSOs to prepare GB's system operations for the post-Brexit environment. A change in these arrangements could have a negative impact on the domestic GB market. It is therefore important that the EU and UK maintain the benefits of membership of a European energy area in which energy can be traded seamlessly, by establishing similar or new arrangements with the GB electricity interconnectors' counterparts.

⁵⁵ Ibid.

2.3 The impact of Brexit on interconnector investments

While other EU member states have tended to look to incumbent transmission system operators (TSOs) for the development of interconnectors, the UK interconnector regime is unique in that it specifically allows for and encourages merchant interconnectors to be developed by private investors.

The models for investing in interconnectors vary. The investment case is developed under the national regulatory frameworks of the countries at either end. Collaborating sponsors, which in many cases are national TSOs, seek to ensure that their ‘side’ of the investment adds up to a viable business case with as much clarity as possible over revenue streams.

The different investment models available in Europe include the following:⁵⁶

- **Regulated asset base.** Tariffs are set to recuperate costs.
- **‘Cap and floor’ (used in the UK).** Provides for partial market exposure, with limits on downside risk and upside.
- **Merchant.** Provides for full market exposure (historically with caps on returns but without floors). However, application for exemptions from certain EU regulations can help investors to manage risks.

For currently planned interconnectors, the investment model on the UK side may not change after Brexit, as it is currently set by UK regulatory structures. However, national regulators in EU member states (and Norway) are also involved in negotiating arrangements for their side of the interconnectors. Brexit may result in additional examination of these frameworks, as happened with the French regulator CRE (Commission de régulation de l’énergie) in the case of the IFA-2 UK–France interconnector. A December 2016 consultation stated that CRE was ‘considering enforcing a strengthened incentive regulation framework in order to balance the way risks are shared between RTE [a French TSO] and the users of the French transmission network’.⁵⁷ CRE also delayed the approval of IFA-2 to February 2017, with construction now expected to start in September 2017.⁵⁸

2.4 Brexit and the all-Ireland Single Electricity Market (SEM)

The Republic of Ireland and Northern Ireland have fully linked and compatible energy networks. The UK’s decision to leave the EU will have important implications for the UK’s relations with Ireland (see Box 4), as well as for the future of the Single Electricity Market (SEM) (see Box 3).

⁵⁶ Chatham House (2017), ‘Submission to BEIS Committee Inquiry – Finance Practitioner Insight into the Impact of the Brexit Vote’, <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/business-energy-and-industrial-strategy-committee/leaving-the-eu-energy-and-climate-negotiation-priorities/written/46734.html> (accessed 9 Apr. 2017).

⁵⁷ Commission de régulation de l’énergie (2016), ‘Consultation by CRE regarding the interconnector “IFA2” between France and Great Britain’, 1 December 2016, www.cre.fr/en/documents/public-consultations/the-interconnector-ifa2-between-france-and-great-britain (accessed 10 Feb. 2017).

⁵⁸ Gosden, E. (2017), ‘Cross-Channel power cable given green light by French’, *The Times*, 11 February 2017, www.thetimes.co.uk/article/cross-channel-power-cable-given-green-light-by-french-sw9rrqt2 (accessed 7 Apr. 2017).

Box 3: The special case of the Irish Single Electricity Market
Silke Goldberg, Herbert Smith Freehills LLP

In addition to its implications for GB and continental Europe, Brexit will have an impact on the energy sector on the island of Ireland. The island's Single Electricity Market (SEM) was established in 2007 to increase energy efficiency and competition throughout both Northern Ireland and the Republic of Ireland. SEM operates as an integrated market, largely on the basis of bespoke market rules contained in the Trading and Settlement Code. The market operator, system operators, generators, suppliers, and interconnector owners, operators and users are obliged to follow this code, which complies with the EU regulatory regime.

While SEM has been designed in line with the EU's Third Energy Package, it is based on a bilateral co-operation agreement between the Dublin and Westminster governments rather than on EU legislation. Therefore, it is only likely to be affected by Brexit in the medium to long term. SEM is regulated by the Irish Commission for Energy Regulation (CER), the Irish national regulatory authority, and is subject to the EU energy sector regime. Therefore, if SEM is maintained post-Brexit, a part of the UK would continue to be subject to EU law. As long as the UK's legal and regulatory framework remains consistent with the provisions of the Third Energy Package, there will be little or no critical friction between the energy laws applying in Northern Ireland and those in the Republic of Ireland.

The Brexit negotiations require a carefully managed energy solution that specifically addresses the SEM issue. Otherwise, there is a risk that a decade of energy integration on the island of Ireland could be reversed. There are a number of possible post-Brexit arrangements and solutions to this issue:

1. The first option is to designate Northern Ireland as a special zone, so that the all-Irish market will continue to be subject to EU law.

Under this arrangement, were UK policy to diverge from that of the EU, there would be tensions between the EU law-governed⁵⁹ SEM⁶⁰ (the continued existence of which was not questioned by the UK government in its February 2017 white paper) and relevant UK policy.

These tensions could raise important questions. If the UK accepts the continued application of EU law in Northern Ireland in relation to the energy sector, it will also need to accept a scenario of regulatory divergence and diversity within the UK. In other words, one part of the country would be subject to EU legislation while the rest would not.

Such a scenario would be likely to pose a constitutional challenge: if EU directives and regulations continued to apply to Northern Ireland, how would directives be transposed into domestic law? The Stormont assembly does not currently have the competence to transpose EU directives. Therefore, either the UK parliament would need to transpose the relevant directives (e.g. those of the EU's 'winter package') into laws applying specifically to Northern Ireland only; or the Stormont assembly would need to be equipped with the relevant powers. This scenario would also leave the people of Northern Ireland subject to a set of laws over which they had no democratic control or influence.

2. The second option would be to create a special status for SEM which, while compliant with EU law, would not subject Northern Ireland to the jurisdiction of the European institutions. However, some of the issues with the first option, in particular in relation to the transposition of EU law so that it applied to Northern Ireland, would also apply to this 'EU-compatible' solution. In addition, a jurisdictional forum would be required to address implementation of and compliance with the same legislation in Northern Ireland.

⁵⁹ The legal framework for SEM falls under the jurisdiction of the European Court of Justice (ECJ). SEM's operations are governed by European Network Codes, and overseen by the Agency for the Cooperation of Energy Regulators (ACER) in its capacity as the European regulatory authority.

⁶⁰ From 23 May 2018, the I-SEM (Integrated Single Electricity Market) will replace SEM as the new wholesale market for electricity for the island of Ireland.

3. The third option would be to unwind SEM, but this is unlikely to be politically palatable either in the Republic of Ireland or Northern Ireland.

Security of supply is also likely to feature high on the agenda in negotiations. The security of gas supply to the Republic of Ireland is heavily dependent on the UK, and specifically on GB imports through the Moffat interconnector (which accounted for 96.3 per cent of the Republic of Ireland’s annual gas supply requirements in 2014/15).⁶¹ The development of the Corrib gas field is likely to improve the Republic of Ireland’s overall gas security. Production began in December 2015, and in 2016/17 is expected to meet around 55 per cent of Gas Networks Ireland’s system demand.⁶² The Republic of Ireland will remain reliant on GB gas imports. It is therefore possible that in the future the Republic of Ireland may seek to develop a dedicated LNG terminal with regasification facility.

Under EU regulations (994/2010) and International Energy Agency (IEA) rules, the Republic of Ireland is required to hold adequate emergency oil stocks. These emergency stocks may also be held in another EU member state, provided that a bilateral oil stockholding agreement has been concluded. The National Oil Reserve Agency (NORA) of Ireland holds 71 per cent of its total stocks on the island of Ireland. It also holds physical stock abroad,⁶³ of which a significant proportion is stored in the UK.⁶⁴

EU Council Directive 2009/119/EC (the ‘Oil Stocks Directive’) obliges member states to maintain minimum stocks of crude oil and/or petroleum products. It has removed the requirement for bilateral agreements when countries want to maintain cross-border oil stocks.⁶⁵ However, in some cases a bilateral agreement or memorandum of understanding may still be required as a matter of national law (e.g. as a regulatory requirement).

The Oil Stocks Directive does require oil stocks to be kept within the EU, as only those that are in the EU are taken into account when determining whether a member state has met its objectives under the directive.

Article 3(1) of the directive specifies:

Member States shall adopt such laws, regulations or administrative provisions as may be appropriate in order to ensure, by 31 December 2012, that the total oil stocks maintained at all times within the Community for their benefit correspond, at the very least, to 90 days of average daily net imports or 61 days of average daily inland consumption, whichever of the two quantities is greater.

In addition, Article 9 of the directive states that specific stocks owned by a member state must be maintained in the ‘territory of the Community’; following the UK’s exit from the EU, this would no longer be the case in relation to any Irish stocks held in the UK, unless a bilateral agreement was reached.

A similar arrangement would be needed if the UK and Ireland chose to replace the solidarity principles proposed under the revision of the security-of-supply regulation (994/2010). This revision proposes that in the case of a severe crisis in one EU member state, neighbouring member states should help ensure gas supplies to households and essential social services in the affected country.

⁶¹ Gas Networks Ireland (2015), *Winter Outlook 2015/16*, www.gasnetworks.ie/Global/Gas%20Industry/18444_GNI_WinterOutlook_15-16_v9.pdf (accessed 7 Apr. 2017).

⁶² Gas Networks Ireland (2016), *Winter Outlook 2016/17*, www.gasnetworks.ie/Global/Gas%20Industry/Gas%20Networks%20Ireland%20Winter%20Outlook%20201617.pdf (accessed 7 Apr. 2017).

⁶³ In the Republic of Ireland’s case these countries are Belgium, Denmark, France, the Netherlands, Sweden and the UK. See International Energy Agency (2017), ‘Ireland’, www.iea.org/countries/membercountries/ireland/oilstocks/ (accessed 10 Mar. 2017).

⁶⁴ Barrett, A., Bergin, A., Fitzgerald, J., Lambert, D., McCoy, D., Morgenroth, E., Siedschlag, I. and Studnicka, Z. (2015), *Scoping the Possible Economic Implications of Brexit on Ireland*, Economic and Social Research Institute, Research Series number 48, www.esri.ie/pubs/RS48.pdf (accessed 7 Apr. 2017).

⁶⁵ Recital 13 of the Oil Stocks Directive now refers to such agreements as ‘useful instruments’ rather than as obligations.

Box 4: An Irish perspective on Brexit

Eamon Ryan TD and former Energy Minister of Ireland (2007–11)

On the island of Ireland we are in the process of creating greater energy interconnections. We introduced an all-island electricity market 10 years ago, which has been a real success. We are now ready to go to a new Integrated Single Electricity Market (I-SEM), which will allow more intraday balancing of electricity markets, to comply with new European rules.

The all-Ireland market provides a lesson on how the politics of Brexit negotiations could work best. We were able to make it happen because energy was excluded from the formal provisions of the St Andrews Agreement on devolved administrations. That freed people up to do mutually beneficial deals that were not seen as a political victory for any one side. The lesson is: get an energy agreement early and allow other more contentious issues to take centre stage.

The other reason we were able to get a north/south deal is because Irish energy policy is increasingly influenced by east/west considerations. Ireland still imports 85 per cent of its energy, mostly from the UK. As Ireland moves to an alternative 100 per cent decarbonized energy system, we will still have to work with the UK to balance an increasingly variable electricity supply.

In fact, we need to go further and make sure that the two islands are integrated within a wider northwest European electricity market. Various reports have shown how such a regional approach will benefit all participants in the long run. This is particularly important for the UK, where wholesale electricity prices are 50 per cent higher than equivalent continental prices.

The UK has recently signed a declaration, drafted by the Dutch government, planning greater cooperation in a North Seas Countries Offshore Grid Initiative (NSCOGI). Little fanfare surrounded the signing, but it gives Ireland the chance of connecting to the rest of the continent and strengthening the entire system.

The same argument for regional cooperation applies to gas security. The lesson from disputes with Russia, for example, is that you are best protected if you have a fungible gas market, in which a supplier cannot play one consumer country off against another. If Britain decided to abandon energy security commitments, we could invest in LNG facilities or look for other solutions, but it is hard to envisage such an outcome. The UK would still have commitments to supply Northern Ireland via the Republic, and it is hardly likely that it would cut itself off from European gas supplies just as its own North Sea gas reserves started to run out.

The key issue in these Brexit energy negotiations is likely to be whether the UK will accept the role of the European Court of Justice (ECJ) in providing judicial oversight in market disputes; and what role, if any, the UK will have in the formulation of market rules and trading arrangements. It seems that the UK has already agreed to a future role for the ECJ in patents law, so a similar exception could surely apply to energy. It is also hard to see what would preclude the UK from ongoing participation in the regulatory and network agencies such as ENTSO-E.

2.5 From policy-setter to policy-taker: implications of Brexit for UK influence and agenda-setting in the IEM

Successive UK governments have been behind the creation of the IEM, which has fundamentally changed how the EU and its member states legislate, not only for electricity but also for gas. The 2009 EU Energy Package established the Agency for the Cooperation of Energy Regulators (ACER) as a formal coordination mechanism for member states' national regulatory authorities in energy. It also recognized the need for pan-European network codes to facilitate deeper market integration and the management

of the European electricity and gas grids.⁶⁶ The UK's decision to leave the EU could have important implications for the UK government's ability to set the agenda and influence European market policy.

2.5.1 Roles of the European Commission, ACER and ENTSO-E in designing European Network Codes (ENCs)

ENCs rely on the input and expertise of national regulatory authorities and relevant TSOs operating in Europe. Currently, the process for determining gas/electricity ENCs is as follows:⁶⁷

- ACER determines the framework for ENCs and delegates the technical development and drafting to the European Network of Transmission System Operators for Gas (ENTSO-G) or ENTSO-E.
- Once the ENCs have been drafted, ACER reviews them. They are then submitted to the European Commission, the European Parliament and member states for review (via the comitology process).⁶⁸
- Member states vote in the Council of the EU. The European Parliament also votes on ENCs.

More ENCs are currently being developed to meet the requirements of the Third Electricity Market Directive, and the process of transposing these into national systems of codes is expected to take several years. Figure 5 also shows the institutions in which, post-Brexit, the UK government and/or UK bodies will no longer take part (or have reduced influence) in setting network codes.

ACER

Full membership of ACER is currently limited to the national energy regulators of EU member states, although the corresponding entities in certain third countries such as Norway have observer status. Back in 2010, ACER recognized that 'some sort of cooperation between EU TSOs and non-EU TSOs from interconnected third countries is indispensable to ensure that network codes on system operations are binding'.⁶⁹ This suggests that it might be possible for Ofgem, the UK's national energy regulator, to rejoin ACER in the future, although this would be dependent on the UK meeting several requirements, namely that:

- 'The relevant [EU] legislation is dynamically incorporated' [in the UK];
- A 'framework for proper enforcement is in place'; and
- Financial contributions to ACER are stipulated in an international agreement between both parties – in this case, the future UK–EU27 agreement.⁷⁰

⁶⁶ European Commission, Directorate-General for Energy (undated), 'Electricity network codes and guidelines', <http://ec.europa.eu/energy/en/topics/wholesale-market/electricity-network-codes> (accessed 5 Feb. 2017).

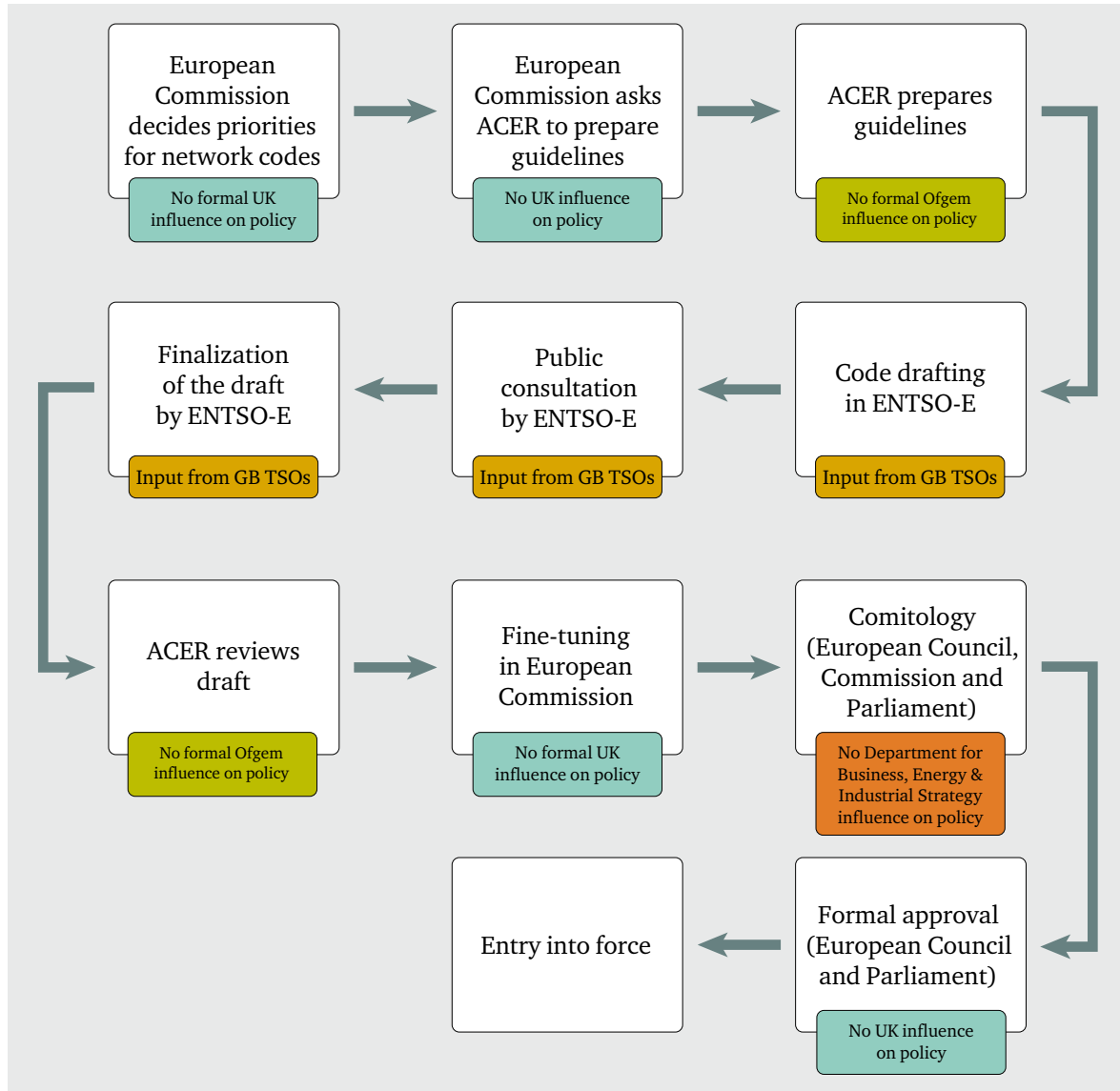
⁶⁷ In 2016, it became clear that the European Commission was looking into strengthening the role of distribution system operators (DSOs). DSOs may therefore also have a greater role in the ENC decision-making process in the future. Pretico, G., Gangale, F., Mengolini, A., Lucas, A. and Fulli, G. (2016), *Distribution System Operators Observatory*, JRC Technical Reports, European Commission Joint Research Centre, http://ses.jrc.ec.europa.eu/sites/ses.jrc.ec.europa.eu/files/publications/dso_observatory_ldna27927enn.pdf (accessed 24 Mar. 2017).

⁶⁸ The comitology process is a direct attempt to share decision-making power at the EU level between the European Council, Commission and Parliament. Here, the UK would be completely excluded from the agenda-setting, reviewing of network codes and amendment process.

⁶⁹ ACER (2010), '2nd ACER Board of Regulators meeting. Minutes', 10 June 2010, p. 6, www.acer.europa.eu/official_documents/bor/meeting_docs/a10-bor-02-02.pdf (accessed 11 Nov. 2016).

⁷⁰ ACER (2010), '3rd ACER Board of Regulators meeting. Minutes', 8 September 2010, www.acer.europa.eu/Official_documents/BoR/Meeting_Docs/A10-BoR-03-02.pdf (accessed 17 Mar. 2017).

Figure 5: The post-Brexit process of adopting electricity ENCs (Role of UK stakeholders)



Sources: Chatham House; European Commission.

While the UK currently complies with all IEM legislation, divergences between UK and EU law are possible in the future – particularly in the absence of a joint enforcement mechanism to ensure the UK’s compliance with IEM legislation. A European Commission Staff working paper further notes that ‘it is unlikely to be acceptable, for instance, that [national regulatory authorities from] Third Countries wishing to participate in ACER “pick and cho[o]se” which network codes they wish to implement into their national legislation and which not’.⁷¹

⁷¹ European Commission (2011), ‘Commission Staff Working Paper on the Possibility of Neighbouring Countries and their Transmission System Operators to Participate in ACER and in the ENTSOs’, SEC(2011) 546 final /2, Brussels, p. 4.

ENTSO-E

It is easier for third-country transmission owners (TOs) and TSOs to join ENTSO-E and ENTSOG. In the case of ENTSO-E, a 2011 European Commission Staff paper noted that ‘excluding these TSOs from ENTSO-E [...] would seem inappropriate, as the electricity networks of these TSOs are physically integrated with the neighbouring EU networks and need to follow the same technical codes’.⁷² Currently membership is conditional on the third country doing the following:

- Meeting the Third Energy Package requirements;
- Having a suitable enforcement mechanism in place; and
- Dynamically incorporating new IEM legislation.

Providing these requirements are met, there is no reason to suggest that GB TSOs would be excluded from ENTSO-E or ENTSOG.

After the UK leaves the EU, however, the ability of GB TSOs to shape and vote on draft network codes in ENTSO-E would be reduced. There are currently two types of voting procedures within ENTSO-E committees, depending on the decision under review. First, there are the procedures for ENTSO-E decisions, which concern day-to-day activities including the approval of policy papers, public positions and advocacy work. On these, GB TSOs would continue to have a vote, although there are limits to the voting capacity of TSOs from non-EU member states, namely that they cannot exceed 28 per cent of the first part of the voting power (one country, one vote) and/or 35 per cent of the second part (population-based). These decisions can also be later overturned in ACER or during the comitology process. Second, and arguably more important in a formal sense, are ‘all-TSO’ decisions in ENTSO-E, which cover proposals, methodologies and implementing measures for ENCs. Here, GB TSOs would be prevented from casting binding votes, as this is restricted to TSOs from EU member states only.⁷³

2.5.2 Retaining influence: EU agencies and regional bodies

Regulatory convergence between UK and EU energy policy, as well as influence over future IEM policy, will be important if the UK is to remain integrated in the IEM.

In March 2017 the UK government published a further white paper to explain the legislative process for leaving the EU, including details of the so-called ‘Great Repeal Bill’. The bill will outline to what extent it will be ‘practical and appropriate’ to convert EU law into UK law, which will take effect when the UK leaves the EU.⁷⁴ Therefore, it is likely that any new laws adopted by the EU before the UK leaves, such as the ‘Clean Energy for All Europeans’ legislative package, will also become UK law. However, there will still be risks of regulatory divergence after the UK leaves the EU, particularly once new EU legislation is in place. A recent report by the House of Lords has suggested that this gap could be bridged, and regulatory divergence avoided in the future, by the creation of a UK government agency, parliamentary grouping or public body to scrutinize future UK energy policy and UK–EU27 energy cooperation.⁷⁵

⁷² Ibid., p. 6.

⁷³ G. Wright interview, anonymous.

⁷⁴ Department for Exiting the European Union (2017), *Legislating for the United Kingdom’s withdrawal from the European Union*, Cm 9446, March 2017, www.gov.uk/government/uploads/system/uploads/attachment_data/file/604516/Great_repeal_bill_white_paper_accessible.pdf (accessed 9 Apr. 2017).

⁷⁵ House of Lords, European Union Committee (2017), *Brexit: environment and climate change*, HL Paper 109, 12th Report of Session 2016–17, 14 February 2017, p. 23, www.publications.parliament.uk/pa/ld201617/ldselect/ldeucom/109/109.pdf (accessed 24 Mar. 2017).

In terms of UK influence on policy, there are already signs that the UK's status in Brussels is shifting from that of 'key political actor' to 'technical consultant' in the Council and the European Parliament, despite the fact that many of the decisions under consideration will have implications for the UK post-Brexit.⁷⁶ Once the UK is outside the EU, the government risks losing its formal voice almost entirely on IEM regulatory matters, with only GB TSOs exercising voting rights on technical codes. Therefore, the UK should consider remaining a member of EU agencies such as the European Environment Agency and, where possible, take part in technical energy groups and dialogues with the EU over better regulation. This should also include the participation of government and related parties in European regional bodies, such as the North Seas Countries Offshore Grid Initiative (NSCOGI).⁷⁷

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UK stakeholders should also remain members of EU-wide associations such as the European Environmental Bureau and the European Chemical Industry Council. They should seek to continue participating in European energy conferences such as the Madrid Forum on gas and the Florence Forum on electricity.

2.6 Compliance and enforcement

In addition to regulatory convergence, the UK and the EU would need to agree on a joint framework to oversee and enforce IEM rules, as well as possibly a common dispute-settlement mechanism. The government's February 2017 white paper recognizes the need to replace the enforcement power of the ECJ, stating that 'the UK will seek to agree a new approach to interpretation and dispute resolution with the EU'.⁷⁸

Compared with some other member states, the UK generally has a strong track record on implementing EU legislation.⁷⁹ Different arrangements currently exist for enforcing compliance and resolving disputes between third countries and the EU (as can be seen in Table 2). For example, disputes with Norway are overseen by the EFTA Surveillance Authority and EFTA Court; the Energy Community has its own enforcement council; and Switzerland relies on national laws or the WTO as the final arbiter, although this may change in the future.

⁷⁶ These include proposals for new EU-wide targets for energy efficiency and renewables, new electricity and gas market rules, and suggested changes to the EU energy governance framework.

⁷⁷ de Jong, J., Pellerin-Carlin, T. and Vinois, J.-A. (2015), *Governing the Differences in the European Energy Union: EU, Regional and National Energy Policies*, Notre Europe Jacques Delors Institute, Policy Paper 144, October 2015, www.institutdelors.eu/media/pp144governanceenergyunionjavinoisjdjongjdioc2015.pdf?pdf=ok (accessed 24 Mar. 2017).

⁷⁸ HM Government (2017), *The United Kingdom's exit from and new partnership with the European Union*, Cm 9417.

⁷⁹ HM Government (2014), *Review of the Balance of Competences between the United Kingdom and the European Union: Energy Report*, www.gov.uk/government/uploads/system/uploads/attachment_data/file/332794/2902398_BoC_Energy_acc.pdf (accessed 27 Mar. 2017).

Table 2: The EU’s electricity relationships – enforcing compliance

	EU members	Norway/EEA	Switzerland	Energy Community	WTO	Customs union
Market access						
Non-tariff barriers allowable?	Y	Y	Y	Y	Y	Y
Membership						
Compliance with current market <i>acquis</i>	Required	Required	Required	Required	Not required	Not required
Advanced market rules – market coupling	Required	Required	Not required	Not required	Not required	Not required
Governance						
European Commission	Y	N	N	N	N	N
ENTSO-E	Y	Y	Y	Y	Y	Observer
ACER	Y	Observer	N	N	N	N
Enforcement						
	ECJ	EFTA Surveillance Authority, EFTA Court	National law	Ministerial Council, no judicial action	GATT, GATS, WTO dispute-settlement processes	Bilateral agreement, WTO dispute

2.7 EU–Swiss dispute settlement and enforcement

As mentioned above, the EU and Switzerland have negotiated a series of bilateral agreements over the past 20 years. While a number of joint committees oversee the functioning of EU–Swiss bilateral agreements, there are no formal surveillance arrangements and there is no effective dispute–settlement mechanism. The 1960 EFTA Convention and the 2002 Vaduz Convention⁸⁰ specify that, unlike EEA members, Switzerland is not subject to the authority of the EFTA Surveillance Authority.

However, this set-up is far from straightforward and has, in the past, been politicized. First, non-energy policy decisions have affected Switzerland’s energy relationship with the EU. In 2007 negotiations started on an Electricity Agreement, which would have seen Switzerland enter the IEM in 2015. However, negotiations were delayed following a Swiss referendum in 2014 in favour of introducing ‘annual quotas on immigration from the EU and giving preference to Swiss citizens in employment matters’.⁸¹ In December 2016, Switzerland adopted a new law which reversed the decision to introduce EU immigration quotas. Negotiations are now under way.

Secondly, the Council of the EU has indicated that deeper access to the IEM will require the adoption of the relevant EU *acquis*. In particular, in order for Switzerland to participate in market coupling, the new Capacity Allocation and Congestion Management (CACM) Regulation (2015/1222), which constitutes one of the pan-European network codes, explicitly requires Switzerland to transpose all

⁸⁰ European Free Trade Association (undated), ‘The EFTA Convention’, www.efta.int/legal-texts/efta-convention (accessed 27 Feb. 2017).

⁸¹ Bahadir, A. and Garcés de los Fayos, F. (2016), ‘The European Economic Area (EEA), Switzerland and the North’, factsheet on the European Union, European Parliament, November 2016, www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuld=FTU_6.5.3.html (accessed 7 Apr. 2017).

‘main provisions of EU electricity market legislation’ (including related EU competition standards and environmental *acquis*). It also requires there to be an intergovernmental mechanism for resolving bilateral disputes on electricity.⁸²

In January 2017, TSO Swiss Grid left the cross-border intraday market project, as it was unable to meet the requirements of the CACM Regulation by the end of 2016, as required.⁸³

2.8 Brexit and European funds

The EU is a significant source of funding for the UK’s efforts to meet energy and climate change mitigation goals, and plays a particularly prominent role in project identification, development and finance.

Box 5: Brexit observations from low-carbon energy financiers

Kirsty Hamilton, Chatham House

This provides a summary of how Brexit was seen by senior finance practitioners (across the debt, equity and advisory sectors) with extensive experience of deploying capital into energy, renewables and increasingly ‘new low-carbon’ investments (distributed energy, storage, demand-side) in the UK in the second half of 2016.

As a global financial centre, London is a primary source of capital for renewable energy/low-carbon investments across Europe and further afield; at the same time, delivering the UK’s carbon and energy requirements requires, and benefits from, substantial inward investment both from Europe and elsewhere.⁸⁴ One financial institution estimates that capital expenditure requirements for development of renewables, battery storage and distributed generation as part of an ‘energy revolution’ in the UK will be in the range of £95–128 billion across 2017–30.

The investment environment is not static: market turbulence and the general perception of high risk and uncertainty that prevailed after the June 2016 referendum subsequently eased, with sentiment shifting by late 2016 to a state described by one financier as like ‘being in the eye of the storm’. This reflected a period of relative calm as unknown factors remained unknown, and as transactions either moved forward as planned (if the risks from ‘Brexit’ were not seen as having a direct effect) or else were delayed for some time.

Observations across 2016

Near-term

The biggest immediate economic impact of the referendum result has been on currency value. The fall in sterling raised costs linked to imports and has made currency-hedging more expensive.

Deals that were already advancing before the referendum have generally gone ahead, notwithstanding some impacts in the aftermath of the vote.

Brexit adds further uncertainty to an energy sector already in transition and complicated by the presence of a number of ‘moving parts’ in policy, energy pricing and business models. The need for visibility on UK energy policy remains an overriding issue for investors, as does a clearer understanding of the consequences of the UK exiting the single market and single energy market.

⁸² *Official Journal of the European Union* (2015), ‘Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management’, L 197/24, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2015:197:FULL&from=EN> (accessed 7 Apr. 2017).

⁸³ XBID (2017), ‘Cross-Border Intraday Market Project, Questions and Answers’, 31 January 2017, www.epexspot.com/en/market-coupling/xbid_cross_border_intraday_market_project (accessed 7 Apr. 2017).

⁸⁴ Barclays Equity Research (2016), ‘UK Energy Revolution: A £215bn investment opportunity to 2030’, 19 August 2016.

Medium-term

One concern immediately after the referendum was the UK's attractiveness to incoming capital. One finance practitioner estimated that capital inflows fell by around 10 per cent in the aftermath of the vote. More specifically, the UK was seen as off-limits as an investment destination by a certain (albeit limited) set of financial institutions. It may not be clear for some time whether this situation will continue, or whether sentiment will stabilize/return to 'normal'.

There is a sense of a general slowdown in the market, but this is difficult to separate from deal-specific factors in actual transactions. In general it is observed that extra time is needed to assess and hedge risks during the transaction process.

There are reports of Brexit-linked clauses starting to appear in investment contracts, reflecting the need to manage certain types of risk.

There is concern about a 'hardening of attitudes' towards the UK during the Brexit negotiations if the context becomes hostile. This could have consequences if, for example, it means external investors are less willing to spend the extra time needed to analyse and assess risk in transactions.

In general, including in the energy sector, the financial and legal implications of changes in the UK–EU relationship – including the impact of the UK leaving the single market – are not widely understood: '*Who will take the risk, who will bear the cost?*' are key questions.⁸⁵

Longer-term

The future of financial 'passporting' – that is, reciprocal authorization for UK financial institutions to operate in the EU and vice versa – and the prospect of additional UK licensing requirements are core Brexit-related issues for financial institutions. There is a risk of a knock-on impact on liquidity in both debt and equity markets if foreign banks scale back their UK presence. This will be assessed at the institutional level by financial firms, though is likely to affect only some services.

'Human capital' is a key issue as many investment teams include people from across the EU. A concern is that EU nationals working in London will seek early opportunities to leave the UK, or indeed that EU nationals will no longer be attracted to working in UK finance in the first place. This could lead to talent leakage, a potentially serious problem for London as a financial centre.

Could London's status as a global financial centre be eroded? The city's range of financial services and depth of expertise are central to its success as a hub for European and international transactions.

Energy-sector finance

The extent and nature of Brexit-related risks are unlikely to be fully known for some time. In this context there is a high-priority need for visibility on the underlying drivers of UK energy sector development – particularly in respect of energy, climate and infrastructure policy, and the nature, timing and detail of the energy transition.

Policy and regulation will also be important for assumptions about the development of the project pipeline in renewable energy and the wider 'new low-carbon' sector (demand-side, storage, distributed energy, etc.). 'Greenfield' or new project development underpins the medium-term investment opportunity.

On the European side, if the UK does not have access to the IEM, this raises significant uncertainties. The detail is not yet fully understood. Key issues include impact on energy pricing, cross-border power trading, and the level of policy cohesion over time between the UK and the EU (particularly in the context of increasing energy system integration across Europe).

Although the impact of Brexit on the availability of funds from the European Investment Bank (EIB) is not yet known, the perception is firming up among financiers that access to EIB or EU funds during Article 50 negotiations cannot be assumed. The EIB has played a key role in supporting the financing of new technology

⁸⁵ Chatham House (2017), 'Submission to BEIS Committee Inquiry – Finance Practitioner Insight into the Impact of the Brexit Vote'.

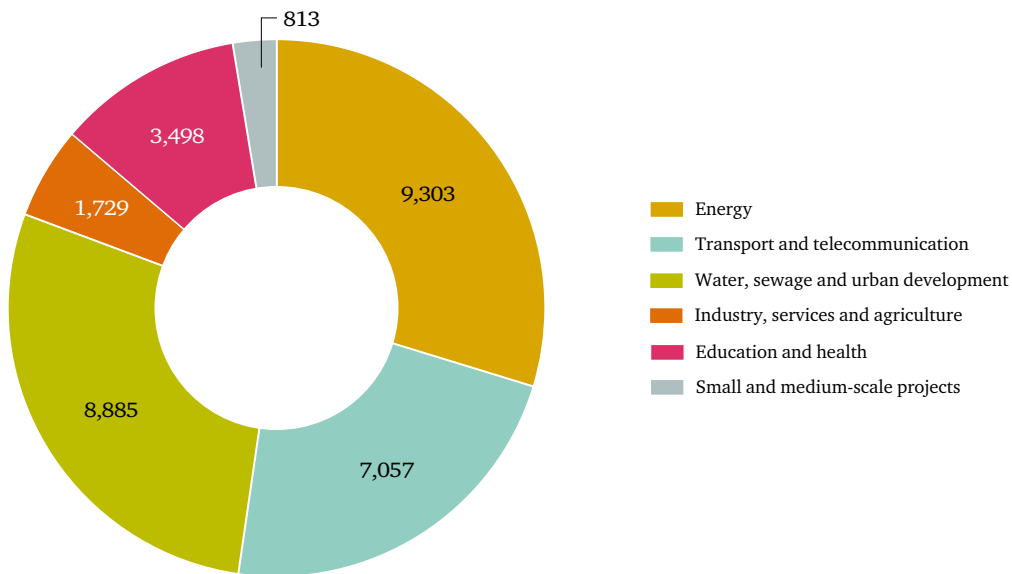
and larger deals. This raises the possibility of financing gaps emerging, and questions about how any gaps would be dealt with.

2.8.1 European Investment Bank

The most important individual source of finance for UK infrastructure is the European Investment Bank (EIB). The EIB’s board of governors, represented by EU ministers and a board of directors, approves projects and budget allocations. The UK is one of the largest subscribers of capital in the EIB, having provided €39 billion (16 per cent of the total) since 2013.⁸⁶ Currently, 90 per cent of EIB lending goes to EU member states, and the UK is one of the largest recipients of EIB funding.

Between 2012 and 2016, the EIB lent €31.3 billion to the UK for a variety of projects, with infrastructure accounting for 47 per cent of this total. Figure 6 shows the breakdown of this investment, the largest of which was for energy projects at over €9.3 billion. In 2016 EIB investments in the UK totalled €6.9 billion, making the country the fifth-largest recipient of loans that year.

Figure 6: EIB lending to the UK by sector, 2012–16 (€ million)



Source: EIB.⁸⁷

⁸⁶ European Investment Bank (undated), ‘Shareholders’, www.eib.europa.eu/about/governance-and-structure/shareholders/index.htm (accessed 17 Mar. 2017).

⁸⁷ European Investment Bank (undated), ‘The EIB in the United Kingdom’, www.eib.org/projects/regions/european-union/united-kingdom/index.htm (accessed 27 Mar. 2017).

Once outside the EU, the UK could lose its positions both as a shareholder (with a 16.11 per cent stake) and board member of the EIB, as these are conditional on EU membership – although the president of the EIB has suggested that keeping the UK as a shareholder post-Brexit should not be ruled out.⁸⁸

The UK's influence within the London-based European Bank for Reconstruction and Development (EBRD) will also be affected by Brexit. Although the EBRD is not an EU institution, all member states, as well as the EU and the EIB, have their own capital subscription and directors for the EBRD. After leaving the EU, the UK will have diminished influence over the voting preferences of the EU and the EIB within the EBRD.

2.8.2 European structural and investment funds

European structural and investment funds represent another significant source of funding for EU member states. These funds are scheduled to make available €454 billion to less developed regions of the EU in 2014–20. Of this sum, 25 per cent is assigned to climate-related projects.⁸⁹ Under current proposals, the UK would receive €2.9 billion for the development of a low-carbon economy and €2.6 billion for climate adaptation projects in 2014–20.⁹⁰ Post-2020, and outside of the EU, the UK will need to fund similar projects from domestic resources.

2.8.3 European Fund for Strategic Investment

The UK has received over €8 billion in financing from the European Fund for Strategic Investment, of which around a quarter has been assigned to energy projects, including for smart meters and offshore wind projects.⁹¹ This fund, which was jointly launched by the EIB and the European Commission in 2015, plans to mobilize €315 billion in additional finance to overcome investment gaps in the EU.

2.8.4 Connecting Europe Facility

The Connecting Europe Facility allocates grants for the development of infrastructure, including energy, to maintain and complete European networks. For the period 2014–20, €5.35 billion has been allocated to gas, electricity and carbon pipeline projects. Since 2014, nearly €190 million has been secured for UK projects. In addition to the interconnectors listed in Table 1, nearly €100 million has been allocated to funding a compressed-air storage facility.⁹²

⁸⁸ Plimmer, G. (2017), 'European Investment Bank signals rule change for UK after Brexit', *Financial Times*, 24 January 2017, www.ft.com/content/d18aad94-e21e-11e6-9645-c9357a75844a (accessed 7 Apr. 2017).

⁸⁹ European Commission (2016), *European Structural and Investment Funds 2014–2020, 2016 Summary Report of the programme annual implementation reports covering implementation in 2014–15*, Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM (2016) 812 final, http://ec.europa.eu/regional_policy/sources/how/strategic-report/esif_annual_summary_2016_en.pdf (accessed 7 Apr. 2017).

⁹⁰ European Commission (2017), 'European Structural and Investment Funds: Country Data for the UK', <https://cohesiondata.ec.europa.eu/countries/UK> (accessed 7 Mar. 2017).

⁹¹ European Investment Bank (2017), 'European Fund for Strategic Investment project list', www.eib.org/efsi/efsi-projects/index.htm?c=GB&se=3 (accessed 7 Mar. 2017).

⁹² European Commission (2017), 'Projects of common interest', projects funded in 2014–16, see list of actions selected for receiving financial assistance under CEF energy as of November 2014, <http://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest> (accessed 22 Mar. 2017).

2.8.5 EU funding for research and development (R&D)

The UK's financial contribution to the EU budget is 12 per cent. However, it receives approximately 15 per cent of total EU R&D funding.⁹³ The EU has two R&D programmes: Horizon 2020, which covers all sectors except for nuclear power; and a specific programme, under Euratom, overseeing nuclear research (see Section 2.11).

The total finance available for Horizon 2020, scheduled to operate over seven years from 2014, is nearly €80 billion. Of this, the following amounts have been allocated to climate and energy issues (excluding agriculture):⁹⁴

- €5.9 billion for security and clean energy
- €6.3 billion for smart, green and integrated transport
- €3.1 billion for climate action and materials efficiency
- €4.8 billion for Euratom funding⁹⁵

EU funding for energy and climate R&D undertaken in the UK is expected, under the current EU budget forecast, to total around €2.5 billion (£2.1 billion) over the seven years of the Horizon 2020 programme, or £300 million per year. It will be possible for the UK to remain part of Horizon 2020 after leaving the EU, as non-member states can be associated with some EU research programmes so long as they make budgetary contributions, usually calculated as a percentage of GDP. There are currently 16 associate members of Horizon 2020.

EU loans and grants provide financial assistance worth approximately £2.5 billion per year to the energy sector in the UK.

2.8.6 Domestic funding for energy and climate post-Brexit

The UK government has committed to maintaining levels of EU funding, at least in the short term. The chancellor of the exchequer, Philip Hammond, announced in August 2016 that all structural and investment funds signed before November 2016 would be fully funded even after the UK's departure from the EU, and that a similar arrangement would apply to research funded by Horizon 2020.⁹⁶

In addition, in his 2016 Autumn Statement, Hammond announced the launch of a new fund entitled the National Productivity Investment Fund, which would make available £4.7 billion of additional funds for R&D until 2021. This was said to be 'an increase of around 20% to total government R&D spending, and more than any increase in any Parliament since 1979'.⁹⁷ This fund will be used to establish an Industrial Strategy Challenge Fund, support collaboration between business and science, and increase research capacity and business innovation. Some of this funding, between £1.2 billion

⁹³ Department for Business, Innovation & Skills (2016), 'Government ministers visit Oxfordshire to open research centre and highlight risks to UK science and innovation from Brexit', press release, 23 May 2016, www.gov.uk/government/news/government-ministers-visit-oxfordshire-to-open-research-centre-and-highlight-risks-to-uk-science-and-innovation-from-brexit (accessed 3 Feb. 2017).

⁹⁴ European Commission (2017), 'Breakdown of the Horizon 2020 Budget', http://ec.europa.eu/research/horizon2020/pdf/press/horizon_2020_budget_constant_2011.pdf (accessed 7 Mar. 2017).

⁹⁵ *Official Journal of the European Union* (2016), 'Supplementary research programme for the ITER project (2014–18)', <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2016:436:FULL&from=EN> (accessed 11 Feb. 2017).

⁹⁶ HM Government (2016), 'Chancellor Philip Hammond guarantees EU funding beyond date UK leaves the EU', 13 August 2016, www.gov.uk/government/news/chancellor-philip-hammond-guarantees-eu-funding-beyond-date-uk-leaves-the-eu (accessed 7 Feb. 2017).

⁹⁷ HM Treasury (2016), 'Policy paper: Autumn Statement 2016', 23 November 2016, www.gov.uk/government/publications/autumn-statement-2016-documents/autumn-statement-2016 (accessed 7 Feb. 2017).

and £1.5 billion per year, would be needed if the UK wanted to replace the EU's R&D programmes or subscribe to them on an associate basis.

It is likely that further government action, perhaps even at the level of devolved administrations, will be necessary to replace the loss of EU funds, EU loans and project development funds such as the Connecting Europe Facility. This might have been possible by expanding the capabilities and remit of the Green Investment Bank, but the UK government moved the bank into private ownership in April 2017. The creation of a new bank similar to Germany's Kreditanstalt für Wiederaufbau, a government-owned development bank that makes loans for grid development, storage, renewable energy and energy efficiency, is also a possibility.

2.9 The Emissions Trading System (ETS)

The UK has a strong history of supporting carbon pricing and was a proponent of the introduction of Europe's first emissions trading system. Remaining part of the EU's ETS is likely to require accepting some form of ECJ jurisdiction, which has been ruled out by the prime minister. The UK will need to decide with the EU on its future participation (see Box 6).

Box 6: The future of the UK's participation in the EU ETS *Martin Nesbit, Institute for European Environmental Policy*

The Emissions Trading System (ETS) is often described as a cornerstone or linchpin of EU climate policy.⁹⁸ The policies of both the UK and EU on climate change mitigation are built around the ETS – although neither Theresa May's speech nor the government's February 2017 white paper makes any mention of the ETS. The scheme is significant for the electricity sector because it covers thermal plants using fossil fuels and adds to generating costs.

The more integrated a policy is at the European level, the more complex it will be to unravel UK involvement.⁹⁹ This applies particularly to the EU ETS, which creates a regulatory market across national borders. If the UK leaves the EU after two years of negotiations without a comprehensive trade deal, this could greatly complicate the process of working out what happens to the ETS – both for installations in the UK and for those in the EU27. Therefore, the need for contingency planning around a 'hard' Brexit is necessary.

There are broadly two options for continued UK participation in the EU ETS.

In theory, the first would be for ETS legislation to continue to apply to the UK, for example as a result of UK participation in the EEA. However, the prime minister's speech in January 2017 effectively ruled this out by rejecting the jurisdiction of the ECJ.

The second option would be for the UK to establish its own emissions trading scheme, and seek agreement to link it to the EU ETS. There are precedents for this in the negotiations to link the EU ETS with Norway and Switzerland¹⁰⁰ – but the process could be complex, and would require rapid regulatory work in the UK and the conclusion of an agreement at EU level, followed by endorsement through the ETS committee procedure; it is difficult to envisage all this happening before the UK formally leaves the EU. While a transitional agreement could provide for the continuing application of the EU ETS post-Brexit, there are daunting hurdles

⁹⁸ See, for example, van Asselt, H. (2010), 'Emissions trading: the enthusiastic adoption of an 'alien' instrument?', in Jordan, A., Huitema, D., van Asselt, H., Rayner, T. and Berkhout, F. (eds) (2010), *Climate Change Policy in the European Union*, Cambridge: Cambridge University Press.

⁹⁹ See the analysis of the implications of UK withdrawal in Baldock, D., Buckwell, A., Colsa-Perez, A., Farmer, A., Nesbit, M. and Pantzar, M. (2016), *The Potential Policy And Environmental Consequences For The UK Of A Departure From The European Union*, Institute For European Environmental Policy.

¹⁰⁰ For a useful summary of negotiations on linking, see Hawkins, S. and Jegou, I. (2014), *Linking Emissions Trading Schemes: Considerations and Recommendations For A Joint EU-Korean Carbon Market*, International Centre for Trade and Sustainable Development.

to overcome – particularly the need for agreement on ECJ jurisdiction, and the potential requirement for co-decided legislation to adapt the ETS directive to the new circumstances. More importantly, will the UK want to remain in the ETS?

The UK has long argued for broader carbon markets as a means of delivering climate change mitigation at least cost, but in reality – because the 2008–09 financial crisis and lax decisions on caps have led to a significant overhang of unused allowances from earlier years in the system – the ETS now operates more as a kind of ‘backstop’, taking effect if other mechanisms underperform. Some arguments against the ETS may start to carry more weight in the UK if the requirements for continued participation look politically unappealing. While some on the environmental left of EU politics criticize the ETS both for its lack of impact and for marketizing the fight against climate change,¹⁰¹ elements on the political right in the UK have tended to lament the ETS as an expensive piece of bureaucracy.¹⁰² Even some who accept the need for action on climate change have argued that a carbon tax would be more effective¹⁰³ (the UK has already unilaterally introduced a carbon price floor signal). Tax or other mechanisms, or the linking of a new UK emissions trading system with carbon markets in the US, Canada and East Asia, might also emerge as competing options, particularly as the UK pursues its emerging global free-trade rhetoric.

Moreover, participation in the EU ETS without control over cap-setting is clearly less attractive than the UK’s current position. Even a linked emissions trading system, with the UK retaining some control over setting its own cap, is unlikely to be an acceptable alternative, since exercising control would come with unpalatable costs for the UK. For example, if the UK wanted to make faster progress on emissions reduction than the average of EU member states (as has been the case in the past, and as it might need to do in future in order to meet Climate Change Act targets), the benefits of setting a lower UK emissions cap would be shared across the wider European market. Thus, the mitigation price signal for UK installations would reflect not the UK’s relatively high ambition, but the average ambition across the European market, and would therefore not rise as much; similarly, the UK exchequer would forgo revenue by auctioning fewer allowances, while not benefiting nearly as much from the (relatively weak) price impact of the UK’s lower cap. Other European finance ministries would, meanwhile, benefit from a windfall price increase without having to reduce the number of allowances they sold.

What are the ETS policy challenges that Brexit poses for the EU27? In the first place, removal of the UK, and UK members of the European Parliament (MEPs), from the decision-making processes on caps, price-management mechanisms (such as the Market Stability Reserve) and allowance allocation is likely to reduce the push to reform the system’s effectiveness. And there would be a further, minor, weakening of the European Emission Allowance (EUA) price as a result of the UK (a current net buyer of allowances) dropping out of the ETS altogether. Other issues would also need to be resolved. These would include the overhang of UK allowances and their redistribution.

If a ‘hard Brexit’ applied to the carbon market, early contingency planning would be needed on how to respond. A proportion of the overhang of allowances in the market exists because of unused EUAs issued to UK installations or auctioned by the UK; it would be unfair on individual allowance-holders simply to cancel UK allowances, but should all existing allowance holdings be subject to a ‘haircut’ – in which all users would have to accept a small reduction in the carbon value of their allowances – to reflect the UK’s departure? What should happen to allowances currently held by UK installations? Does an adjustment need to be made to the legislation to deliver the necessary change in the EU-wide total of allowances? And how, in the meantime, should the risk of UK installations selling off allowances or unwinding carbon price hedges (on the assumption that they may have no compliance need for them) be tackled?

¹⁰¹ See, for example, Reyes, O. (2014), *Life Beyond Emissions Trading*, briefing paper, Corporate Europe Observatory.

¹⁰² Zuluaga, D. (2017), ‘A Post-Brexit Framework for Electricity Markets’, Institute for Economic Affairs, March 2017, <https://iea.org.uk/wp-content/uploads/2017/03/A-Post-Brexit-Framework-for-Electricity-Markets.pdf> (accessed 3 Apr. 2017).

¹⁰³ Helm, D. (2016), *Energy and Climate Policy After Brexit*, Energy Futures Network, Paper 21, www.dieterhelm.co.uk/energy/energy/energy-and-climate-policy-after-brexit/ (accessed 3 Apr. 2017).

The technical and regulatory challenges of finding a cooperative solution for future UK participation in the EU ETS, or of managing the ETS consequences of a ‘hard Brexit’, are complex. These challenges are solvable given enough time, goodwill and flexibility. However, there is a need for early clarity on the principles to be applied. Market participants, particularly but not only in the UK, will become increasingly restless if such clarity is not forthcoming.

2.10 Impact of Brexit on UK emissions reduction targets

In October 2014, EU member states agreed to collectively reduce emissions by at least 40 per cent from 1990 levels by 2030, as part of the preparations for the Paris Climate Summit the following year. In July 2016, the European Commission clarified the separation of this target into a 43 per cent cut in ETS emissions and a 30 per cent cut in non-ETS emissions by 2030, both compared to 2005 levels.

If the UK is no longer part of the ETS or linked to it, emissions from the power sector and large industrial emitters would start counting directly against the UK’s carbon budget as ‘gross’ (i.e. actual) emissions rather than being counted as ‘net’ emissions within the ETS.¹⁰⁴ This would not prevent the UK from meeting its emissions reduction goals for ETS sectors, such as electricity generation, but it would have implications for the overall emissions reduction target for the UK. According to the UK’s Committee on Climate Change, under gross accounting rules the UK would have to increase its overall emissions target to a 61 per cent reduction from 1990 levels by 2030, compared with 57 per cent under net accounting rules.¹⁰⁵

2.11 ‘Brexatom’

The 1957 Euratom Treaty, one of the three founding treaties of the European Economic Community, established the European Atomic Energy Community (EAEC). According to supporters of nuclear power, Euratom has played a key role in helping to create a ‘safe, well-regulated and efficient’¹⁰⁶ nuclear industry in Europe, through:

- Ensuring the provision of nuclear material for civil purposes;
- Preventing the proliferation of nuclear materials;
- Setting health and safety standards for the public and workers;
- Coordinating research; and
- Providing finance for the construction of nuclear infrastructure.

Unlike the Treaty on the Functioning of the European Union, the Euratom Treaty has not been subject to major reform and remains a standalone legal entity. However, the 1986 Single European Act and later the Treaty of Lisbon did lead to a deeper integration of Euratom structures with those of the EU, and both Euratom and the EU now share institutions such as the EU Council and the European

¹⁰⁴ Ward, B. and Carvalho, M. (2016), ‘Submission to inquiry by the House of Commons Select Committee on Business, Energy and Industrial Strategy Committee on ‘Leaving the EU: negotiation priorities for energy and climate change policy’, ESRC Centre for Climate Change Economics and Policy/Grantham Research Institute, December 2016, www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2017/01/Grantham-Research-Institute-submission_brexit-and-climate-policy_Final.pdf (accessed 11 Mar. 2017).

¹⁰⁵ Committee on Climate Change (2016), *Meeting Carbon Budgets – Implications of Brexit for UK climate policy*, October 2016, www.theccc.org.uk/wp-content/uploads/2016/10/Meeting-Carbon-Budgets-Implications-of-Brexit-for-UK-climate-policy-Committee-on-Climate-Change-October-2016.pdf (accessed 11 Mar. 2017).

¹⁰⁶ European Nuclear Society (2007), ‘50 years of the Euratom Treaty: reflecting on the past, safeguarding the future’, Issue No. 16 Spring (April 2007), www.euronuclear.org/e-news/e-news-16/euratom-treaty.htm (accessed 16 Nov. 2016).

Commission, as reflected in Article 106a of the Euratom Treaty. This integration was partly a response to Austria's reluctance to join Euratom upon accession to the EU in 1995, even though a legal opinion presented to the European Commission and the EU Council at the time stated that a member state must adhere to all treaties when acceding to the EU.¹⁰⁷

Consequently, there is some disagreement over whether the UK must leave the EAEC (a process popularly dubbed 'Brexitom') once it leaves the EU.¹⁰⁸ Interestingly, Article 106a of the Euratom Treaty merely incorporates the Article 50 procedure of the Treaty on European Union – therefore, if the UK wishes to exit Euratom, it would need to trigger Article 106a of the Euratom Treaty (and not Article 50 of the Treaty on European Union).¹⁰⁹

The draft 'Withdrawal Bill' and the February 2017 white paper,¹¹⁰ as well as the notification to leave letter sent to the European Council,¹¹¹ have all made it clear that the government intends to take the UK out of the Euratom Treaty. The government has indicated that it will 'have the most open mind possible' in its discussions.¹¹² However, it has also stated its intention that the UK will no longer be subject to the jurisdiction of the ECJ,¹¹³ making remaining in the EAEC impossible. Brexitom will have a significant impact on the functioning of the UK's nuclear industry, particularly in respect of five key areas: nuclear material safeguards, R&D, the Euratom Supply Agency, nuclear safety standards and international agreements. It will also have an impact on the future direction of nuclear policy in the EU.

Nuclear material safeguards

The UK, as a nuclear weapons state, is not required to conduct inspections of its military nuclear facilities, although it has agreed to inspections of civil nuclear facilities in line with requirements set out by the International Atomic Energy Agency (IAEA). In 1976, a trilateral agreement was signed between Euratom, the IAEA and the UK sharing responsibility for the non-proliferation of nuclear material in the UK.¹¹⁴ Chapter VII of the Euratom Treaty establishes a nuclear material control system under which the European Commission is responsible for ensuring that nuclear material is not diverted. The Commission fulfils this responsibility by ensuring that physical inspections are undertaken at nuclear facilities.¹¹⁵

¹⁰⁷ Fouquet, D. (2014), 'Development of a catalogue of answers in the main examination procedure of the European Commission State aid SA.34947 (2013 / C) (ex 2013 / N) - Investment contract (Pre-form "Contract for Difference") for the new nuclear power plant Hinkley Point C-UK- Invitation to submit comments pursuant to Article 108 (2) TFEU (2014 / C 69/06, Official Journal of the European Union C 69/60)', report prepared for the Federal Ministry of Agriculture, Forestry, Environment and Water Management, April 2014.

¹⁰⁸ For example, law firm Burges Salmon states that 'Article 106a of the Euratom Treaty provides that the Article 50 procedure under the Treaty of European Union also applies to the Euratom Treaty'. In contrast, McDermott Will & Emery states that 'if the UK government formally notifies the European Council of its intention to leave the European Union pursuant to Article 50 TEU, from a legal point of view, that notification would not affect the United Kingdom's membership in the Euratom Community'. See more at Salt, I. (2016), 'Is Brexit the nuclear option?', Burges Salmon, 4 July 2016, www.burges-salmon.com/news-and-insight/legal-updates/is-brexite-the-nuclear-option/ (accessed 8 Nov. 2016); Bruneau, M. and Hamilton, A. (2016), 'Brexit Versus Euratom: What the "No" Vote Could Mean for UK Membership in the European Nuclear Peace Treaty', McDermott Will & Emery, July 19 2016, www.mwe.com/en/thought-leadership/publications/2016/07/brexit-versus-euratom (accessed 8 Nov. 2016).

¹⁰⁹ However, of course, the issue of leaving Euratom was not expressly put to the British people in the referendum, nor did the European Union Referendum Act 2015 extend to Euratom (and, as far as we are aware, there were no references to Euratom in any relevant government papers or consultations). So it is arguable that the UK government has no mandate to leave Euratom (which is legally separate from the EU).

¹¹⁰ UK Parliament (2017), 'European Union (Notification of Withdrawal) Bill', Clause 1, Article 18, www.publications.parliament.uk/pa/bills/cbill/2016-2017/0132/en/17132en07.htm.

¹¹¹ May (2017), Letter to President Tusk of the European Council, triggering Article 50.

¹¹² Hansard Online (2017), 'European Union (Notification of Withdrawal) Bill', Volume 620, 31 January 2017, [https://hansard.parliament.uk/commons/2017-01-31/debates/C2852E15-21D3-4F03-B8C3-F7E05F2276B0/EuropeanUnion\(NotificationOfWithdrawal\)Bill](https://hansard.parliament.uk/commons/2017-01-31/debates/C2852E15-21D3-4F03-B8C3-F7E05F2276B0/EuropeanUnion(NotificationOfWithdrawal)Bill) (accessed 8 Feb. 2017).

¹¹³ Department for Exiting the European Union, (2017), *Legislating for the United Kingdom's withdrawal from the European Union*, Cm 9446.

¹¹⁴ International Atomic Energy Agency (1978), 'The text of the Agreement of 6th September 1976 between the United Kingdom of Great Britain and Northern Ireland, The European Atomic Energy Community and the Agency in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', INFCIRC 263, October 1978.

¹¹⁵ European Commission (2014), *Nuclear Safeguards*, <https://ec.europa.eu/energy/sites/ener/files/documents/20141007%20Nuclear%20Safeguards%20Brochure.pdf> (accessed 8 Nov. 2016).

The budget for safeguards activities in the EU was €23.1 million in 2015. Due to the number and scale of the UK's nuclear fuel fabrication and waste-management facilities, including the large Sellafield site, the EU conducts a quarter of all its nuclear inspections in the UK.¹¹⁶ The IAEA has also progressively reduced its presence during inspections by 'relying more on the complementary results of Euratom inspections'.¹¹⁷

Without Euratom's involvement, more inspections would need to be carried out either by the UK's Office for Nuclear Regulation (ONR), by a new agency, or via an agreement with the IAEA. The total budget of the ONR in 2015 was £68.8 million,¹¹⁸ of which only £1 million was dedicated to current proliferation safeguards activities. By one account,¹¹⁹ that amount would need to double for the UK to carry out safeguarding responsibilities. This additional funding might have to come straight from the UK's central government budget.

Furthermore, it is still unclear how long it would take to recruit new staff to carry out these inspections. This issue was raised in the European Parliament, where Vice-President Ramón Luis Valcárcel concluded that Brexatom raised 'grave concerns',¹²⁰ particularly given the ageing workforce and the competitive job market.¹²¹

An additional concern is the movement of dual-use (military and civilian) goods which currently fall under EU law.¹²² A specific regulation stipulates that such goods may not leave the EU without export authorization. Therefore, the movement of nuclear goods between the EU27 and the UK will require explicit authorization from EU member states unless the EU grants the UK an EU General Export Authorisation (such as those it has granted to the US and Canada).¹²³ At the same time, the UK will need to engage with non-EU member states to ensure that relevant nuclear materials can be exported to the UK. National authorities in those countries (having regard to their national legal requirements) are also likely to insist that the UK – post-Brexit and post-Brexatom – has a sufficiently robust national security and safeguards regime before they allow exporters to ship nuclear materials to the UK.

R&D

Euratom has its own R&D programme, and in 2013 EU member states and the European Parliament agreed to a budget of €1.6 billion for this programme for the period 2014–18.¹²⁴ Additional funding of €2.5 billion from other EU budgets has been allocated to the ITER International Fusion Energy Organisation.¹²⁵

Nuclear fusion receives the largest share of the Euratom research budget, with funding assigned to the Joint European Torus (JET), which is based in the UK; and to ITER, which is currently

¹¹⁶ European Commission (2014), *Report on the Implementation of Euratom Safeguards in 2014*, https://ec.europa.eu/energy/sites/ener/files/documents/20151211%20Annual_Report%202014.pdf (accessed 8 Nov. 2016).

¹¹⁷ *Ibid.*

¹¹⁸ World Nuclear News (2016), 'UK regulator projects 10% annual growth in 'frontline' staff to 2020', 29 March 2016, <http://www.world-nuclear-news.org/RS-UK-regulator-projects-10-annual-growth-in-frontline-staff-to-2020-29031601.html> (accessed 17 Jan. 2017).

¹¹⁹ Participant at Chatham House roundtable, January 2017.

¹²⁰ Politico EU (2017), 'Brexit Files', 2 February 2017, www.politico.eu/newsletter/brexit-files/politico-brexit-files-we-have-liftoff-irish-energy-sapped-screw-it-moment/ (accessed 27 Feb. 2017).

¹²¹ Business Matters (2016), 'Nuclear watchdog risks meltdown, critics warn', 12 January 2016, www.bmmagazine.co.uk/newswire/nuclear-watchdog-risks-meltdown-critics-warn/ (accessed 10 Mar. 2017).

¹²² European Council (2009), 'Council Regulations (EC) No 428/2009'.

¹²³ European Commission (2014), 'The EU Dual Use Export Control Regime', http://trade.ec.europa.eu/doclib/docs/2014/february/tradoc_152181.pdf (accessed 10 Mar. 2017).

¹²⁴ Council of the European Union (2013), 'Euratom programme for nuclear research (2014 to 2018)', press release, 16 December 2013, www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/140114.pdf (accessed 2 Feb. 2017).

¹²⁵ *Official Journal of the European Union* (2016), 2016/2 436/23, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013AP0468> (accessed 2 Feb. 2017).

under construction in France. The EU currently provides €60 million a year¹²⁶ for JET's operation under a deal which will expire in 2018, so a significant UK financial contribution will be needed to keep JET running post-Brexit. An early draft document from the European Parliament's industry, research and energy (ITRE) committee proposed that the UK's ongoing contribution to ITER and broader EU research programmes should be settled during the Article 50 negotiations.

ITER has been the primary focus for future European and international fusion research. The facility is funded by the EU, China, India, Japan, South Korea, Russia and the US, with Europe contributing 45 per cent of the budget and the non-EU partners contributing 9 per cent each. European funding comes primarily from the EU and its member states, although Switzerland is a partner country and contributes through its membership of Fusion for Energy, the international body coordinating the ITER project.¹²⁷ The expected total construction cost of the ITER project in 2001 was €5.9 billion (at 2008 prices), with the EU contribution estimated at €2.7 billion. By 2010, the expected construction cost had risen to over €11 billion, with the European Commission proposing that Euratom provide an additional €1.4 billion to cover the construction cost shortfall during 2012 and 2013.¹²⁸ The latest US estimate of the cost of its 9 per cent contribution has risen from \$1.1 billion in 2001 to between \$4 billion and \$6.5 billion today.¹²⁹

Euratom Supply Agency

The Euratom Supply Agency oversees the supply of nuclear materials and has an 'exclusive right to conclude contracts relating to the supply of ores, source materials and special fissile materials coming from inside the Community or from outside'.¹³⁰ In other words, the agency authorizes the sale of nuclear fuel to all EU member states, which de facto means that Euratom retains ownership of the nuclear material. Therefore, Brexit will require the ownership of all the 'UK's nuclear material' to be legally transferred from Euratom to the UK. It is not known if this transfer will lead to any significant legal problems.

Nuclear safety standards

The EU, through Euratom, is responsible for setting nuclear safety standards for operating reactors and for nuclear waste-management strategies. It is also responsible for regulating radiation and health protection for workers and the public, and for protection of the environment. Once the UK leaves Euratom, it would still abide by the nuclear safety standards that are 'enshrined in UK legislation', as well as those developed by the IAEA.¹³¹ This correlates with the recent views expressed by the secretary of state for exiting the EU, David Davis, who said: '[I]f it's not possible to come to a conclusion, with some sort of relationship with Euratom, then we will no doubt be able to do one with the [IAEA], possibly the most respectable international body in the world.'¹³²

¹²⁶ HM Government (2016), 'Government ministers visit Oxfordshire to open research centre and highlight risks to UK science and innovation from Brexit', press release, 23 May 2016, www.gov.uk/government/news/government-ministers-visit-oxfordshire-to-open-research-centre-and-highlight-risks-to-uk-science-and-innovation-from-brexit (accessed 2 Feb. 2017).

¹²⁷ Fusion for Energy (undated), 'Organisation Structure', <http://fusionforenergy.europa.eu/aboutfusion/orgstructure.aspx> (accessed 8 Nov. 2016).

¹²⁸ European Commission (2010), 'Communication from the Commission to the European Parliament and the Council, ITER status and possible way forward', COM (2010) 226 final, <https://publications.europa.eu/en/publication-detail/-/publication/ba4e3187-f032-4443-8e4a-2eef5e7c5812/language-en> (accessed 8 Nov. 2016).

¹²⁹ US Department of Energy (2016), 'US Participation in the ITER Project', https://science.energy.gov/~media/fes/pdf/DOE_US_Participation_in_the_ITER_Project_May_2016_Final.pdf (accessed 8 Nov. 2016).

¹³⁰ *Official Journal of the European Union* (2012), 'Consolidated Version Of The Treaty Establishing The European Atomic Energy Community, Article 52', <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12012A%2FTXT> (accessed 8 Nov. 2016).

¹³¹ Greatrex, T. (2017), 'Nuclear safety standards will continue to apply', Letter to the Editor, *Financial Times*, 30 January 2017, www.ft.com/content/fe12228-e312-11e6-8405-9e5580d6e5fb (accessed 20 Jan. 2017).

¹³² NucNet (2017), 'UK Could Seek 'Alternative Agreement' To Euratom With IAEA After Brexit', 2 February 2017, www.nucnet.org/all-the-news/2017/02/02/uk-could-look-for-alternative-agreement-to-euratom-with-iaea-after-brexit (accessed 17 Feb. 2017).

However, there are significant differences between the oversight and enforcement mechanisms of Euratom and those of the IAEA. The IAEA's Convention on Nuclear Safety produces 'international benchmarks to which States would subscribe'. As part of this, states are required to submit national reports, which are subject to peer review. However, in contrast to Euratom's regime, the IAEA's convention provides no sanctions for non-compliance. Until now, the international convention has been 'supplemented by' EU legislation, which 'provides binding legal force to the main international safety principles'.¹³³ To compensate for the loss of European legislation, the UK government would need to consider working to enhance the international or regional safety regime – such as the Western European Regulators Association – and/or increasing domestic transparency over its safety procedures.

International agreements

The civil nuclear business in the UK benefits from the supply of nuclear materials and equipment from a number of countries (both Euratom members and non-members). If the UK exits Euratom without any replacement arrangement being established, it will become impossible for the UK's civil nuclear business to continue to operate or develop in the longer term. Many of the UK's supply chain arrangements with non-Euratom countries are routed via Euratom and predicated on the application of the Euratom safeguards regime within the UK. It is unclear whether these could be revised and/or whether new agreements could be adopted with third countries before the UK's departure from the Euratom Treaty (expected in March 2019). Indeed, '[n]uclear cooperation agreements can take much time to put in place, possibly longer than the two-year negotiating window provided by the Article 50 process'.¹³⁴ Furthermore, according to Vince Zabielski, a senior lawyer at Pillsbury Winthrop Shaw Pittman, '[i]f the UK leaves Euratom before new stand-alone nuclear cooperation treaties are negotiated with France and the United States, current new build projects will be placed on hold while those stand-alone treaties are negotiated'.¹³⁵

Although the UK is likely to try to maintain a close relationship with Euratom, possibly through an associate agreement or nuclear cooperation agreement, these structures can take time to negotiate and approve. The UK could seek to enter into a formal agreement with Euratom (under Article 101 of the Treaty), or establish a more wide-ranging association agreement (under Article 206) providing for reciprocal rights and obligations (though a UK–Euratom agreement is more likely to be entered into under Article 101, as this requires approval only by a qualified majority vote in the European Council). However, if the agreement is 'mixed' (i.e. covers issues not in the sole competence of Euratom), then signature and ratification by all the EU member states – and possibly national parliaments – will be required as well. It is also unclear whether negotiations on a new status for the UK within Euratom could start before the broader Article 50 negotiations on the terms of the UK's withdrawal from the EU are concluded.

If the UK is unable to conclude an agreement with Euratom, it may seek to enter into arrangements with individual Euratom member states. However, several requirements and conditions will apply, including the following: (i) Euratom consent will be required on the 'compatibility' of relevant arrangements with the Euratom Treaty; (ii) where an agreement relates to delivery of fissile material, consent can be withheld without any reason; and (iii) any other Euratom member state can challenge the arrangement if it considers that the relevant member state has failed to meet its obligations under the Euratom Treaty. Additionally, as flagged above, the UK will need to enter into cooperation

¹³³ European Nuclear Safety Regulators Group (2017), 'Nuclear safety directive', www.ensreg.eu/nuclear-safety-regulation/eu-instruments/Nuclear-Safety-Directive (accessed 3 Feb. 2017).

¹³⁴ Leech, J. and Cowen, R. (2017), 'Brexit and Euratom: No rush to exit?', World Nuclear News, 20 January 2017, www.world-nuclear-news.org/V-Brexit-and-Euratom-No-rush-to-exit-20011701.html (accessed 2 Feb. 2017).

¹³⁵ World Nuclear News (2017), 'UK nuclear industry faces prospect of Euratom exit', 27 January 2017, www.world-nuclear-news.org/NP-UK-nuclear-industry-faces-prospect-of-Euratom-exit-27011701.html (accessed 2 Feb. 2017).

arrangements with relevant non-Euratom countries, as it will cease to benefit from the cooperation arrangements currently in place between Euratom and non-Euratom countries.

Nuclear power policies in the EU

The UK has been an active supporter of nuclear power in the EU – for example, it hosted an informal ministerial meeting in March 2013¹³⁶ – and its exit from the EU will be felt by the other pro-nuclear EU countries. However, it is not just the UK's allies on the issue that are lamenting its departure: Tommy Dooley TD, spokesman on energy issues for the main Irish opposition party Fianna Fáil, stated: 'Make no mistake about it, this is a huge issue for Ireland and the rest of Europe.'¹³⁷ As FORATOM, a trade association for the European nuclear industry, noted: 'The UK's departure will tilt the balance in favour of anti-nuclear countries [as] the ratio is currently 14 pro-nuclear Members [sic] States and 14 anti-nuclear Member States.'¹³⁸

¹³⁶ HM Government (2013), 'Informal Ministerial meeting of EU countries interested in nuclear power generation', 12 March 2013, www.gov.uk/government/uploads/system/uploads/attachment_data/file/185076/draft_note_informal_ministerial_meeting_eu_countries_nuclear_power_gen.pdf (accessed 2 Feb. 2017).

¹³⁷ Fianna Fáil (2017), 'Irish interests must be protected when UK leaves EURATOM – Dooley', 18 February 2017, www.fiannafail.ie/irish-interests-must-be-protected-when-uk-leaves-euratom-dooley/ (accessed 17 Mar. 2017).

¹³⁸ FORATOM (2016), 'Potential impact of the Brexit on the European nuclear industry', 24 June 2016, www.foratom.org/newsfeed/potential-impact-of-the-brexit-on-the-european-nuclear-industry/ (accessed 16 Mar. 2017).

3. The UK and the EU27: the Global Dimension

Brexit is likely to change how the UK and the EU27 interact with the rest of the world across all sectors, not least in the fields of energy and climate change.

The UK government's February 2017 white paper states that '[b]y leaving the EU we will have the opportunity to strike free trade agreements with countries around the world'. Informal talks have already begun with existing energy exporters such as Australia, the Gulf states and the US.¹³⁹ Qatar's energy minister, Mohammed bin Saleh al-Sada, has said that he sees Brexit as an opportunity to increase exports of LNG to the UK and create an FTA between the UK and members of the Gulf Cooperation Council.¹⁴⁰ However, trade deals are only part of the enhanced international relationships that the UK will now have to develop; it will also have to forge agreements on joint collaboration on research and innovation, and on encouraging inward investment. A further challenge is that GB is a relatively isolated energy market: it would therefore be impractical to unplug its energy networks from the rest of Europe.¹⁴¹

The EU's approach to intra-EU energy cooperation has always looked to deepen the IEM, harmonize policies among member states, and build relationships with suppliers, transit countries and other large consumers.

The EU's approach to intra-EU energy cooperation has always looked to deepen the IEM, harmonize policies among member states, and build relationships with suppliers, transit countries and other large consumers. It is currently expanding the number of preferential trade agreements it has with other countries, recently concluded a comprehensive FTA with Canada, and is negotiating FTAs with Japan, India and the US – although progress on the latter has stalled and is unlikely to be revived under the administration of President Donald Trump. The EU's energy policy is unlikely to change significantly post-Brexit, with plans for a strong Energy Union premised on economic modernization, societal benefits and solidarity between Europeans. However, there is a risk that the loss of a key advocate for market liberalization could result in the EU27 moving in a different direction, such as taking new diplomatic approaches and setting new objectives for climate and energy.

¹³⁹ Conway, E. (2017), 'Free trade talks already under way with range of non-EU countries', Sky News, 19 January 2017, <http://news.sky.com/story/free-trade-talks-already-under-way-with-range-of-non-eu-countries-10734819> (accessed 26 Jan. 2017); HM Government (2017), 'The government's negotiating objectives for exiting the EU: PM speech'.

¹⁴⁰ Finn, T. (2017), 'Qatar sees Brexit as chance to supply UK more gas – minister', Reuters, 28 March 2017, http://uk.reuters.com/article/uk-britain-uk-gas-idUKKBN16Z14E?utm_source=POLITICO.EU&utm_campaign=9c22ee83fc-EMAIL_CAMPAIGN_2017_03_29&utm_medium=email&utm_term=0_10959edeb5-9c22ee83fc-190016065 (accessed 9 Apr. 2017).

¹⁴¹ See also Froggatt, A., Tomlinson, S. and Raines, T. (2016), *UK Unplugged? The Impacts of Brexit on Energy and Climate Policy*, Research Paper, London: Royal Institute of International Affairs, www.chathamhouse.org/publication/uk-unplugged-impacts-brexit-energy-and-climate-policy (accessed 9 Apr. 2017).

Box 7: Impact of Brexit on EU27 climate and energy policy areas

North Sea Grid

As member states decarbonize further, interconnection will be vital to trading renewable energy smoothly across borders. While the UK has relatively little interconnection (an equivalent of 7 per cent of generation capacity at peak demand), Chapter 2 showed that the country is planning to increase this share.

In part this reflects a commitment to the development of the Regional Group North Sea, part of ENTSO-E's Ten-Year Network Development Plan, which aims to improve interconnection between the separate synchronous power systems located in northern Europe: the island of Ireland, GB, Sweden, Norway and the northwest continental EU (Belgium, Denmark, France, Germany, Luxembourg and the Netherlands).¹⁴² In 2016, the 10 countries – nine EU member states plus Norway – that were interested in furthering energy cooperation in the North Sea signed a political declaration setting as an objective the deployment of offshore renewable energy. The declaration encouraged not only interconnection, but also the development of a grid 'able to accommodate large scale offshore wind energy'.¹⁴³ Today, the UK has installed more offshore wind-powered generation capacity than any other country in the EU:¹⁴⁴ the UK accounts for around 10 per cent of the EU's total and is an important energy player in the North Sea.

The UK's continual involvement in the various North Sea initiatives will be important for the EU's energy relations with Ireland, for increasing interconnection between the Norwegian and Western European markets, as well as for supporting the development of offshore wind power and critical supply chains as part of the EU's plans for decarbonization.

Gateway for European gas imports

While the UK has become increasingly reliant on gas imports for its own consumption, it is also an important provider of gas for Ireland, as noted in Section 2.4, and for mainland Europe through an interconnector joining the UK with Belgium. The UK also has the largest LNG port in Europe, and is one of the EU's largest importers of LNG, supplying over a quarter of the EU's total. In 2015, the UK's total LNG exports (158 TWh) were larger than its total LNG imports (152 TWh),¹⁴⁵ which shows that the UK in effect is passing on the LNG that it imports to the mainland continental market. While LNG accounts for only a small share (around 4 per cent) of the EU's gas imports,¹⁴⁶ it makes a significant contribution to gas supply in certain countries, including Belgium.

Greenhouse gas (GHG) accounting

The UK's 2008 Climate Change Act and subsequent five-yearly carbon budgets put the UK on a decarbonization pathway that was more ambitious than that of the EU as a whole. Once the UK leaves the EU, however, the remaining member states, if they wish to maintain their current emissions reduction pathway, may need to compensate for the loss of the UK's participation and increase their own share of emissions cuts by 138 MtCO₂e by 2030 (representing about 4.5 per cent of additional efforts).¹⁴⁷ If or how this would be divided between the ETS and non-ETS sectors, or among the remaining member states, is yet to be determined.

¹⁴² According to the Regional Group North Sea plan, increased interconnection is expected to lead to a 'higher integration of the European energy market, increasing the integration of renewable energy sources facilitating lower CO₂ emissions'. See ENTSO-E (2016), 'North Seas, regional planning, Ten Year Network Development Plan', <http://tyndp.entsoe.eu/insight-reports/north-seas/> (accessed 31 Mar. 2017).

¹⁴³ European Commission (2016), 'North Seas Countries agree on closer energy cooperation', press release, 6 June 2016, http://europa.eu/rapid/press-release_IP-16-2029_en.htm (accessed 4 Apr. 2017). The UK later signed the political declaration and was present at the first meeting of the North Seas Energy Forum on 23 March 2017, see <https://ec.europa.eu/energy/en/news/first-meeting-north-seas-energy-forum-held>.

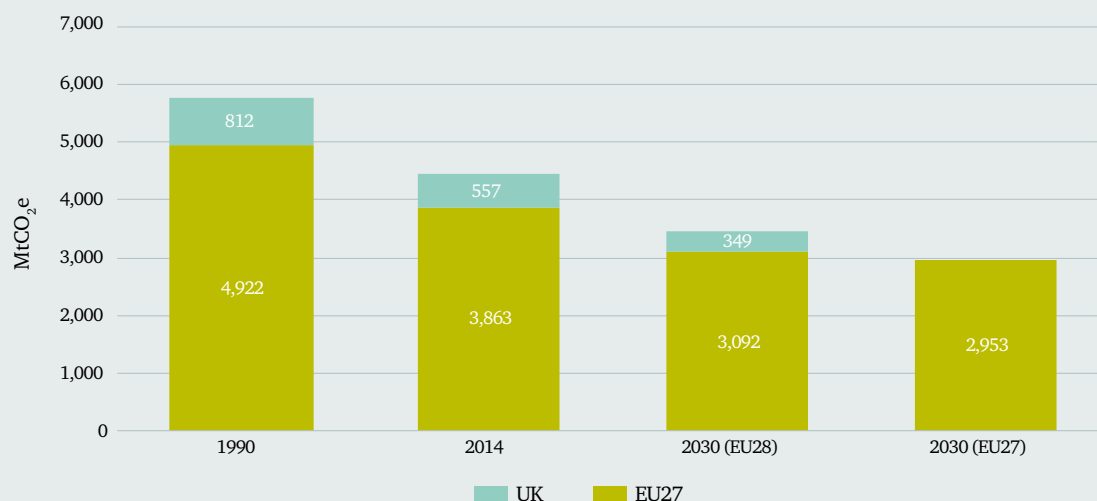
¹⁴⁴ WindEurope (2017), *Wind in power 2016 European Statistics*, February 2017, <https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Statistics-2016.pdf> (accessed 4 Apr. 2017).

¹⁴⁵ Department for Business, Energy & Industrial Strategy (2016), *Digest of United Kingdom Energy Statistics (DUKES)*, 'Natural Gas: Chapter 5', July 2016, www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes (accessed 4 Apr. 2017).

¹⁴⁶ Eurogas (2016), *Statistical Report 2015*, 19 January 2016, www.eurogas.org/uploads/2016/flipbook/statistical-report-2015/mobile/index.html#p=1 (accessed 4 Apr. 2017).

¹⁴⁷ Carvalho, M. and Fankhauser, S. (2017), 'With or without you? Why the European Union's climate targets will be harder to meet post-Brexit', blog post, Grantham Research Institute, 16 January 2017, <http://blogs.lse.ac.uk/brexit/2017/01/16/with-or-without-you-why-the-european-unions-climate-targets-will-be-harder-to-meet-post-brexit/> (accessed 7 Feb. 2017).

Figure 7: EU emissions reductions



Source: Grantham Centre LSE.

What could be more worrying for the EU27 is the UK's contribution to reductions in the non-ETS sector, where the UK's share under the Effort Sharing Directive (ESD) is set at 37 per cent, more than the EU average of 30 per cent. Already the European Environment Agency acknowledges non-ETS sectors as those most likely to miss the 2030 targets unless EU and member state policies are strengthened.¹⁴⁸

This is an issue likely to require resolution in the Article 50 negotiations, with a range of options available to the UK and the EU27. The simplest option for the EU27 would be for the UK to remain part of the EU's climate change accountability, at least in the short term. The UK could use its higher-than-average contribution to the current EU joint target as a means of exercising leverage over the EU27; from a climate policy perspective, it would be preferable for the UK to use this leverage to secure continued UK participation in mechanisms such as the ETS, rather than to secure other, non-climate, UK negotiating priorities.

Changing balance in EU institutions

The UK's exit from the EU risks changing the balance of support for different policies and levels of ambition within the European Council and Parliament. Notably, the UK has been one of the driving forces behind EU climate policies and targets, and was instrumental in establishing the Ministerial Green Growth Group in which 13 EU countries united to push for the early adoption of ambitious 2030 climate and energy policies.¹⁴⁹ The UK has also been a strong supporter of market mechanisms (both for electricity and gas), emissions reductions and nuclear power. This being said, the UK has also blocked more ambitious EU renewables and efficiency targets. In recent years, the UK has been less supportive of renewable energy, compared with many of the other member states, and was one of the countries that opposed member state targets in the 2030 clean energy package.

¹⁴⁸ European Environment Agency (2016), 'Greenhouse gas (GHG) emission trends, projections and targets in the EU', 9 December 2016, www.eea.europa.eu/data-and-maps/daviz/greenhouse-gas-ghg-emission-trends-2#tab-chart_1 (accessed 3 Mar. 2017).

¹⁴⁹ HM Government (2013), 'Ministers make joint case for ambitious & immediate EU low carbon action', press release, 28 October 2013, www.gov.uk/government/news/ministers-make-joint-case-for-ambitious-immediate-eu-low-carbon-action (accessed 31 Mar. 2017).

3.1 Energy cooperation

3.1.1 An ‘Enlarged European Energy Union’

In its proposals for an Energy Union, the EU recognized the importance of working with its neighbours by stating:

With the goal of building a resilient Energy Union, with an ambitious climate policy at its core, the EU is committed to strengthen its energy dialogue with neighbourhood countries in energy security, energy market reforms and the promotion of sustainable energy.¹⁵⁰

This goal was reaffirmed on the first anniversary of the Energy Union, when Vice-President for the Energy Union Maroš Šefčovič stated that ‘the Energy Union does not stop at the EU borders’.¹⁵¹

The UK is a major energy importer, gas export hub, and proponent of a competitive European energy market with strong climate objectives. Including the country in the EU’s plans for a pan-European energy neighbourhood would therefore create an opportunity to strengthen regional energy cooperation. Cooperation with the EU on energy and climate within a multilateral framework would also be in the UK’s interest, as it would provide an opportunity for the UK and the EU to promote common initiatives. A common institutional set-up would also prevent delays to trade and investment by providing a framework for cooperation, enforcement and dispute resolution.

It is also likely that the EU27 will be more receptive to using an existing framework or taking a multilateral approach, rather than setting up a new bilateral approach as Switzerland has; there is a risk that the latter would encourage third countries to pursue ad hoc energy relationships with the EU, which could become complicated and unsustainable. The most obvious vehicle for the development of an enhanced energy neighbourhood policy would be the European Energy Community (EEC). However, for the UK such an option is complicated by the fact that a number of EEC member states are also candidates for EU membership, and see the EEC partly as a means of accession. In fact, the EEC was set up expressly to help those countries intending to join the EU to bring their energy sectors in line with those of EU member states. This includes the adoption of relevant EU *acquis* (including on energy, the environment, and certain competition and procurement standards). Clearly, the UK, as a former member state, would not fit well into such a group.

One solution would be to create a new multilateral energy grouping for member states and neighbouring countries. This might be termed the ‘Enlarged European Energy Union’ (EEEEU). In particular, an EEEEEU would:

- Facilitate close integration of neighbouring countries’ energy markets into the IEM, in particular managing electricity through a common framework, rather than on an ad hoc basis;
- Agree to common goals for environmental protection and product standards, and security-of-supply rules and requirements;
- Offer a more limited pooling of sovereignty than that currently required by EU membership;

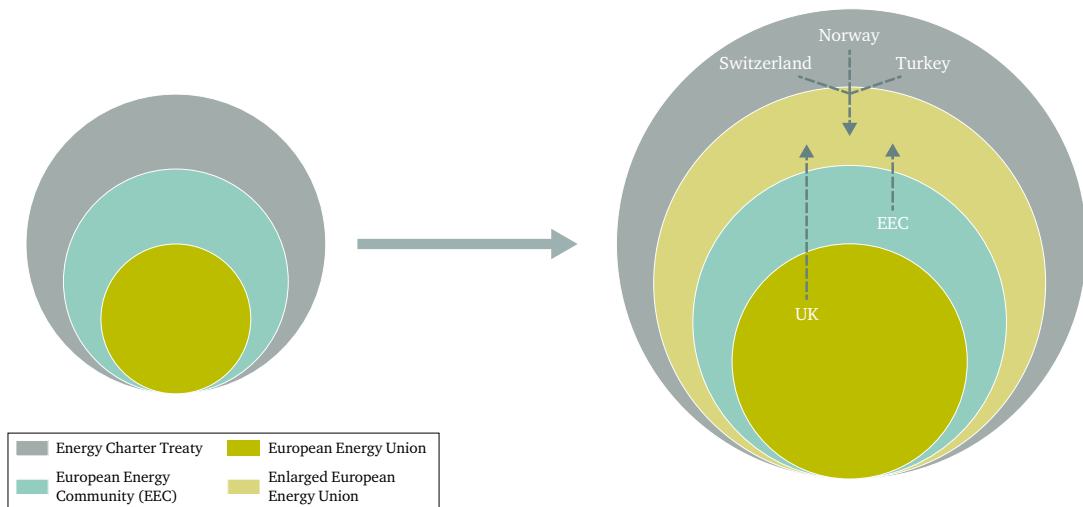
¹⁵⁰ European Commission (2015), ‘Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Review of the European Neighbourhood Policy’, SWD (2015) 500 final, JOIN (2015) 50 final, http://eeas.europa.eu/archives/docs/enp/documents/2015/151118_joint-communication_review-of-the-enp_en.pdf (accessed 13 Feb. 2017).

¹⁵¹ European Commission (2016), ‘Speech by Vice-President for Energy Union Maroš Šefčovič on “Energy Union – 1 year on” at the conference organised by Jacques Delors Institute’, 25 February 2016, http://europa.eu/rapid/press-release_SPEECH-16-424_en.htm (accessed 13 Feb. 2017).

- Be open to, or eventually even replace, the ECJ by reinforcing mechanisms for joint monitoring and dispute settlement, in line with recent European Commission proposals;
- Prevent delays to trade and investment, in particular for projects of common interest such as energy infrastructure;
- Meet the EU’s objectives of building a continent-wide competitive energy market, while developing a more regional approach to decarbonization and security of supply; and
- Allow neighbouring countries such as Norway and the UK to be more closely involved with EU policymaking in this field.

Furthermore, an EEEU would increase confidence in the transit of energy resources, particularly gas from Russia, and help secure energy investment and enhance security in strategically important countries such as Ukraine. If successful, this framework for cooperation could serve as a model for energy cooperation in other regions in the world.

Figure 8: A potential pan-European framework for energy cooperation – an ‘Enlarged European Energy Union’



3.1.2 Relationships with global technology and resource suppliers

The EU has extensive relationships with non-member countries on energy. These relationships are built on recognition that addressing global challenges such as climate change, technology innovation and price instability requires systematic cooperation. Cooperation involves establishing agreements with suppliers, major consumers and transit countries – in this respect the EU pays considerable attention to Norway and Russia, which are vital suppliers of fossil fuels (see Table 3). These countries are also key suppliers of energy to the UK. An EEEU would help ensure that competition between the UK and EU27 for traditional energy supplies is kept to a minimum, while helping to build a platform for greater consultation and transparency.

Table 3: Main sources of imported energy in the UK and EU, 2014 (% of total imports)

Coal				Crude oil				Natural gas			
UK		EU		UK		EU		UK		EU	
Russia	38	Russia	29	Norway	42	Russia	30	Norway	57	Russia	37
Colombia	29	Colombia	21	Algeria	14	Norway	13	Qatar	24	Norway	32
US	22	US	21	Nigeria	13	Nigeria	9	Netherlands	15	Algeria	12
Rest of world	11	Rest of world	29	Rest of world	31	Rest of world	48	Rest of world	12	Rest of world	18

Sources: European Commission; *Digest of United Kingdom Energy Statistics (DUKES)*.

Of course, once it has left the EU, the UK is also likely to seek to leverage unilaterally its global influence in energy sectors. Oil, gas and coal are traded on the open market; in line with WTO rules, the EU does not impose tariffs on these products. These rules would also likely apply to an independent UK. As such, the potential gain for an independent UK would lie in other aspects of energy trading relationships. For example, the UK could seek to include substantial energy components within wider external trade deals, such as including Canadian and US exports of LNG to the UK, which could help to lower UK energy prices.¹⁵²

The UK could also look into tariff-free access for low-carbon technologies, including in any overall trade agreement with the EU. Currently, the UK exports worldwide around £0.9 billion worth of low-carbon equipment (including renewables, clean vehicles, insulation and energy efficiency) each year, and imports around £2.1 billion worth of such goods. Alternatively, the UK could sign up to the Environmental Goods Agreement (EGA), which the EU and 16 other WTO members have been negotiating since 2014. This multilateral agreement aims to cut to 5 per cent the duties on a selected list of environmental technologies (including renewables and energy-saving technologies).¹⁵³

Creating a strategic trading relationship with key producers of fuels and materials could also increase the opportunities for UK firms to access and assist in the development of resources abroad. Likewise, if EU state aid rules no longer apply, it might be easier to secure preferential investment terms for foreign producers, particularly if the producers are state-owned. As an illustration, the chairman of Russia’s Gazprom, Viktor Zubkov, was reported as saying that it will be easier to do business in the UK if the UK leaves the EU¹⁵⁴ – although any specific UK–Russian energy deal would almost certainly require the lifting of sanctions.¹⁵⁵ The security of these investments would need to be considered in light of the UK government’s industrial strategy, including its ongoing commitment to lowering carbon emissions and reducing the use of fossil fuels in the UK.

¹⁵² Pollitt, M. G. (2017), *The Economic Consequences of Brexit: Energy*, Energy Policy Research Group, Cambridge: University of Cambridge, www.eprg.group.cam.ac.uk/wp-content/uploads/2017/01/1702-Text.pdf (accessed 14 Mar. 2017).

¹⁵³ Carvalho, M. and Dussau, D. (2017), ‘UK needs free trade with the European Union in low-carbon technologies’, London School of Economics and Political Science, 8 February 2017, www.lse.ac.uk/GranthamInstitute/news/uk-needs-free-trade-with-the-european-union-in-low-carbon-technologies/ (accessed 14 Mar. 2017).

¹⁵⁴ Soldatkin, V. (2016), ‘Russia’s Gazprom says easier to deal with Britain outside EU’, Reuters, 18 July 2016, <http://uk.reuters.com/article/uk-russia-gazprom-britain-eu-idUKKCN0ZY276> (accessed 13 Feb. 2017).

¹⁵⁵ Kuszniir, J. (2016), ‘Russia hopes to benefit from Britain’s departure’, Europe’s World, 18 November 2016, <http://europesworld.org/2016/11/18/russia-hopes-benefit-britains-departure/#.WKG02m-LRMw> (accessed 13 Feb. 2017).

3.2 Greater flexibility for enhanced climate diplomacy

The UK has long been a global champion of ambitious domestic and international targets to tackle climate change and other areas of environmental degradation. The UK government's February 2017 white paper notes that the UK intends to 'continue to be a leading actor [...] in global efforts to tackle major challenges, including climate change'.¹⁵⁶ The UK is the largest contributor to global climate finance, having pledged \$10.9 billion,¹⁵⁷ and is a significant donor to climate change adaptation and mitigation initiatives. This is in addition to the fact that the UK is the fourth-largest contributor¹⁵⁸ to EU climate funds worth \$430 million.¹⁵⁹ The UK is also one of only a handful of countries that currently meet the UN target of spending 0.7 per cent of gross national income (GNI) on overseas development assistance, some of which goes to protecting the environment and meeting climate commitments.

Since the referendum on EU membership in 2016, the government has published its response to the UK's fifth carbon budget (2028–32). In November 2016, the government committed £730 million to renewable-electricity projects and increasing clean-energy investment.¹⁶⁰ In September 2016 Prime Minister May reaffirmed the UK's commitment to the Paris Agreement. However, since planned UK emissions reductions are currently counted as part of the EU's Nationally Determined Contribution (NDC) under the 2016 Paris Agreement, the UK would still need to submit its own NDC in line with current domestic targets.

The UK could also choose to play a more ambitious role by increasing its NDC above the EU's target. In its existing submission, the UK government states that '[t]he EU and its Member States are committed to a binding target of at least 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990'. If the UK resubmitted its commitment, with inclusion of a pledge (in line with the fifth carbon budget) to reduce emissions by at least 57 per cent from 1990 levels by 2030,¹⁶¹ this would place the UK in a global leadership role. It would mean that the UK had the most ambitious 2030 greenhouse gas (GHG) reduction target of any developed country. This would send an important international signal, particularly as more ambitious GHG emissions reductions will be needed to keep global warming this century 'well below' the international agreed threshold of 2°C above pre-industrial levels and below the target threshold of 1.5°C.

More broadly, the election of President Trump, his subsequent cabinet appointments, and proposed budget cuts at the US Environmental Protection Agency raise serious doubts about the US's commitment to climate change action over the next four years. This is likely to result in a leadership vacuum at an important period in the post-Paris Agreement review period. This creates an opportunity for the UK and the EU27 to assemble a 'coalition of the willing', ideally including China, India and other emerging economies, to lead on clean energy and climate change action, for example through creative climate diplomacy.¹⁶²

¹⁵⁶ HM Government (2017), *The United Kingdom's exit from and new partnership with the European Union*, Cm 9417.

¹⁵⁷ Climate Funds Update (2016), 'The data', www.climatefundsupdate.org/data (accessed 20 Jan. 2017).

¹⁵⁸ BBC (2017), 'EU budget, who pays what?', <http://news.bbc.co.uk/1/hi/world/europe/8036097.stm#startSee> (accessed 27 Feb. 2017).

¹⁵⁹ *Ibid.*

¹⁶⁰ Department for Business, Energy & Industrial Strategy (2016), 'Government sets out plans to upgrade UK energy infrastructure and increase clean energy investment', press release, 9 November 2016, www.gov.uk/government/news/government-sets-out-plans-to-upgrade-uk-energy-infrastructure-and-increase-clean-energy-investment (accessed 26 Mar. 2017).

¹⁶¹ Committee on Climate Change (2015), 'Chapter 2 Overview of the Climate Science and International Circumstances' in 'Fifth Carbon Budget', www.theccc.org.uk/wp-content/uploads/2015/11/Fifth-Carbon-Budget_Ch2_Overview-of-climate-science-and-international-circumstances.pdf (accessed 26 Mar. 2017).

¹⁶² See also House of Lords, European Union Committee (2017), *Brexit: environment and climate change*, HL Paper 109, p. 44.

4. Conclusion and Recommendations

Energy cooperation has been a priority for Europe ever since the creation of the European Coal and Steel Community in 1951. Among many things, the creation of the IEM, subsequent packages of legislation, and proposals for an Energy Union are geared to ensuring efficiency and competition between EU markets and across the continent. With already considerable strategic alignment between the EU and the UK on energy and climate issues, energy deserves special attention due to the critical importance of real-time trade in electricity across the English Channel.

In the likely event that the future deal between the EU27 and UK is not finalized within the two-year period specified by the Article 50 process, the UK government should seek to maintain its current status within the IEM and ETS during the transition process; this would require full compliance with the energy *acquis* but would maintain short-term policy certainty and investor confidence.

4.1 Maintaining electricity market engagement and interconnectors

The UK is an important energy player. It is also a relatively isolated electricity market, and thus reliant on interconnectors to mainland Europe. As a consequence, and given the UK's plans for further decarbonization, the UK should seek to remain fully integrated with European energy networks for economic, environmental and security-of-supply reasons. Therefore:

1. The UK should remain committed to current plans to treble its electricity interconnection by 2025, particularly as it looks to decarbonize its economy over the coming years.
2. The UK government, its commercial partners and EU counterpart governments must continue to work together to ensure confidence in the economic viability of each individual project at both ends of the relevant interconnector.

4.2 Compliance and enforcement

To be fully integrated with the IEM, the UK would need to comply with the relevant EU *acquis* (including on energy, environment and competition) and agree to a joint legislative framework for regulatory oversight and enforcement. Therefore:

3. In the absence of ECJ enforcement, the UK should consider creating a government committee, parliamentary grouping or public body to scrutinize future UK energy policy and future UK–EU27 energy compliance. This should also include the participation of the devolved administrations.
4. The UK should seek to strengthen the EU's proposals for a robust pan-European energy partnership, which would establish a common framework to help ensure regulatory convergence between the EU and non-EU countries participating in the IEM.

4.3 Retaining influence over IEM decision-making

The UK's decision to leave the EU could have important implications for the UK government's ability to set the agenda and influence the IEM. Once the UK is outside the EU, the UK government risks losing its formal voice almost entirely on IEM regulatory matters, with only GB TSOs exercising voting rights on technical codes.

5. The UK government should consider remaining a member of EU agencies, technical groups and regulatory dialogues with the EU. Likewise, UK stakeholders should consider remaining part of EU-wide associations and forums.
6. GB TSOs should seek to remain influential members of ENTSO-E and ENTSG.¹⁶³
7. The UK should seek to strengthen the EU's proposals for a robust pan-European energy partnership, while highlighting concrete ways in which the EU can give neighbouring countries a greater say in regional and European energy issues. The UK should support proposals for the reform of ACER, published in November 2016.
8. Once the UK leaves the EU, the UK government and GB stakeholders should seek to expand informal channels of influence in Brussels. This will require greater financial resources and staffing to compensate for the loss of direct engagement in the EU decision-making process.

4.4 Maintaining the SEM in Ireland

The Republic of Ireland and Northern Ireland have fully linked and compatible energy networks, as demonstrated by the development of joint markets, regulatory bodies and shared infrastructure. The UK government has recognized the need for specific measures to avoid 'disruption to the all-Ireland single electricity market operating across the island of Ireland'.¹⁶⁴

9. Regardless of the UK's future relation to the IEM, the UK and Irish governments should prioritize the continued development of I-SEM (Integrated Single Electricity Market) – either by creating a special status for I-SEM or by designating Northern Ireland as a special zone (both courses of action could imply the continuing application of ECJ jurisdiction). These efforts will require clear support from other EU member states and European energy institutions, such as ENTSO-E, ENTSG and ACER.
10. There is a strong economic rationale for a regional approach to management of emergency oil and gas stocks and shared infrastructure. The UK should remain involved in regional dialogues on energy.

4.5 ETS and climate change

The UK has a strong history of supporting carbon pricing and was a proponent of the introduction of Europe's first emissions trading system. However, remaining part of the ETS is likely to require accepting ECJ jurisdiction, which has been ruled out by Prime Minister May. Therefore, the government should:

¹⁶³ Non-EU TSOs can be members of ENTSO-E, but at the moment can only be associate members of ENTSG.

¹⁶⁴ HM Government (2017), *The United Kingdom's exit from and new partnership with the European Union*, Cm 9417.

11. Maintain existing domestic targets through the Emissions Reduction Plan, also known as the Clean Growth Plan, which is expected to detail the policies and measures necessary to meet the fifth carbon budget.
12. Set out a clear, credible, long-term domestic strategy for how it will enforce a carbon price that contributes to the ambitious decarbonization necessary to meet the goals set out in the 2008 Climate Change Act. The government will need to ensure close cooperation with the devolved administrations in designing the strategy.
13. In the short term, until the completion of the third phase (2013–20) and probably longer, the UK should aim to remain part of the ETS. Establishing a separate emissions trading system is likely to be complicated, time-consuming and expensive. Clear contingency arrangements should be set out if continued participation in the ETS is no longer possible.
14. Explore the possibility of introducing a national emissions trading scheme that could be linked both to the EU ETS and global markets, such as those in Canada and South Korea. The UK government should carefully weigh the costs of linking a domestic emissions trading system with a global one, particularly given that the UK is a relatively small emissions market which may not be as attractive to a larger emissions reduction scheme. Consideration should also be given to the introduction of a carbon tax. While there are a number of options, it is clear that any future arrangement in which the UK is outside the EU ETS must ensure policy longevity and a meaningful carbon price that reflects the environmental costs.

4.6 Euratom

The government has made it clear that the UK will leave the Euratom Treaty. This has important nuclear safety and security implications, and raises questions about the UK's relationship with international institutions, particularly the IAEA. Introducing new measures to address nuclear safety and security standards will require considerable regulatory changes, additional staff and government finance. While each action is complex in its own right, the key challenges for the UK government and the EU27 are the multidimensional aspects of Brexatom and the short time scale for achieving resolution.

15. To maintain confidence in the non-proliferation regime, there must be no gaps or shortcomings in international oversight. The UK will need to ensure a smooth transition from the current trilateral inspections and safeguards regime to one conducted solely by the IAEA and UK. The UK may need to increase its contribution to the IAEA and to the budget of the ONR.
16. If the government wishes the UK to remain a global centre for fusion research, considerable additional funding will be required.
17. Once the UK has left Euratom, the government should consider establishing new institutions responsible for ensuring that nuclear safety and health and safety standards are adhered to. It should also consider including additional transparency checks and balances into domestic legislation as a means of compensating for lack of EU oversight.

4.7 Replacing EU funds

The EU and related institutions are an important source of funding and project development assistance for the energy sector in the UK. More measures will be needed to replace these even before the UK has left the EU, as project development is expected to tail off following the triggering of Article 50 on 29 March 2017.

18. The UK government should advocate a change in the membership rules of the European Investment Bank (EIB) in order to remain a shareholder in the EIB and a recipient of large EIB loans.
19. The UK government and devolved administrations need to establish a fund or financial mechanisms to replace European loans (from the EIB) and project development funds (from the Connecting Europe Facility).
20. Approximately £300 million worth of energy R&D is undertaken in the UK each year using EU funds. To maintain its key role in energy innovation, the UK government should prepare to spend a similar amount either by remaining part of the EU's research programmes or by increasing domestic and/or bilateral energy research.

4.8 Enlarging the European Energy Union

Currently, the EU has a piecemeal approach to energy cooperation with its neighbours. While the UK government may be reluctant to re-enter a multinational framework on energy, taking this route is likely to be the most advantageous for ensuring its domestic environmental, economic and security-of-supply objectives. It would also help the EU meet its objectives for a competitive, resilient and secure pan-European energy framework.

21. The UK should explore with like-minded countries neighbouring the EU, such as Switzerland and Norway, the possibility of support for a more ambitious 'Enlarged European Energy Union' (EEEEU).
22. The UK should consider more active engagement in regional forums and in an EEEU to aid security of supply across the continent, help markets integrate, and encourage a more regional approach to decarbonization.
23. The UK and EU27 need to convey to consumers and policymakers the mutual benefits and opportunities from a strong energy relationship across Europe; this needs to be commenced early on in the Brexit negotiations and continued throughout them.

Annex 1: Key Elements of the EU Electricity Framework, 1996–2016

Date	Rule	Description
1996	Directive 96/92/EC	Grid interoperability, unbundling and transparency of accounting, third-party access, establishment of independent conciliation board.
2001	Directive 2001/77/EC	Framework strategy for the promotion of electricity from renewable sources.
2003	Directive 2003/54/EC	Replaced Directive 96/92/EC; further unbundling of accounts, third-party access to networks, establishment of independent national regulatory authorities.
	Regulation 1228/2003	Conditions for access to networks for cross-border trade in electricity, including compensation for transmission system operators (TSOs), non-discriminatory and transparent tariffs, allocation of cross-border capacity in case of congestion, harmonization of safety, operational and planning standards, and publication of relevant data by TSOs.
	Directive 2003/87/EC	Rules for the EU Emissions Trading System (ETS), including power stations using coal, gas and oil.
	Directive 2003/96/EC	Restructuring the Community framework for the taxation of energy products and electricity. Amended in 2004.
2009	Directive 2009/72/EC	Replaced Directive 2003/54/EC; unbundling of networks from supply and generation, non-discriminatory third-party access, establishment of Agency for the Cooperation of Energy Regulators (ACER).
	Regulation 713/2009	Establishment of ACER with competence to impose binding codes for EU-wide markets.
	Regulation 714/2009	Superseded Regulation 1228/2003; certification of TSOs, creation of European Network of Transmission System Operators for Electricity (ENTSO-E), information exchange for congestion management.
	Directive 2009/29/EC	Amended Directive 2003/96/EC, updated rules for the ETS.
	Directive 2009/28/EC	Superseded Directive 2001/77/EC; updated framework for the promotion of energy from renewable sources.
2011	Regulation 1227/2011	Oversight rules for electricity wholesale markets, giving greater powers to ACER.
2013	Regulation 347/2013	Guidelines for the development and interoperability of priority cross-border and trans-European infrastructure, including for projects of common interest (PCIs).
	Regulation 1316/2013	Connecting Europe Facility to provide funding to PCIs.
	Regulation 543/2013	Mandatory rules requiring member state data providers and owners to submit fundamental information related to electricity generation, load, transmission and balancing for publication through the ENTSO-E Transparency Platform.
2015	Regulation 2015/1222	Rules for calculating and allocating cross-border capacity and congestion management, defining and reviewing bidding zones, and operating day-ahead and intraday markets.
2016	Regulation 2016/1719	Rules for securing network capacity and hedge positions beyond day-ahead time frames.
	Regulation 2016/631	Rules relating to the connection of, principally, new power-generating installations to national electricity networks.
	Regulation 2016/1447	Rules relating to the connection of new high-voltage direct-current systems to national electricity networks.
	Regulation 2016/1388	Rules relating to the connection of new demand facilities to national electricity networks.

Note: Regulations in shaded area are European Network Codes (ENCs). ENCs on balancing, system operation, and emergency and restoration are forthcoming.

Annex 2: Estimates of Benefits from Market Integration

Source	Estimated benefits
Newbery, Strbac and Viehoff (2016)	<ul style="list-style-type: none"> • Benefits of market coupling with existing interconnectors \approx €4 billion/year across the EU, of which €2.4 billion due to lower prices. • Potential gains from more efficient use of GB interconnectors in range of €24–109 million in 2012–14. • Models further potential EU-wide benefits of shared balancing under different scenarios to 2030. The gains range from €5 billion to €43 billion by 2030.
Mott MacDonald (2013)	<ul style="list-style-type: none"> • Compares the annual benefits from cross-border trade in balancing electricity in different countries and under different scenarios. • Potential benefits of balancing trade between France and GB estimated at around €50 million/year. • Benefits increase with greater penetration of wind power. Benefits across EU could be in the order of €3 billion/year.
Vivid Economics (2015)	<ul style="list-style-type: none"> • Estimated benefits/cost of exit from market coupling at around £90 million/year at current levels of interconnection; up to £160–200 million/year by early 2020s if interconnection is expanded. • Benefits/cost of exit from cross-border balancing, based on Mott MacDonald/EC 2013, estimated at £80–100 million/year by early 2020s, assuming alternative bilateral arrangements not possible. • Benefits of interconnection estimated at £160–170 million/year in 2020s, lost if projects are cancelled (Viking Link, IFA-2, FABLink).

Annex 3: Estimates of Benefits from More Interconnection

Source	Estimated benefits
Redpoint (2013)	<ul style="list-style-type: none"> Assesses net benefits of (more) interconnection for GB across four scenarios over 2015–40. Net present value (NPV) of benefits ranged from -£9.5 billion (i.e. net cost) to £9 billion. Additional interconnectors are net beneficial in all scenarios, but optimal interconnection depends on scenario.
National Grid (2015)	<ul style="list-style-type: none"> Sharing reserves over interconnectors might reduce capacity needs by 2.8 GW (= £43 million/year at 2015 capacity market auction prices).
Ofgem (2013)	<ul style="list-style-type: none"> NSN interconnector (to Norway) will produce GB consumer benefits of £3.5 billion over 25 years. Further three interconnectors could increase consumer welfare by £3–8 billion under the base case. Excludes CO₂ emissions reductions benefits.
Imperial College/NERA (2012)	<ul style="list-style-type: none"> Models contribution of different elements, one of which is interconnection, to increased balancing challenges under four scenarios for achieving decarbonization of the power sector. Cost optimization model that builds capacity up to the point that NPV of the marginal increment of transmission = 0; at least 20 GW of interconnection is built up to 2040, and at least 25 GW by 2050 across all four scenarios, between GB, the Republic of Ireland and continental Europe.
Vivid Economics (2015)	<ul style="list-style-type: none"> Benefits of interconnection estimated at £160–170 million/year in 2020s, lost if projects are cancelled (Viking Link, IFA-2, FABLink).

Acronyms and Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
CACM	capacity allocation and congestion management
CEF	Connecting Europe Facility
CER	Commission for Energy Regulation
CRE	Commission de Régulation de L'Énergie
EAEC	European Atomic Energy Community
EBRD	European Bank for Reconstruction and Development
ECJ	European Court of Justice
EEA	European Economic Area
EEC	European Energy Community
EEEU	'Enlarged' European Energy Union
EFTA	European Free Trade Association
EIB	European Investment Bank
ENC	European Network Code
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
ESD	Effort Sharing Directive
ETS	Emissions Trading System
EU	European Union
EUA	European Emission Allowance
FCA	forward capacity allocation
GB	Great Britain (i.e. England, Scotland and Wales. Excludes Northern Ireland)
GHG	greenhouse gas
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IEM	internal energy market
I-SEM	Integrated Single Electricity Market
LNG	liquefied natural gas
MtCO ₂ e	million tonnes of carbon dioxide equivalent
MWh	megawatt hour
NDC	Nationally Determined Contribution
NORA	National Oil Reserve Agency
NSCOGI	North Seas Countries Offshore Grid Initiative
ONR	Office for Nuclear Regulation
SEM	Single Electricity Market
TSO	transmission system operator
TWh	terawatt hour
UNFCCC	UN Framework Convention on Climate Change
WTO	World Trade Organization

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